

2. AFFECTED ENVIRONMENT

The project is located on Topsail Beach in Pender County, North Carolina. Topsail Beach is located on the southern portion of Topsail Island, a 26-mile long barrier island on North Carolina's central coast consisting of three communities; North Topsail Beach, Surf City, and Topsail Beach. Significant Resources found within the vicinity of the project area, in both the marine and terrestrial environment, are described below. Physical resources, socioeconomic resources, recreation and aesthetic resources, cultural resources, Section 122, P.L. 91-611 Resources, and water quality conditions are also discussed in this section.

2.01 Marine Environment

Marine waters in the vicinity of the beach nourishment area and offshore borrow sites provide habitat for a variety of ocean fish and are important commercial and recreational fishing grounds (Appendix A, Figure A-1). Kingfish, spot, bluefish, weakfish, spotted sea trout, flounder, red drum, king mackerel, and Spanish mackerel are actively fished from boats, the beach, and local piers. Offshore marine waters serve as habitat for the spawning of many estuarine dependent species. These species, according to Dr. Stan Warlen (NMFS letter dated January 5, 1993), "compose approximately 75 percent of commercially and recreationally important catch of fish and invertebrates in North Carolina". The surf zone typically exhibits a high diversity of fish fauna. Based on data collected from surf zone seine sampling along the South Atlantic Bight, 130 species of fishes are known from the surf zone between North Carolina and southern Georgia of which 47 species have been recorded from North Carolina beaches. The major recruitment period for juvenile fishes to surf zone nurseries is late spring through early summer. These waters also accumulate juvenile, ocean spawning, and estuarine dependent fish and invertebrates in the late winter and early spring prior to their transport through New Topsail and New River Inlets (Hackney *et al.*, 1996).

The intertidal zone within the proposed beach nourishment area serves as habitat for invertebrates including mole crabs, coquina clams, amphipods, isopods, and polychaetes, which are adapted to the high energy, sandy beach environment. These species are not commercially important; however, they provide an important food source for surf-feeding fish and shore birds. Offshore bottoms also provide habitat for benthic-oriented organisms. Special concerns are hardbottom areas, which generally support a diversity of soft corals, anemones and sponges and provide habitat for reef fish such as black seabass, red porgy, and groupers. Hardbottoms are also attractive to pelagic species such as king mackerel, amberjack, and cobia.

2.01.1 Wetlands and Flood Plains

Coastal wetlands of the project vicinity include tidal salt marshes, which occur along the shorelines and island fringes along the backside of Topsail Island (Appendix A, Figure A-2). Intertidal wetlands of the area are very important ecologically due to their high primary productivity, their role as nursery areas for larvae and juveniles of many marine

species, and their refuge/forage value to wildlife. In addition, they provide esthetically valuable natural areas. Many types of wetland communities are present in the project area; smooth cordgrass marsh, needlerush marsh, saltmeadows, and high marsh. All are important primary producers of organic matter and, therefore, serve as part of the base of the aquatic food chain. Smooth cordgrass (*Spartina alterniflora*) marshes occur within the intertidal zone along the sounds and tidal creeks, and provide valuable nursery habitat for many commercially valuable species of marine and estuarine organisms. The frequent removal of organic material and the daily tidal sedimentation processes make salt marsh communities very productive (Schafale and Weakley, 1990). Needlerush marsh is dominated by black needlerush (*Juncus roemerianus*) and occurs in areas that are irregularly flooded. Saltmeadows are essentially pure stands of salt meadow cordgrass (*Spartina patens*), which can occur between 3.5-5.0 feet above mean sea level. Salt grass (*Distichlis spicata*), sea lavender (*Limonium carolinianum*), glasswort (*Salicornia* Spp.), and sea ox-eye (*Borrchia frutescens*) are also prominent plants in this community. High marsh is a transitional community between high ground areas and wetlands and, depending on location and frequency of flooding, may have characteristics of either. It is important in stabilizing the shifting sands of the barrier island. Given time and protection, it will eventually become vegetated with dominant shrub species such as marsh elder (*Iva frutescens*), wax myrtle (*Myrica cerifera*), and yaupon (*Ilex vomitoria*) (Wilson, 1981).

The State of North Carolina defines Primary Nursery Areas (PNA) as tidal saltwaters, which provide essential habitat for the early development of commercially important fish and shellfish (Appendix A, Figure A-3). It is in these estuarine areas that many fish species undergo initial post-larval development. Primary Nursery Areas are designated by the North Carolina Marine Fisheries Commission and currently total 80,144 acres statewide. With the exception of navigation channels, these include most estuarine waters of the project vicinity, including those bounded by New River (north), Mason Inlet (south), AIWW (west), and the landward side of Topsail Island. Protection of juvenile fish is provided in these areas through prohibition of many commercial fishing activities, including the use of trawls, seines, dredges, or any mechanical methods of harvesting clams or oysters (<http://www.ncfisheries.net/rules.htm>; 15 NC Administrative Code 3B .1405).

2.01.2 Inlet, Flats, and Sounds

New Topsail Inlet separates Topsail Island to the northeast from Lea Island to the southwest and serves as the major ocean outlet for the waters of the Atlantic Intracoastal Waterway through Howard's Creek, Topsail Creek, and Banks Channel. The mean minimum inlet width for the past 60 years has been 1,575 feet and over the past decade, the average rate of migration has been southwest 98 feet per year (Cleary and Marden, 1999). The inlet is a critical migratory pathway for many organisms entering and exiting the sounds, including larval fishes and crustaceans (Section 2.01.5), and anadromous and catadromous fishes. Portions of the sound located around New Topsail Inlet contain large intertidal shoals and mud flats, which are very important to migrating and wintering waterbirds, including the Piping Plover.

Topsail Sound is a large estuarine system separated from the ocean by barrier islands. Many variables influence the character of the sound including wind direction and force, inlet flows, etc. Salinity near the inlet varies depending on tides and freshwater discharge and normally ranges between 10 and 32 parts per thousand (Hettler and Barker, 1993). Tides near the inlet normally follow those of the sea; however, there are times when the combined forces of freshwater discharge and wind overwhelm incoming tides and force water out of the inlet throughout the tidal cycle. Below the surface of the sound is a mosaic of shifting sand habitats. Seagrass beds could potentially grow in this environment; however, none have been documented at Topsail Beach (Fritz Rhode, pers. comm.). The Carolina diamondback terrapin is a state listed species of concern for Pender County, North Carolina and may be found on the soundside of Topsail Beach in brackish water areas and feeds mostly feed on clams, shrimp, crabs, snails, and small fish. They have been known to eat some vegetation but they are primarily carnivores (<http://www.chelonia.org/>).

2.01.3 Nearshore Ocean

Sand excavation and material placement for beach and berm construction will occur in the near shore ocean in an area described by Day *et al.* (1971) as the “turbulent zone”. The turbulent zone includes ocean waters from below low tide to a depth of about 60 feet NGVD (National Geodetic Vertical Datum). Identified sediment borrow areas proposed for project construction and periodic nourishment are located beyond the -30 foot NGVD contour to approximately 5.5 miles offshore (Appendix A, Figure A-6). Those borrow sites located beyond 3 nautical miles offshore are subject to federal mining requirements imposed by the Minerals Management Service (MMS). Beach nourishment will introduce fill into nearshore waters with a depth of closure of about 23 feet. Benthic organisms, phytoplankton, and seaweeds are the major primary producers in this community with species of *Ulva* (sea lettuce), *Fucus*, and *Cladocera* (water fleas) being fairly common where suitable habitat occurs. Many species of fish-eating birds are typically found in this area including gulls, terns, cormorants, loons, and grebes (Section 2.02.3). Marine mammals and sea turtles also are frequently seen in this area (See Appendix I). Fishes and benthic resources of this area are discussed in Sections 2.01.7 and 2.01.9 respectively.

2.01.4 Surf Zone Fishes

The surf zone along the area beaches provides important fishery habitat of which some species are dependent. Surf zone fisheries are typically diverse, and 47 species have been identified from North Carolina; however, the actual species richness of fishes using the North Carolina surf area for at least part of their life history is much higher (Ross, 1996; Ross and Lancaster, 1996). According to Ross (1996), the most common species in the South Atlantic Bight surf zone are Atlantic menhaden (*Brevoortia tyrannus*), striped anchovy (*Anchoa hepsetus*), bay anchovy (*Anchoa mitchilli*), rough silverside (*Membras martinica*), Atlantic silverside (*Menidia menidia*), Florida pompano (*Trachinotus carolinus*), spot (*Leiostomus xanthurus*), Gulf kingfish (*Menticirrhus littoralis*), and

striped mullet (*Mugil cephalus*). Two species in particular, the Florida pompano and gulf kingfish (*Menticirrhus littoralis*) seem to use the surf zone exclusively as a juvenile nursery area and are rarely found elsewhere. The major recruitment time for juvenile fishes to surf zone nurseries is late spring through early summer (Hackney *et al.*, 1996). Recent studies by Ross and Lancaster (1996) indicate that the Florida pompano and gulf kingfish may have high site fidelity to small areas of the beach and extended residence time in the surf zone suggesting its function as a nursery area. Major surf zone species consume a variety of benthic and planktonic invertebrates, with most of the prey coming from the water column. The dominant benthic prey are coquina clams (*Donax variabilis*); however, this is not the dominant food item throughout the South Atlantic Bight. Furthermore, many surf zone fishes exhibit prey switching in relation to prey availability, which could mitigate impacts from beach nourishment (Ross, 1996).

2.01.5 Larval Fishes

New Topsail and New River Inlets are important passageways for the larvae of many species of commercially or ecologically important fish. Spawning grounds for many marine fishes are believed to occur on the continental shelf with immigration to estuaries during the juvenile stage. The shelter provided by the marsh and creek systems within the sound serves as nursery habitat where young fish undergo rapid growth before returning to the offshore environment.

Transport from offshore shelves to estuarine nursery habitats occurs in three stages: offshore spawning grounds to nearshore, nearshore to the locality of an inlet or estuary mouth, and from the mouth into the estuary (Boehlert and Mundy, 1988). Hettler *et al.* (1997) documented, through analysis of larvae otoliths, that a large number of young Atlantic menhaden (*B. tyrannus*) larvae averaging 55 days post hatch arrived in mid-March on the date of maximum observed daily concentration (160 larvae per 100 m³ (3,531 ft³). For all species recorded in this study, abundance varied as much as an order of magnitude from night to night. The methods these larvae use to traverse large distances over the open ocean and find inlets are uncertain. Various studies have hypothesized such mechanisms as passive wind and depth-varying current dispersal and active horizontal swimming transport. However, little is known regarding larval distribution in the nearshore area.

Little research has been conducted within the New Topsail Inlet system in regards to larval species composition and abundance. However, the Beaufort Inlet system located about 60 miles north/northeast of New Topsail Inlet has been thoroughly studied and significant amounts of data have been collected in regards to larval transport of commercially and ecologically important fish. Considering the close proximity of these two inlet systems and their similar tidal prisms it can be expected that species composition would be similar (Larry Settle, pers. comm.; Thomas Lankford, pers. comm.). During the winters of 1992-1993 and 1993-1994, Hettler and Hare (1998) conducted an experiment at Beaufort Inlet, North Carolina in order to further understand the estuarine ingress of offshore spawning species. A complex lateral structure in estuarine circulation, independent of the inlet opening size, was found in regards to larval

concentration with significant interactions among inlet side, distance offshore, and date of ichthyoplankton tows. Length of species caught varied by cruise, inlet side, and distance offshore. The differences in larval concentration offshore and inshore and the species differences in length suggest species-specific rates controlling the net number of larvae entering the nearshore from offshore, the net number of larvae entering the inlet mouth from nearshore, and the larval mortality in the nearshore zone. Results from this study suggest two bottlenecks for offshore-spawning fishes with estuarine juveniles: the transport of larvae into the nearshore zone and the transport of larvae into the estuary from the nearshore zone (Hettler and Hare, 1998).

Egg and larval transport from offshore spawning grounds to the inshore environment of Beaufort Inlet was studied by Hettler and Hare (1998) in seven estuarine dependent species, including Atlantic menhaden (*Brevoortia tyrannus*), spot (*Leiostomus xanthurus*), Atlantic croaker (*Micropogonias undulatus*), pinfish (*Lagodon rhomboides*), summer flounder (*Paralichthys dentatus*), southern flounder (*P. lethostigma*) and Gulf flounder (*P. albigutta*). Research conducted by the National Marine Fisheries Service (NMFS) Beaufort Laboratory through June 2002 collected a total of 120 species of larval fish fauna off the Beaufort Inlet and adjacent waters. According to Hettler and Hare (1998), average weekly concentration (number per 100 m³ (3,531 ft³) for all of the above estuarine dependent species, with the exception of Gulf flounder, was calculated during the October 1994 to April 1995 immigration season. Concentrations were 22.9, 4.8, 25.7, 12.4, 0.3, and 0.8 larvae/100m³ (3,531 ft³) respectively (Hettler and Hare, 1998). According to the spring tide flow calculated by Jarrett (1976) and the calculated daily larval concentration within the water column, approximately 32.5, 6.8, 36.5, 17.6, 0.43, and 1.1 million larvae pass through the inlet during a single spring tide for each respective species. Concentrations for all species combined (Attachment 1 of Appendix I) entering the inlet during a single tidal prism range from 0.5 to 5 larvae/m³. Therefore, daily calculated larval concentration at Beaufort Inlet for all species within the tidal prism ranges between 66 to 710 million (Larry Settle, Pers. Comm.).

2.01.6 Anadromous Fishes

A number of anadromous fish species occur in ocean waters along the North Carolina coast and migrate into rivers and their tributaries to spawn in freshwater. These include the striped bass (*Morone saxatilis*), Atlantic sturgeon (*Acipenser oxyrinchus*) and shortnosed sturgeon (*Acipenser brevirostrum*), as well as several members of the herring family (Clupeidae) such as the American shad (*Alosa sapidissima*), hickory shad (*Alosa mediocris*), alewife (*Alosa pseudoharengus*), and blueback herring (*Alosa aestivalis*). Historically, most accessible coastal streams in North Carolina were utilized by these species, and highest use occurred from mid-winter to mid-spring during the spawning runs. Sampling in the New River in 1974 and 1975 by the NC Division of Marine Fisheries (NCDMF) identified the presence of blueback herring, alewife, American shad, and Atlantic sturgeon, although egg-netting results indicated very poor spawning success for all anadromous species. This study concluded that anadromous fish stocks in New River were very low and that, as a result, there was little or no utilization of the fishery (Sholar, 1975). Recent reports from the NCDMF indicate that there are no recent records of shortnose

sturgeon in the project area (F. Rhode 2004, pers. comm.) (See Biological Assessment Appendix I). Because of the lack of suitable freshwater spawning areas in the project area and the requirement of low salinity waters by juveniles, any shortnose sturgeons present would most likely be non-spawning adults (NMFS, 1998).

2.01.7 Nekton

Nekton collectively refers to aquatic organisms capable of controlling their location through active movement rather than depending upon water currents or gravity for passive movement. Nekton of the nearshore Atlantic Ocean along Topsail Island, North Carolina can be grouped into three categories: estuarine dependent species; permanent resident species; and seasonal migrant species. The most abundant nekton of these waters are the estuarine dependent species, which inhabit the estuary as larvae and the ocean as juveniles or adults. This group includes species which spawn offshore, such as the Atlantic croaker (*Micropogon undulatus*), spot (*Leiostomus xanthurus*), Atlantic menhaden (*Brevoortia tyrannus*), star drum (*Stellifer lanceolatus*), southern kingfish (*Menticirrhus americanus*), flounders (*Paralichthys* spp.), mullets (*Mugil* spp.), anchovies (*Anchoa* spp.), blue crab (*Callinectes sapidus*), and penaeid shrimp (*Farfantepenaeus* spp. and *Lilopenaeus* sp.), as well as species which spawn in the estuary, such as red drum (*Sciaenops ocellatus*) and weakfish (*Cynoscion regalis*). Species which are permanent residents of the nearshore marine waters include the black sea bass (*Centropristis striata*), longspine porgy (*Stenotomus caprinus*), Atlantic bumper (*Chloroscombrus chrysurus*), inshore lizardfish (*Synodus foetens*), and searobins (*Prionotus* spp.). Common warm water migrant species include the bluefish (*Pomatomus saltatrix*), Spanish mackerel (*Scomberomorus maculatus*), king mackerel (*Scomberomorus cavalla*), cobia (*Rachycentron canadum*), Florida pompano (*Trachinotus carolinus*), and spiny dogfish (*Squalus acanthias*). Oceanic large nekton located offshore of Topsail Island are composed of a wide variety of bony fishes, sharks, and rays, as well as fewer numbers of marine mammals and reptiles. Marine mammals and reptiles that may be present in the offshore borrow sites are addressed in the biological assessment (see Appendix I).

2.01.8 Benthic Resources -Beach and Surf Zone

The intertidal zone of the beach shoreface is extremely dynamic and is characterized as the area from mean low tide landward to the high tide mark. This area serves as habitat for invertebrate communities adapted to the high-energy sandy beach environment. Important invertebrates of the surf zone and beach/dune community include the mole crab (*Emerita talpoida*), coquina clams (*Donax variabilis*), polychaete worms, amphipods, and ghost crabs (*Ocypode quadrata*). Mole crabs and coquinas represent the largest component of the total macrofaunal biomass of North Carolina intertidal beaches, and they are consumed in large numbers by important fish species such as flounders, pompanos, silversides, mullets, and kingfish (Reilly and Bellis, 1978; Leber, 1982; Johnson, 1994). Beach intertidal macrofauna are also a seasonally important food source for numerous shorebird species.

Through recent studies supported by the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers, the distributions and abundance of these animals on nearby beaches is fairly well documented. Extensive sampling of the intertidal and nearshore beach environment was performed and documented in the USACE New York District's biological monitoring report titled, "Final Report for The Army Corps of Engineers New York District's Biological Monitoring Program for the Atlantic Coast of New Jersey, Sea Bright to Manasquan Inlet, Beach Erosion Project (2001)." Results from this study indicate that the intertidal infaunal assemblage was dominated by rhynchocoels, the polychaetes *Scolelepis squamata*, *Protodriloides (LPIL)*, and *Microphthalmus* spp., oligochaetes, the mole crab *Emerita talpoida*, as well as a number of haustoriid amphipods. The nearshore infaunal assemblage included many of the same taxa, but was dominated by the wedge clam, *Donax variabilis*, the polychaete *Magelona papillicornis*, the clams *Spisula solidissima* and *Tellina agilis*, and the amphipods *Acanthohaustorius millsii* and *Psammonyx nobilis*, and the polychaete *Asabellides oculata*. These documented infaunal assemblages are consistent with other studies throughout the Atlantic Coast (Burlas et. al., 2001). In North Carolina, along Bogue Banks and Topsail Island, infaunal assemblages are dominated by *Donax variabilis*, *Donax parvula*, and *Emerita talpoida* which function as an important first link in the flow of energy within the intertidal system (Leber, 1982; Reilly and Bellis, 1978). Other organisms occurring less frequently are Amphipods (*Haustorius canadensis*, *Talorchestia megalopthalma*, and *Amphiporia virginiana*) and Polychaetes (*Scolelepis squamata* and *Nephtys picta*) (Lindquist and Manning, 2001; Nelson, 1993; Leber, 1982; Reilly and Bellis, 1978).

2.01.9 Benthic Resources – Nearshore Ocean

Aquatic organisms that live in close association with the bottom, or substrate, of a body of water, are collectively called the benthos. Benthos communities provide a link between planktonic and benthic production and commercially important fish species (Posey, 1991). Benthic communities of the project area exhibit a wide range of organism composition and density, and community structure may vary considerably depending on substrate type and salinity regime. Most nearshore benthic invertebrates tend to be r-strategists, which are characteristically small-bodied, short-lived, and have high fecundity, efficient dispersal mechanisms, and rapid growth rates. Thus, recolonization of a disturbed area is generally initiated by r-strategists (Bowen and Marsh, 1988).

Benthic surveys of three nearshore ocean sites located off Virginia Beach were conducted for the USDOI Minerals Management Service in 1996 and 1997 by Cutter and Diaz (1998). They collected a total of 119 taxa from 13 Smith-MacIntyre grabs collected in 1996. Half of the top 14 taxa (occurrence and abundance) were polychaetes. The remainder included representatives from the amphipods, decapods, bivalves, nemerteans, tanaids, echinoderms, and chordates. They found the overall community composition to be typical for sandy shallow continental shelf habitats and with similar species composition for similar depths and sediment types reported by Day *et al.* (1971) for North Carolina (Table 2.1). Day *et al.* (1971) defines the nearshore ocean as the "turbulent zone", which includes ocean waters from below low tide to a depth of about 60 feet. According to Day *et al.*, polychaete species are highly represented in this zone

with pelecypods, decapods, amphipods, echinoderms, and cephalochordates also present. Benthic resources in the proposed borrow areas off of Topsail Island are similar to those found during other similar studies. Appendix S, Technical Memorandum, Topsail Beach Benthic Community Characterization Survey, Pender County, NC, May 2007, concluded that the benthic community found within the six proposed borrow sites off Topsail Beach is similar in composition and taxa dominance to those described in other studies along the North Carolina and South Carolina coasts (Byrnes *et al.* 2003; USACE 2002, 2006; and Posey and Alphin 2000, 2002). However, the study concluded that the number of species present and abundance were noticeably lower off Topsail Beach than off Kure Beach (Posey and Alphin 2000) and Dare County (USACE 2006). It is likely that the differences between the benthic community off Topsail Beach and the two referenced studies are due to the more extensive sampling effort associated with baseline monitoring programs as compared to a less intensive sampling regime for a general characterization study (e. g. ten sampling stations per site off Dare County as compared to three to five stations per site for the Topsail Beach benthic characterization study).

Table 2.1. Abundant benthic species within the turbulent zone near Cape Lookout North Carolina. (Day et. al. 1971)

Group and Species	Depth, meters			
	3	5	10	20
Archiannelida				
<i>Polygordius sp.</i>	X	X	X	X
Polychaeta				
<i>Palaenous heteroseta</i>		X	X	X
<i>Pseudeurythoe ambigua</i>			X	X
<i>Exogone dispar</i>			X	X
<i>Goniadides n.sp</i>			X	X
<i>Magelona papillicornis</i>	X	X	X	
<i>Ophelia denticulata</i>		X	X	X
<i>Macroclymene zonalis</i>				
Amphipoda				
<i>Platyischnopus n.sp</i>	X	X	X	
<i>Maera sp.1</i>		X	X	X
Decapoda				
<i>Dissodactylus mellitae</i>	X	X	X	
Pelecypoda				
<i>Spisula ravenelli</i>	X	X	X	X
Gastropoda				
<i>Olivella adela</i>	X		X	X
<i>O. mutica</i>	X	X	X	
Echinoidea				
<i>Mellita quinquiesperforata</i>	X	X	X	X
Cephalochordata				
<i>Branchiostoma caribbaeum</i>		X	X	X

Biological characterization results from field surveys performed by the Minerals Management Service (MMS) of offshore shallow shelf habitats in the Outer Banks, North Carolina identified members of the major invertebrate and vertebrate groups commonly found in the general area. Dominant infaunal groups consisted of crustaceans, echinoderms, mollusks, and polychaetes, while epifaunal taxa consisted primarily of decapods, sea stars, and squid. Dominant demersal fish species included clearnose skate (*Raja eglanteria*), flounder (*Paralichthys sp.*), scup (*Stenotomus chrysops*), and searobin (*Prionotus scitulus*) (Byrnes et al., 2003). Posey and Alphin (2000), collected offshore benthic infaunal samples at depths of 30-40 ft. from pre-borrow sites of Kure Beach, North Carolina. Results indicate that the benthic community was very diverse, with over 600 species, and largely dominated by polychaetes, with crustaceans and bivalves comprising most of the remaining taxa. Of the 104 total taxa collected for the one-time sampling performed for Topsail Beach, polychaetes also dominated the community, comprising over 30% of the relative abundance at four of the six borrow sites (USACE, 2007).

2.01.10 Hardbottoms

Localized areas not covered by unconsolidated sediments, where the ocean floor consists of hard substrate, are known as hardbottoms. Hardbottoms are found along the continental shelf off the North Carolina coasts. Hardbottoms are also called "live-bottoms" because they support a rich diversity of invertebrates such as corals, anemones, and sponges, which are refuges and food sources for fish and other marine life. They provide valuable habitat for reef fish such as black sea bass, red porgy, and groupers. Hardbottoms are also attractive to pelagic species such as king mackerel, amberjack, and cobia. While hardbottoms are most abundant in southern portions of North Carolina, they are located along the entire coast (USFWS, 1990).

Offshore (>-23 ft. NGVD)

Hardbottom communities in the vicinity of Topsail Beach are within state waters. Shallow limestone and siltstone rock units offshore of Topsail Beach dominate and control the nearsurface geology and submarine landscape (USACE, 2004). According to Cleary (2003), the area offshore of Topsail Beach is characterized as a broad, shallow, high-energy shelf system with a thin and variable unconsolidated sediment cover as indicated by a large frequency of rock outcrops. The Topsail Beach shoreface consists of a thin patchy veneer of modern sediments covering the low relief Oligocene limestone and siltstone hardbottoms (Cleary, 2003). This thin veneer of sediment is ephemeral and easily reworked during storms; thus, exposing rock units in areas where the sediment cover is thin.

Seismic profile coverage, vibracores, and diver surveys have provided information, between the active beach (-23 ft NGVD) and three miles offshore of Topsail Beach, on the subcrop units that are frequently exposed as hardbottom. Sidescan sonargraphs offshore of the project area depict areas of high acoustic reflectance representing rock hardbottoms. Six shore normal fathometer sonargraphs were collected along Topsail Beach in order to determine the distribution of major hardbottom scarps and intervening low areas. From these sonargraphs, Cleary (2003) identified four limestone hardbottom scarps located at around 36 ft. deep between one and two miles offshore. The largest contiguous area of exposed rock occurs offshore of the southern 2.2 miles of Topsail Beach. The hardbottom protrudes above the seafloor as scarps exhibiting relief of 2-15 ft. with relatively low relief (2.5 ft.) hummocky limestone hardbottom in the areas between. Using existing information from researchers, recreational divers, and fisherman, Moser and Taylor (1995) developed a database of the distribution and aerial extent of hardbottoms within North Carolina waters. The location of the hardbottom communities identified in this study are found in Table 2.2. Data from the Southeast Monitoring and Assessment Program (SEAMAP) indicate that three areas of identified hardbottom and two areas of potential hardbottom are located offshore of the 3-mile state line and within about 1-mile of the proposed borrow areas (SEAMAP, 2001). However, only one hardbottom identified by SEAMAP falls near the proposed offshore borrow areas (borrow area B) (Appendix A, Figure A-1).

Table 2.2. Hard Bottom locations within waters off Topsail Beach, North Carolina according to Moser and Taylor (1995).

Location According to Moser and Taylor (1995)	Nearest Inlet Access	Vertical Distances		Reef Site Location	
		Approximate Water Depth (feet)	Relief *	Latitude	Longitude
14	New Topsail	35-40	High	34 ⁰ 20.29'	77 ⁰ 36.35'
15	New Topsail	35-40	High	34 ⁰ 19.96'	77 ⁰ 36.20'
16	New Topsail	35-40	High	34 ⁰ 20.11'	77 ⁰ 36.69'
17	New Topsail	35-40	Low	34 ⁰ 20.83'	77 ⁰ 33.94'
18	New Topsail	35-40	Low	34 ⁰ 20.93'	77 ⁰ 33.96'
19	New Topsail	35-40	Moderate	34 ⁰ 21.19'	77 ⁰ 33.81'
20	New Topsail	35-40	Moderate	34 ⁰ 21.11'	77 ⁰ 33.78'
21	New Topsail	35-40	Moderate	34 ⁰ 21.03'	77 ⁰ 33.54'
22	New Topsail	35-40	Moderate	34 ⁰ 21.41'	77 ⁰ 33.70'
23	New Topsail	35-40	Moderate	34 ⁰ 21.73'	77 ⁰ 34.00'
77	New Topsail	35-40	N/A	34 ⁰ 20.27'	77 ⁰ 35.21'
106	New Topsail	35-40	Low	34 ⁰ 20.65'	77 ⁰ 34.96'
116	New Topsail	35-40	N/A	34 ⁰ 20.55'	77 ⁰ 36.30'
151	New Topsail	35-40	N/A	34 ⁰ 22.00'	77 ⁰ 36.00'

* Low relief (L) was defined as <0.5m, Moderate relief (M) was defined as 0.5-2.0 m, and High relief (H) was defined as profiles >2 m (Moser and Taylor, 1996).

Nearshore (<-23 ft NGVD)

In order to confirm the presence or absence of hardbottom within the nearshore environment (<-23 ft. NGVD) of Topsail Beach, sidescan and multibeam survey techniques were performed. A summary evaluation and detailed survey reports are provided in Appendix R. Based on the survey data collected, the Corps concludes that no hard bottom features are located within the -23 depth of closure limits of the West Onslow Beach and New River Inlet (Topsail Beach) Shore Protection Project. After review of the data, the high backscatter depressional features identified through side scan and multi beam sonar, as well as the surface sediment samples collected within and outside of these features, are consistent with previous descriptions in the available literature of Rippled Scour Depressions (RSD), Rippled Channel Depressions (RCD), and/or sorted bedform features. Furthermore, these features are identified in the North Carolina CHPP as soft bottom habitat and are not considered Essential Fish Habitat, Habitat Area of Particular Concern, Primary Nursery Area, or Strategic Habitat Area. Impacts to soft bottom habitat are discussed in detail in Sections 2.01.8 and 2.01.9 and 8.01.6 and 8.01.7.

Artificial Reef

The State of North Carolina, Department of Environment and Natural Resources, Division of Marine Fisheries Artificial Reef Program manages 6 reefs that are located off Topsail Beach. They are AR 355, AR 360, AR 362, AR 364, AR 366, and AR 368. Of these

managed reefs, AR360 “Topsail Reef” is within close proximity of the proposed offshore borrow areas and is located at 34° 20’ 59” N and 77° 36’ 11” W (Table 2.3). It was deployed in 1984 and modified in 1992 and consists of about 49,000 tires and 850 4’x8’ pieces of concrete pipe. Currently this reef no longer exists in its confined location but rather, is broken up and spread out well beyond its original footprint and is exposed or buried at different locations. The location of these hard bottom habitats and artificial reef sites, in relation to project features, is shown in Appendix A, Figure A-1.

Table 2.3 Artificial reefs, NC Division of Marine Fisheries.

NC Reef Site No.	Nearest Inlet Access and Distance	Approx. Water Depth	LORAN Position Coordinates	Latitude and Longitude	Comment
355	New River 9.7 miles	60 feet	27210.0 39324.4	34 ⁰ 21'11" 77 ⁰ 20'00"	230' Bridge span
360	New Topsail 2.5 miles	44 feet	27256.9 39252.5	34 ⁰ 20'59" 77 ⁰ 36'11"	Concrete pieces
362	New Topsail 8.7 miles	54 feet	27233.1 39244.5	34 ⁰ 15'43" 77 ⁰ 30'27"	Concrete pieces
364	New Topsail 6.0 miles	44 feet	27267.4 39169.6	34 ⁰ 14'50" 77 ⁰ 42'50"	174' JELL II Boat mold
366	New Topsail 13.9 miles	66 feet	27214.6 39255.0	34 ⁰ 12'57" 77 ⁰ 25'15"	
368	New Topsail 15.5 miles	66 feet	27211.7 39195.0	34 ⁰ 09'34" 77 ⁰ 25'50"	Small vessel

(<http://www.ncfisheries.net/reefs/lok2fear.htm>)

Since the placement of tire-based artificial reefs throughout North Carolina, many have broken loose from their original footprint and wash up consistently throughout the North Carolina beaches. In 2001 (December – April), during Phase I of the Bogue Banks Beach Nourishment project in Bogue Banks, North Carolina, the dredging contractor encountered about 5,000 tires within the borrow sites that had broken free from an artificial reef site. Based on this history, the NCDMF has identified concerns that, though the historical placement of AR 360 is outside of the identified borrow sites, there is a potential for loose tires to be located within the borrow sites. However, the NCDMF’s artificial reef program has a team to document and pick up tires that wash up on the local beaches. Based on this database, it appears that the tires from AR360 have moved in a North and Northwest direction from the original location and would, more than likely, not be found in the identified borrow areas (Jim Francesconi, pers. comm.) (Appendix A, Figure A-1).

2.01.11 Essential Fish Habitat (EFH)

The 1996 Congressional amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (PL 94-265) set forth new requirements for the National Marine Fisheries Service (NMFS), regional fishery management councils (FMC), and other Federal agencies to identify and protect important marine and anadromous fish habitat. These amendments established procedures for the identification of Essential Fish Habitat (EFH) and a requirement for interagency coordination to further the conservation of Federally managed fisheries. Table 2.4 lists the Federally managed fish species of North Carolina for which Fishery Management Plans have been developed by the South Atlantic Fishery Management Council (SAFMC), Mid-Atlantic Fishery Management Council (MAFMC), and National Marine Fisheries Service (NMFS). In addition, this table shows EFH by fish lifestage and ecosystem type for those species that have designated EFH. Table 2.5 shows the categories of EFH and Habitat Areas of Particular Concern (HAPC) for managed species, which were identified in the Fishery Management Plan Amendments affecting the South Atlantic area. The fish species and habitats shown in these tables require special consideration to promote their viability and sustainability. The potential impacts of the proposed action on these fish and habitats are discussed in Section 8.01.8 of this report.

Table 2.4. Essential Fish Habitat (EFH) Species for Coastal North Carolina ¹							
MANAGEMENT PLAN	MANAGEMENT PLAN	COMMON NAME	SCIENTIFIC NAME	EFH for LIFE STAGES BY ECOSYSTEM ³		GEOGRAPHICALLY DEFINED HABITAT AREAS OF PARTICULAR CONCERN (HAPC)	
	SPECIES GROUP	OF SPECIES	OF SPECIES			(North Carolina Locations Only)	
AGENCY ²				Marine	Estuarine		
1	SAFMC	Calico Scallop	Calico scallop	<i>Argopecten gibbus</i>	A		
2	SAFMC	Coastal Migratory Pelagics	Cobia	<i>Rachycentron canadum</i>	E L P J A	L P J A	Capes Fear, Lookout, & Hatteras sandy shoals; The Point; Ten Fathom Ledge; Big Rock; Bogue Sound; New River; hardbottom
3	SAFMC	Coastal Migratory Pelagics	Dolphin	<i>Coryphaena hippurus</i>	L P J A		Capes Fear, Lookout, & Hatteras sandy shoals; The Point; Ten Fathom Ledge; Big Rock; Bogue Sound; New River; hardbottom
4	SAFMC	Coastal Migratory Pelagics	King mackerel	<i>Scomberomorus cavalla</i>	J A		Capes Fear, Lookout, & Hatteras sandy shoals; The Point; Ten Fathom Ledge; Big Rock; Bogue Sound; New River; hardbottom
5	SAFMC	Coastal Migratory Pelagics	Spanish mackerel	<i>Scomberomorus maculatus</i>	L J A	J	Capes Fear, Lookout, & Hatteras sandy shoals; The Point; Ten Fathom Ledge; Big Rock; Bogue Sound; New River; hardbottom
6	SAFMC	Coral & Coral Reef	Corals	100s of species	Florida only		Big Rock; Ten Fathom Ledge; The Point
7	SAFMC	Golden Crab	Golden crab	<i>Chaceon fenneri</i>	A		
8	SAFMC	Red Drum	Red drum	<i>Sciaenops ocellatus</i>	E L A	P J S A	tidal inlets, state nursery, spawning sites, SAV
9	SAFMC	Shrimp	Brown shrimp	<i>Farfantepenaeus aztecus</i>	E L A	P J S	tidal inlets, state nursery, overwintering habitats
10	SAFMC	Shrimp	Pink shrimp	<i>Farfantepenaeus duorarum</i>	E L A	P J S	tidal inlets, state nursery, overwintering habitats
11	SAFMC	Shrimp	Rock shrimp	<i>Sicyonia brevirostris</i>	A		
12	SAFMC	Shrimp	Royal red shrimp	<i>Pleoticus robustus</i>	A		
13	SAFMC	Shrimp	White shrimp	<i>Litopenaeus setiferus</i>	E L A	P J S	tidal inlets, state nursery, overwintering habitats
14	SAFMC	Snapper Grouper	Blackfin snapper	<i>Lutjanus buccanella</i>	J A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
15	SAFMC	Snapper Grouper	Blueline tilefish	<i>Caulolatilus microps</i>	E A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
16	SAFMC	Snapper Grouper	Golden tilefish	<i>Lopholatilus chamaeleonticeps</i>	A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
17	SAFMC	Snapper Grouper	Gray snapper	<i>Lutjanus griseus</i>	L A	P J A	hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
18	SAFMC	Snapper Grouper	Greater amberjack	<i>Seriola dumerilii</i>	J A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
19	SAFMC	Snapper Grouper	Jewfish	<i>Epinephelus itajara</i>	Florida only	Florida only	hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
20	SAFMC	Snapper Grouper	Mutton snapper	<i>Lutjanus analis</i>	Florida only	Florida only	hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
21	SAFMC	Snapper Grouper	Red porgy	<i>Pagrus pagrus</i>			
22	SAFMC	Snapper Grouper	Red snapper	<i>Lutjanus campechanus</i>	L P J A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
23	SAFMC	Snapper Grouper	Scamp	<i>Mycteroperca phenax</i>	A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
24	SAFMC	Snapper Grouper	Silk snapper	<i>Lutjanus vivanus</i>	J A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
25	SAFMC	Snapper Grouper	Snowy grouper	<i>Epinephelus niveatus</i>	E L A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
26	SAFMC	Snapper Grouper	Speckled hind	<i>Epinephelus drummondhayi</i>	A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
27	SAFMC	Snapper Grouper	Vermillion snapper	<i>Rhombopilites aurorubens</i>	J A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
28	SAFMC	Snapper Grouper	Warsaw grouper	<i>Epinephelus nigrilus</i>	E A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
29	SAFMC	Snapper Grouper	White grunt	<i>Haemulon plumieri</i>	E L A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
30	SAFMC	Snapper Grouper	Wreckfish	<i>Polyprion americanus</i>	A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
31	SAFMC	Snapper Grouper	Yellowedge grouper	<i>Epinephelus flavolimbatus</i>	E L A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
32	SAFMC	Spiny Lobster	Spiny Lobster	<i>Panulirus argus</i>	L J A	L J A	Spiny lobster EFH and HAPC located only in Florida
1	MAFMC	Atlantic Mackerel, Squid, Butterfish	Atlantic butterfish	<i>Peprilus triacanthus</i>			
2	MAFMC	Atlantic Mackerel, Squid, Butterfish	Atlantic mackerel	<i>Scomber scombrus</i>			
3	MAFMC	Atlantic Mackerel, Squid, Butterfish	Long finned squid	<i>Loligo pealei</i>			
4	MAFMC	Atlantic Mackerel, Squid, Butterfish	Short finned squid	<i>Illex illecebrosus</i>			
5	MAFMC	Atlantic Surfclam & Ocean Quahog	Ocean quahog	<i>Artica islandica</i>			
6	MAFMC	Atlantic Surfclam & Ocean Quahog	Surfclam	<i>Spisula solidissima</i>			
7	MAFMC	Bluefish	Bluefish	<i>Pomatomus saltatrix</i>	L J A	J A	
8	MAFMC	Spiny Dogfish	Spiny dogfish	<i>Squalus acanthias</i>	J A		
9	MAFMC	Summer Flounder, Scup, Black Sea Bass	Black sea bass	<i>Centropristis striata</i>			
10	MAFMC	Summer Flounder, Scup, Black Sea Bass	Scup	<i>Stenotomus chrysops</i>			
11	MAFMC	Summer Flounder, Scup, Black Sea Bass	Summer flounder	<i>Paralichthys dentatus</i>	L J A	L J A	SAV for larvae and juveniles
1	NMFS	Billfish	Blue marlin	<i>Makaira nigricans</i>	E L J A		
2	NMFS	Billfish	Longbill spearfish	<i>Tetrapturus pfluegeri</i>	J A		
3	NMFS	Billfish	Sailfish	<i>Istiophorus platypterus</i>	E L J A		
4	NMFS	Billfish	White marlin	<i>Tetrapturus albidus</i>	J A		

Table 2.4 (Continued). Essential Fish Habitat (EFH) Species for Coastal North Carolina. ¹						
MANAGEMENT PLAN	MANAGEMENT PLAN SPECIES GROUP	COMMON NAME OF SPECIES	SCIENTIFIC NAME OF SPECIES	EFH for LIFE STAGES BY ECOSYSTEM ²		GEOGRAPHICALLY DEFINED HABITAT AREAS OF PARTICULAR CONCERN (HAPC) (North Carolina Locations Only)
AGENCY ³				Marine	Estuarine	
5	NMFS	Sharks	Atlantic angel shark	<i>Squatina dumeril</i>		
6	NMFS	Sharks	Atlantic sharpnose shark	<i>Rhizoprionodon terraenovae</i>	J A	J
7	NMFS	Sharks	Basking shark	<i>Cetorhinus maximus</i>		
8	NMFS	Sharks	Big nose shark	<i>Carcharhinus altimus</i>	J	
9	NMFS	Sharks	Bigeye sand tiger shark	<i>Odontaspis noronhai</i>		
10	NMFS	Sharks	Bigeye sixgill shark	<i>Hexanchus vitulus</i>		
11	NMFS	Sharks	Bigeye thresher shark	<i>Alopias superciliosus</i>	E L P J S A	
12	NMFS	Sharks	Blacknose shark	<i>Carcharhinus acronotus</i>	J A	
13	NMFS	Sharks	Blacktip shark	<i>Carcharhinus limbatus</i>	J A	
14	NMFS	Sharks	Blue shark	<i>Prionace glauca</i>	J S A	
15	NMFS	Sharks	Bonnethead	<i>Sphyrna tiburo</i>	J A	J A
16	NMFS	Sharks	Bull shark	<i>Carcharhinus leucas</i>	J	J
17	NMFS	Sharks	Caribbean reef shark	<i>Carcharhinus perezi</i>	Florida only	
18	NMFS	Sharks	Caribbean sharpnose shark	<i>Rhizoprionodon porosus</i>		
19	NMFS	Sharks	Dusky shark	<i>Carcharhinus obscurus</i>	A	J A
20	NMFS	Sharks	Finetooth shark	<i>Carcharhinus isodon</i>	E L P J S A	
21	NMFS	Sharks	Galapagos shark	<i>Carcharhinus galapagensis</i>		
22	NMFS	Sharks	Great hammerhead	<i>Sphyrna mokarran</i>	J A	
23	NMFS	Sharks	Lemon shark	<i>Negaprion brevirostris</i>	J A	J A
24	NMFS	Sharks	Longfin mako shark	<i>Isurus paucus</i>	E L P J S A	
25	NMFS	Sharks	Narrowtooth shark	<i>Carcharhinus brachyurus</i>		
26	NMFS	Sharks	Night shark	<i>Carcharhinus signatus</i>	J A	
27	NMFS	Sharks	Nurse shark	<i>Ginglymostoma cirratum</i>	J A	
28	NMFS	Sharks	Oceanic whitetip shark	<i>Carcharhinus longimanus</i>	J S A	
29	NMFS	Sharks	Porbeagle shark	<i>Lamna nasus</i>		
30	NMFS	Sharks	Sand tiger shark	<i>Odontaspis taurus</i>	J A	
31	NMFS	Sharks	Sandbar shark	<i>Carcharhinus plumbeus</i>	J A	J A
32	NMFS	Sharks	Scalloped hammerhead	<i>Sphyrna lewini</i>	J A	
33	NMFS	Sharks	Sharpnose sevengill shark	<i>Heptranchias perlo</i>		
34	NMFS	Sharks	Shortfin mako shark	<i>Isurus oxyrinchus</i>	E L P J S A	
35	NMFS	Sharks	Silky shark	<i>Carcharhinus falciformis</i>	J	
36	NMFS	Sharks	Sixgill shark	<i>Hexanchus griseus</i>		
37	NMFS	Sharks	Smalltail shark	<i>Carcharhinus porosus</i>		
38	NMFS	Sharks	Smooth hammerhead	<i>Sphyrna zygaena</i>		
39	NMFS	Sharks	Spinner shark	<i>Carcharhinus brevipinna</i>	J A	
40	NMFS	Sharks	Thresher shark, common	<i>Alopias vulpinus</i>		
41	NMFS	Sharks	Tiger shark	<i>Galeocerdo cuvieri</i>	J S A	
42	NMFS	Sharks	Whale shark	<i>Rhincodon typus</i>		
43	NMFS	Sharks	White shark	<i>Carcharodon carcharias</i>	J	
44	NMFS	Swordfish	Swordfish	<i>Xiphias gladius</i>	E L J S A	
45	NMFS	Tuna	Albacore	<i>Thunnus alalunga</i>	A	
46	NMFS	Tuna	Atlantic bigeye tuna	<i>Thunnus obesus</i>	J A	
47	NMFS	Tuna	Atlantic Yellowfin tuna	<i>Thunnus albacares</i>	E L J S A	
48	NMFS	Tuna	Skipjack tuna	<i>Katsuwonus pelamis</i>	E L J S A	
49	NMFS	Tuna	Western Atlantic bluefin	<i>Thunnus thynnus</i>	E L J S A	

Notes:
1. These Essential Fish Habitat species were compiled from **Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies**. February 1999 (Revised 10/2001) (Appendices 2, 3, 6, 7, and 8). Although 49 species are listed in Appendix 3 under National Marine Fisheries Service management, only 35 of these species have EFH listed in Appendix 8.
2. Organizations responsible for Fishery Management Plans include:
SAFMC = South Atlantic Fishery Management Council;
MAFMC = Mid-Atlantic Fishery Management Council;
NMFS = National Marine Fisheries Service.
3. Life stages include:
E = Eggs, L = Larvae, P = PostLarvae, J = Juveniles, S = SubAdults, A = Adults

Table 2.5. Categories of Essential Fish Habitat and Habitat Areas of Particular Concern identified in Fishery Management Plan Amendments affecting the South Atlantic Area.^{1,2}

<u>ESSENTIAL FISH HABITAT</u>	<u>GEOGRAPHICALLY DEFINED HABITAT AREAS OF PARTICULAR CONCERN</u>
Estuarine Areas	Area - Wide
Estuarine Emergent Wetlands	Council-designated Artificial Reef Special Management Zones
Estuarine Scrub / Shrub Mangroves	Hermatypic (reef-forming) Coral Habitat & Reefs
Submerged Aquatic Vegetation (SAV)	Hard Bottoms
Oyster Reefs & Shell Banks	Hoyt Hills
Intertidal Flats	<i>Sargassum</i> Habitat
Palustrine Emergent & Forested Wetlands	State-designated Areas of Importance of Managed Species
Aquatic Beds	Submerged Aquatic Vegetation
Estuarine Water Column ²	
Seagrass	
Creeks	
Mud Bottom	
Marine Areas	North Carolina
Live / Hard Bottoms	Big Rock
Coral & Coral Reefs	Bogue Sound
Artificial / Manmade Reefs	Pamlico Sound at Hatteras / Ocracoke Islands
<i>Sargassum</i>	Capes Fear, Lookout, & Hatteras (sandy shoals)
Water Column ²	New River
	The Ten Fathom Ledge
	The Point

¹Essential Fish Habitat areas are identified in Fishery Management Plan Amendments for the South Atlantic and Mid-Atlantic Fishery Management Councils. Geographically Defined Habitat Areas of Particular Concern are identified in Fishery Management Plan Amendments affecting the South Atlantic Area. Information in this table was derived from Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies. February 1999 (Revised 10/2001) (Appendices 4 and 5).

²EFH for species managed under NMFS Billfish and Highly Migratory Species generally falls within the marine and estuarine water column habitats designated by the Fishery Management Councils.

2.02 Terrestrial Environment

2.02.1 Maritime Shrub Thickets

This community normally occurs landward of the dune where it is protected from salt spray and the full force of ocean winds. Maritime shrub thicket is located sporadically throughout Topsail Beach, occurring on the backside of the island, west of the highway, and is interspersed with marsh areas, which border the sound. Dominant shrubs and trees in this community are wax myrtle (*Myrica cerifera*), yaupon (*Ilex vomitoria*), red cedar (*Juniperus virginica*), live oak (*Quercus virginiana*), and loblolly pine (*Pinus taeda*). Vines are also common with greenbriar (*Smilax bona-nox*), pepper-vine (*Ampelopsis arborea*) and grape (*Vitis rotundifolia*) being particularly abundant. This community type offers excellent cover for neo-tropical migrating songbirds. Other important species that may be found in the maritime thicket include the seaside sparrow, painted bunting, saltmarsh sharp-tailed sparrow, Nelson's sharp-tailed sparrow, and marsh and sedge wrens. Raptors may also be common during migration (e.g. American kestrel, merlin, peregrine falcon, bald eagle, northern harrier) (Sue Cameron, pers. comm.).

2.02.2 Beach and Dune

Terrestrial areas that may be influenced by the new proposed actions include 5.0 miles of Topsail Beach, from about 1,500 ft. south of Godwin Avenue (~2,500 ft. North of New Topsail Inlet) to the Topsail Beach/Surf City town limit (extending about 2,000 ft. into the Southern end of Surf City), and roadway rights-of-way utilized as corridors for dredge pipelines. Terrestrial habitat types within these areas include sandy or sparsely vegetated beaches and vegetated dune communities. The first line of stable vegetation is outside or landward of the proposed project limits. Utility corridors may have herbaceous or shrub cover. Barren areas are also widespread due to the disturbed nature of the utility corridors. Mammals occurring within this environment are opossums, cottontails, gray foxes, raccoons, feral house cats, shrews, moles, voles, and house mice.

Among North Carolina's upland habitats, the beach and dune community could be considered depauperate in both plants and animals. The beach environment is severe due to constant exposure to salt spray, shifting sands, wind, and sterile soils with low water retention capacity. Common vegetation of the upper beach includes beach spurge (*Euphorbia polygonifolia*), sea rocket (*Cakile edentula*) and pennywort (*Hydrocotyle bonariensis*). The dunes are more heavily vegetated, and common species include American beach grass (*Ammophila breviligulata*), panic grass (*Panicum amarum*), sea oats (*Uniola paniculata*), broom straw (*Andropogon virginicus*), seashore elder (*Iva imbricata*), and salt meadow hay (*Spartina patens*). Seabeach amaranth is present throughout Topsail Beach and is addressed in Appendix I. Important invertebrates of the beach/dune community include the mole crab (*Emerita talpoida*), coquina clams (*Donax variabilis*) (See Section 2.01.8), and ghost crabs (*Ocypode quadrata*).

Ghost crabs occupy the upper zone of the beach environment and functions as an important predator in the beach community. Up to 60% of their diet consists of mole

crabs up to 25% consists of coquina clams (Wolcott, 1978). During the sea turtle nesting season, ghost crabs are also known to prey on incubating sea turtle eggs and newly hatched sea turtle hatchlings. *Ocypode quadrata* is the only ghost crab occurring in the southeastern United States and, though little is known regarding its life history aspects, the various reproductive and larval components most likely reflect that of other decapods. Though timing of recruitment is poorly understood, it most likely occurs between late spring and early fall (Hackney *et al.*, 1996).

2.02.3 Birds

Birds common to the nearshore ocean in the project area include loons, grebes, gannets, cormorants, scoters, red-breasted mergansers, gulls, and terns (Table 2.6). The waters off of Topsail Island and Onslow Beach are very important to migrating and wintering northern gannets, loons and grebes because of the abundant hard bottom habitat (Sue Cameron, pers. comm.); however, most of the significant nearshore high-relief hardbottom habitat supporting abundant prey species are located north of the project area (Bill Cleary, pers. comm.; Hall, 2004). The USFWS indicate that sea ducks raft in large numbers in the nearshore ocean waters of the project area during spring and fall migrations. Ducks, geese, and many kinds of shorebirds may also be found here during the spring and fall.

The beaches of the project vicinity are heavily used by migrating shorebirds. However, dense development and high public use of project area beaches may reduce their value to shorebirds. Along the ocean beach, blackbellied plovers, ruddy turnstones, whimbrels, willets, knots, semi-palmated sandpipers, and sanderlings may be found. Table 2.6 provides a more complete list of waterbirds found in the project area. The dunes of the project area support fewer numbers of birds but can be very important habitats for resident species and for other species of songbirds during periods of migration. In the herbaceous dune areas, the American kestrel, merlin, bald eagle, peregrine falcon, northern harrier, and other raptors may be found during migration. Other birds occurring in this area are mourning doves, swallows, fish crows, starlings, meadowlarks, red-winged blackbirds, boat tailed grackles, and savannah sparrows.

Table 2.6. List of waterbirds that occur within the Topsail Beach project area and their status (LeGrand et al, 2001).

Common Name	Scientific Name	Season ¹	NC Status ²
Red-throated loon	<i>Gavia stellata</i>	M, W	
Common loon	<i>Gavia immer</i>	M, W	
Horned Grebe	<i>Podiceps auritus</i>	M, W	
Brown pelican	<i>Pelecanus occidentalis</i>	B, M, W	SR
Double-crested cormorant	<i>Phalacrocorax auritus</i>	B, M, W	SR
Northern Gannet	<i>Morus bassanus</i>	M, W	
Great blue heron	<i>Ardea herodias</i>	B, M, W	
Great egret	<i>Ardea albus</i>	B, M, W	
Snowy egret	<i>Egretta thula</i>	B, M	SC
Reddish egret	<i>Egretta rufescens</i>	M	
Tricolored heron	<i>Egretta tricolor</i>	B, M	SC
Little blue heron	<i>Egretta caerulea</i>	B, M, W	SC
Black-crowned night heron	<i>Nycticorax nycticorax</i>	B, M, W	
White ibis	<i>Eudocimus albus</i>	B, M, W	
Glossy ibis	<i>Plegadis falcinellus</i>	B, M	SC
Osprey	<i>Pandion haliaetus</i>	B, M	
Clapper rail	<i>Rallus longirostris</i>	B, M, W	
Black-bellied plover	<i>Pluvialis squatarola</i>	M, W	
Wilson's plover	<i>Charadrius wilsonia</i>	B, M	SR
Semipalmated plover	<i>Charadrius semipalmatus</i>	M	
Piping plover	<i>Charadrius melodus</i>	B, M, W	T (T)
Killdeer	<i>Charadrius vociferus</i>	B, M, W	
American oystercatcher	<i>Haematopus palliatus</i>	B, M, W	SR
American avocet	<i>Recurvirostra americana</i>	M	
Black-necked stilt	<i>Himantopus mexicanus</i>	B, M	SR
Greater yellowlegs	<i>Tringa melanoleuca</i>	M, W	
Lesser yellowlegs	<i>Tringa flavipes</i>	M, W	
Willet	<i>Catoptrophorus semipalmatus</i>	B, M, W	
Spotted sandpiper	<i>Actitis macularia</i>	M	
Whimbrel	<i>Numenius phaeopus</i>	M	
Marbled godwit	<i>Limosa fedoa</i>	M, W	
Ruddy turnstone	<i>Arenaria interpres</i>	M, W	

¹ Season
 B = Breeding; M = Migrating; W = Wintering

² NC Status
 Endangered (E); Threatened (T); Special Concern (SC); Significantly Rare (SR). E, T, and SC status species are given legal protection status by the NC Wildlife Resources Commission. SR status is defined as any species which has not been listed by the NC Wildlife Resources Commission as E, T, or SC species, but which exists in the state in small numbers and has been determined by the NC Natural Heritage Program to need monitoring. Federal status is indicated in parentheses.

Table 2.6. List of waterbirds that occur within the Topsail Beach project area and their status (LeGrand et al, 2001). – (continued).

Sanderling	<i>Calidris alba</i>	M, W	
Semipalmated sandpiper	<i>Calidris pusilla</i>	M	
Western sandpiper	<i>Calidris mauri</i>	M, W	
Least sandpiper	<i>Calidris minutilla</i>	M, W	
Red Knot	<i>Calidris canutus</i>	M, W	
Dunlin	<i>Calidris alpina</i>	M, W	
Short-billed dowitcher	<i>Limnodromus griseus</i>	M, W	
Bonaparte's gull	<i>Larus philadelphia</i>	M, W	
Laughing gull	<i>Larus atricilla</i>	B, M	
Ring-billed gull	<i>Larus delawarensis</i>	M, W	
Herring gull	<i>Larus argentatus</i>	B, M, W	
Great black-backed gull	<i>Larus marinus</i>	B, M, W	
Gull-billed tern	<i>Sterna nilotica</i>	B, M	T
Caspian tern	<i>Sterna caspia</i>	B, M, W	SR
Royal tern	<i>Sterna maxima</i>	B, M, W	
Sandwich tern	<i>Sterna sandvicensis</i>	B, M	
Common tern	<i>Sterna hirundo</i>	B, M	SC
Forster's tern	<i>Sterna forsteri</i>	B, M, W	
Least tern	<i>Sterna antillarum</i>	B, M	SC
Black tern	<i>Chlidonias nigra</i>	M	
Black skimmer	<i>Rynchops niger</i>	B, M	SC

¹ Season
 B = Breeding; M = Migrating; W = Wintering

² NC Status
 Endangered (E); Threatened (T); Special Concern (SC); Significantly Rare (SR). E, T, and SC status species are given legal protection status by the NC Wildlife Resources Commission. SR status is defined as any species which has not been listed by the NC Wildlife Resources Commission as E, T, or SC species, but which exists in the state in small numbers and has been determined by the NC Natural Heritage Program to need monitoring. Federal status is indicated in parentheses.

On 10 July 2001, the USFWS designated 1,114 acres (Unit NC-11) of critical habitat for wintering piping plovers (*Charadrius melodus*) of which the southern spit of Topsail Beach is included. The unit extends southwest from 1.0 km northeast of Mean Lower Low Water (MLLW) of New Topsail Inlet on Topsail Island to 0.53 km southwest of MLLW of Rich Inlet on Figure Eight Island. It includes both Rich Inlet and New Topsail Inlet and the former Old Topsail Inlet. All land, including emergent sandbars, from MLLW on the Atlantic Ocean and sound side to where densely vegetated habitat begins and where constituent elements no longer occur (Federal Register, 2001). Bird surveys have been sporadically performed on Topsail Beach since 1987 and since then 61 piping plovers have been identified as individuals or pairs. Since 1987, a total of 7 nests were identified of which only 1 was successful in 1999 (Sue Cameron, pers. comm.) (See Biological Assessment (Appendix I)).

Colonially nesting waterbirds (gulls, terns, and wading birds) are an important part of the project area ecosystem. These species formerly nested primarily on the barrier islands of the region but have had most of these nesting sites usurped by development or recreational activities. With the loss of their traditional nesting areas, these species have retreated to the relatively undisturbed dredged material disposal islands, which border the navigation channels throughout the State. These islands often offer ideal nesting areas as they are close to food sources, well removed from human activities, and are isolated from mammalian egg and nestling predators. Other species also use the islands for loafing or roosting during migratory periods or the winter months including painted buntings. Surveys by the NCWRC for American oystercatchers and Wilson's plovers this year indicated that the dredge islands, natural islands and shell rakes behind Topsail Island are very important nesting areas for these species. However, dredged material islands within the immediate vicinity of the project area that are diked are used by only a small number of nesting waterbirds. Though most of the project area is heavily developed, the southern end of Topsail Island, as well as nearby Lea and Hutaff islands, provide important and unique undeveloped habitat for breeding birds including terns (*Sterna spp.*), skimmers (*Rynchops niger*), piping plovers (*Charadrius melodus*), Wilson's plovers (*Charadrius wilsonia*), and American oystercatchers (*Haematopus palliatus*). These undeveloped barrier island areas are rare within the project vicinity and are very important breeding habitats for these species.

The black skimmer (*Rynchops niger*), least tern (*Sterna antillarum*), and common tern (*Sterna hirundo*) are State listed species of concern for Pender County, North Carolina and are found on Topsail Beach year round during both the breeding season and during migration, with peak abundance occurring in the summer months. Terns feed by diving from the air upon insects and small fish and the black skimmer feeds on shrimp or small fish by flying just above the water with the tip of the long lower mandible shearing the surface. All of these bird species may use Topsail Beach for roosting, foraging, breeding, and nesting (Potter *et al.*, 1980).

2.02.4 Endangered and Threatened Species

Updated lists of federally endangered and threatened (E&T) species for the project area were obtained from NMFS (Southeast Regional Office, St. Petersburg, FL on August 16, 2004) and the U.S. Fish and Wildlife Service (USFWS) website (<http://nc-es.fws.gov/es/es.html>). These were combined to develop the composite list shown in Table I-1 of the biological assessment (Appendix I), which includes federally listed E&T species that could be present in the area based upon their historical occurrence or potential geographic range. However, the actual occurrence of a species in the area depends upon the availability of suitable habitat, the season of the year relative to a species' temperature tolerance, migratory habits, and other factors. The likelihood of occurrence and potential project impacts regarding E&T species are summarized in the Biological Assessment (Appendix I.)

An updated list of state listed species for Pender County, North Carolina was obtained from the North Carolina Natural Heritage Program website (<http://www.ncnhp.org/>). From this list, species that may be present within the project vicinity are the black skimmer (*Rynchops niger*) (species of concern), least tern (*Sterna antillarum*) (species of concern), common tern (*Sterna hirundo*) (species of concern), gull billed tern (*Sterna nilotica*) (threatened), Wilson's plover (*Charadrius wilsonia*) (significantly rare), American oystercatcher (*Haematopus palliatus*) (significantly rare), and Carolina diamondback terrapin (*Malaclemys terrapin centrata*) (Species of Concern). Bird species are addressed within Sections 2.02.3 and 8.02.3 and the Carolina diamondback terrapin is addressed in Sections 2.01.2 and 8.01.2 of this EIS.

2.03 Physical Resources

2.03.1 Wave Conditions

Waves selected as input for the study were taken from the Corps of Engineers' Coastal and Hydraulics Laboratory Wave Information Study (WIS). Updated WIS wave hindcast data for Station 292, located about 10 miles offshore of Topsail Island, for the period 1990 to 1999 were used. Based on these data, waves commonly approach the southeast-facing study area from east through south directions (nearly two-thirds of the time), with east-southeast and southeast approaching waves occurring most frequently (nearly one-third of the time). Annually, the most frequently occurring wave heights range from 1.6 to 3.2 feet, with a mean wave height of about 3.3 feet. In winter, the most frequently occurring wave heights range from 1.6 up to 4.9 feet due to storms, with easterly to northeasterly approaching waves increasing in frequency. Summer wave conditions have more of a southeasterly component and are commonly in the 1 to 3 foot range, except for tropical systems that can generate the infrequent, but extreme waves of 15 feet or more.

2.03.2 Shoreline and Sand Transport

Long-term shoreline changes between 1963 and 2002 were determined by comparing MHW shoreline positions for each reach. Shoreline change rates were relatively low in the northern half of the study area (less than one foot per year), with some slight accretion along the interior reaches 13 through 22 (about 10,000 feet). In the southern portion of the study area, erosion rates gradually increase to over 3 feet of erosion per year (reaches 5 to 7). In the immediate vicinity of the inlet (reaches 1 to 4), inlet migration has resulted in accretion. These 1,000-foot long study reaches are visible in Section 7, Figure 7.2 and in Appendix A, Figures A-7 and A-8.

Sediment transport modeling of all of Topsail Island indicates an average net sediment transport of about 200,000 cubic yards per year to the north in the Topsail Beach study area. This northerly sediment transport is consistent with the findings of the August 1992 Design Memorandum for the project, which reported a northerly transport rate of 325,000 cubic yards/year for Topsail Beach.

2.03.3 Geology and Sediments

The Topsail Beach Project study area is located in the Atlantic Coastal Plain Physiographic Province bordering Onslow Bay. The geomorphology of the area is characterized by beaches, dunes, and marshes typical of a barrier island complex. The Atlantic Coastal Plain and Onslow Bay are both underlain by relatively flat-lying sedimentary units which gently dip and thicken to the southeast. This large sedimentary wedge includes both sediments which have not been indurated or cemented and rock units. These sedimentary units range in age from Cretaceous to Quaternary and overlie crystalline basement rock. A patchy veneer of Holocene sands and gravels overlies the Quaternary strata. The sand soils found on the Topsail Island beaches are classified as fine-to-medium-grained poorly-graded sands (SP) according to the Unified Soils Classification System.

The small rivers and streams entering Onslow Bay contribute small sediment loads as a significant fraction is deposited within the estuaries. This in turn contributes to the sand-starved nature of the coast in this area.

2.04 Socio-Economic Resources

The local economic impact area includes all of Topsail Island and the nearby areas of both Pender and Onslow Counties, North Carolina. Topsail Island includes not only Topsail Beach on the south end of the island but also Surf City and North Topsail Beach on the north end of Topsail Island. Highways 50 and 210 connect the island to the mainland portion of the two counties.

2.04.1 Demographics

Demographics for the existing economic conditions for the two-county study area include census data for population, housing, and personal income are shown in Table 2.7. The total population of the two county area was over 190,000 in 2000. The Town of Topsail Beach had 471 permanent residents in 2000; however, the peak seasonal population is estimated to exceed 7,000.

Table 2.7 - Socioeconomic Conditions Pender and Onslow Counties, NC

	Pender County	Onslow County	Town of Topsail Beach
Population, 2000	41,082	150,355	471
Ave. Household size	2.49	2.72	1.87
Housing Units	20,798	55,726	1,149
Occupied year-round	16,054	48,122	252
Seasonal or vacant	4,744	7,604	897
Estimated peak season population			7,252
In labor force	19,087	85,054	209
Per capita income	17,882	14,853	35,838
Per Capita Personal Income 2002	21,720	25,317	N/A

Source: U.S. Census Bureau (<http://factfinder.ensus.gov>) and U.S. Dept. of Commerce – Bureau of Economic Analysis (<http://bea.doc.gov/bea>)

The population of Pender County grew from 28,855 in 1990 to 41,082 in 2000, an increase of 42 percent. Onslow County population was virtually unchanged during the same period. The State of North Carolina grew by 21 percent during that same period. Personal per capita income for Pender and Onslow counties was reported to be \$27,720 and \$25,317 respectively. Personal per capita income for the State of North Carolina was \$20,307.

Historical population growth for Pender and Onslow counties are shown in Figure 2.2, as well as historical and projections by the NC State Demographer through 2029 are shown in Figure 2.3.

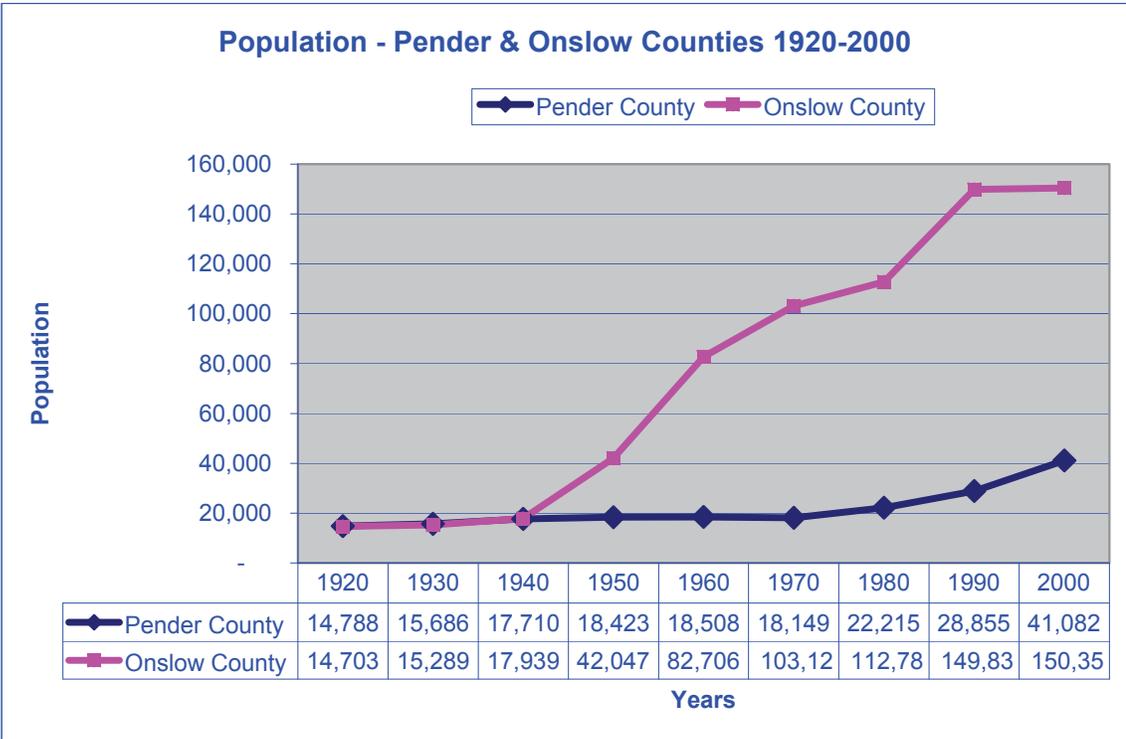


Figure 2.2 Population history

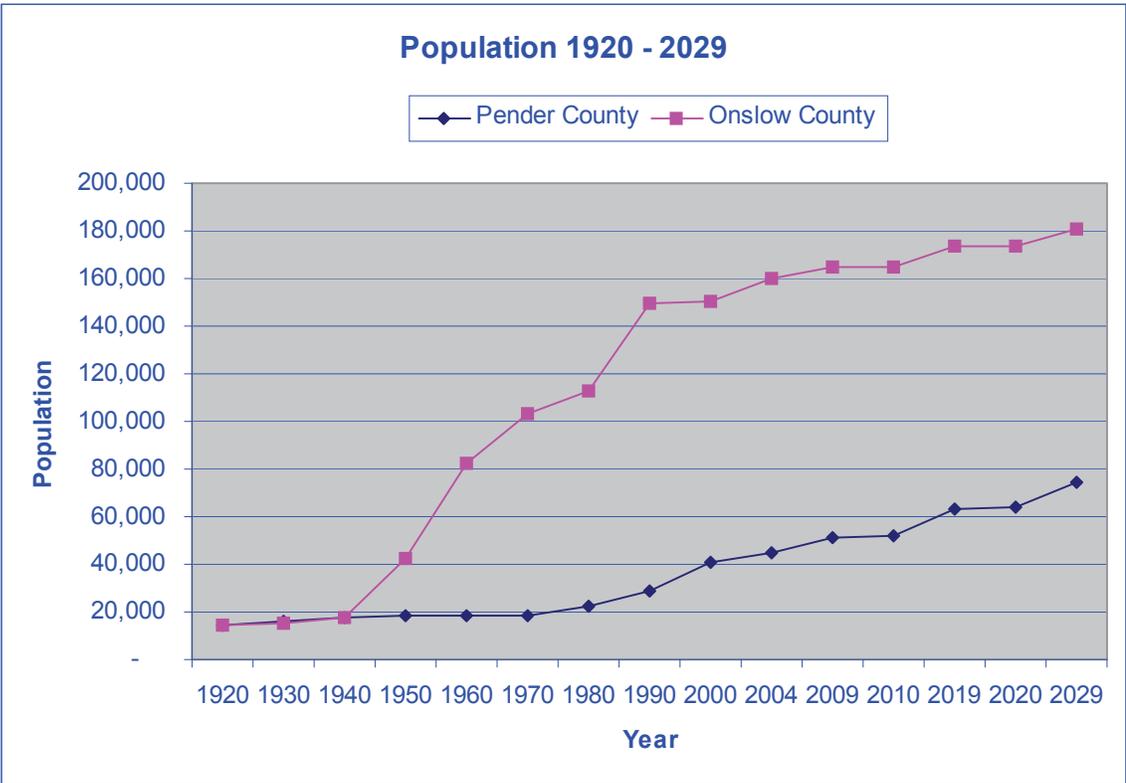


Figure 2.3 Projected population.

2.04.2 Esthetic and Recreational Resources

The Town of Topsail Beach, which was incorporated in 1963, is an urbanized beach community characterized by paved streets, parking lots, hotels, single-family dwellings, hotels, and low-rise condominiums. A scenic setting is provided by waters of the Atlantic Ocean, New Topsail Inlet, Topsail Creek, and Banks Channel and the numerous vessels common to these waters. The marine environment provides opportunities for boating and fishing, as well as an escape from the faster pace of land-based activities. Beaches generally offer extensive recreational opportunities for activities such as swimming, sunbathing, walking, surfing, bird watching, and fishing. In addition, one ocean fishing pier, the Jolly Roger Pier, is located in the study area and is considered an important recreational facility at Topsail Beach. The esthetic value of this beach community is evidenced by the popularity of the area for family oriented use and tourism. The seasonal influx of tourists increases the population from approximately 425 year round residents to more than 7,000 (<http://www.topsailbeach.org/>) during the warmer months of the year. However, the Topsail Beach has lost some of its visual appeal due to the severe erosion resulting from the hurricanes of 1996-1999 and 2003.

2.04.3 Commercial and Recreational Fishing

The North Carolina Division of Marine Fisheries (NCDMF) reported nearly 600,000 pounds of commercial finfish and shellfish landings in the vicinity of New Topsail Inlet in both 2003 and 2004. Significant shellfish landings included over 200,000 pounds reported from Hampstead and over 100,000 pounds reported from Surf City in 2003. As shown in Appendix A, Figure A-4, only 2 small areas in the vicinity of Topsail Beach are closed to shellfishing. Finfish landings reported from Hampstead exceeded 100,000 pounds in both 2003 and 2004. The commercial value of all finfish and shellfish landings reported in the vicinity of New Topsail Inlet was nearly \$800,000 in both 2003 and 2004.

Recreational fishing includes fishing from head boats, charter boats, private boats, piers, and the surf. Fishing from head boats is best in the winter months for snapper and grouper. Fishing from charter boats is excellent for King mackerel and bottomfish during the winter. Offshore, gulfstream species, like yellowfin tuna and Wahoo are available. Inside fishing has been successful for inshore species such as red drum, speckled trout, and flounder.

Private boat anglers can find bluefin tuna in the nearshore area, king mackerel and other bottomfish species in the offshore, and other species such as speckled trout, red drum, and flounder can be found in the inside areas of the creeks and Atlantic Intracoastal Waterway. NCDMF reports that most piers are closed for the season and shore fishing activity will be limited in this area.

2.05 Cultural Resources

The six proposed borrow areas are located 1 to 5.5 miles offshore of New Topsail Inlet and the Town of Topsail Beach. This area has seen significant maritime activity since at

least the early 18th century when permanent settlement began. One of the earliest land grants included the inlet and area surrounding the sound, and by 1755 New Topsail Sound was designated as an official inspection point for export commodities in New Hanover County, along with counties Brunswick, Wilmington, and New Exeter. Inspections were conducted for export commodities of fish, flour, butter, flax seed, beef, pork, rice, tar, pitch and turpentine, staves and headings, sawed lumber and shingles. Throughout the Colonial Period, the inlet was relatively stable and was suitable for passage by schooners and small sloops. During the latter part of the eighteenth century and throughout most of the nineteenth century, New Topsail Inlet migrated significantly to the north. According to Wilson Anglely's (1984) analysis, the Mouzon Map of 1775 and the Price-Strother Map of 1808, the inlet migrated northward some two miles. While the Mac Rae-Brazier Map of 1833 indicates no significant change, the U.S. Coast Survey Map of 1865 shows that an additional migration of two miles occurred during that period. The migration appears to have abated during the end of that century, as is suggested by review of the Kerr-Cain Map of 1882 and the Post Route Map of 1896. A detailed U.S. Coast Survey Map of 1885 indicates that the New Topsail Inlet was approximately 3,000 feet wide at that time.

At least eleven vessels are reported or believed to have been lost in the area of Topsail Inlet (Table 2.8). This number includes the loss of four vessels in 1750, part of the Spanish Plate Fleet. One of those ships, packet boat *El Salvador* was lost in the vicinity of Topsail Inlet on August 18, 1750. Due to the shifting sands, the surviving remains were buried in a matter of days, making salvaging operations difficult.

Table 2.8. NC Division of Archives and History, Underwater Archaeology Section
Shipwreck Files

Wreck Name	Date Lost	Type Vessel	Location
<i>El Salvador</i>	18 Aug 1750	Nao	Topsail Inlet (suspected)
<i>Unknown Brig</i>	Sep 1769	Brigantine	Below Topsail Inlet
<i>Betsy</i>	1771	Merchant	Old Topsail Inlet
<i>Adelaide</i>	22 Oct 1862	Schooner	Mouth of New Topsail Inlet
<i>Alexander Cooper</i>	22 Aug 1863	Schooner	New Topsail Inlet
<i>Industry</i>	2 Feb 1863	Schooner	5 miles north of Topsail Inlet
<i>Phantom</i>	23 Sep 1863	Steamer	200 yards offshore in 30 feet of water, Topsail Inlet
<i>Unknown Schooner</i>	22 Jan 1863	Schooner	Westward of Stump Inlet
<i>Wild Dayrell</i>	3 Feb 1864	Side-wheel Steamer	Rich Inlet
<i>Mary Bear</i>	9 Sep 1881	Schooner	New Topsail Inlet
<i>William H. Sumner</i>	7 Sep 1919	Schooner	Topsail Inlet

Before the Civil War, the following vessels were lost in the vicinity: schooner *Superior*, driven ashore November 24, 1841; an unknown brig in September 1769, run ashore below Topsail Inlet; English merchantman *Betsy* in 1771 at Old Topsail Inlet. The Civil War also resulted in a number of wrecks, including the schooner *Adelaide* of Halifax an unidentified schooner west of Stump Inlet, the iron-hulled steamer *Phantom*, and the schooner *Industry*. During the late 19th and early 20th centuries the following losses are recorded: the schooner *Mary Bear* on September 9, 1881, at New Topsail Inlet; and schooner *William H. Sumner* on September 7, 1919, grounded at Topsail Inlet.

The inlet area was active in salt production. An 1864 military map shows at least 2 Confederate salt works situated on either side of Holmes Landing. The presence of the salt works is further substantiated in a letter of November 1, 1862, written by USS Lieutenant William Cushing to his superior.

In 1932, a 12-foot deep and ninety-foot wide segment of the Intracoastal Waterway between Beaufort and the Cape Fear south of Wilmington was completed. The channel allowed for an increase in vessel traffic from 33,710 tons in 1932 to 243,000 tons in 1939. As reported the previous year, the character of the vessel traffic – of around 9,000 vessel trips – consisted of approximately 8,500 motor vessels, 300 tugs, 200 barges, and a smattering of pleasure craft. Cargo vessels transported agricultural commodities, lumber, petroleum products, seafood, fertilizer, and general merchandise.

2.06 Water Resources

2.06.1 Hydrology

Tides in the area are semidiurnal and the mean tidal range is about 3.0 feet at New River Inlet and at New Topsail Inlet. Regular reversals of flow occur with each tidal cycle except during periods of high fresh water flow. The salinity of the area varies due to many factors including freshwater inflow, tidal action, and wind. From 2002 to 2004, average salinities in the Topsail Island vicinity range from an average of 14.2 parts per thousand (ppt) near New River Inlet, to 23.9 ppt in the Atlantic Intracoastal Waterway behind Topsail Island, to 35.9 ppt in the nearshore ocean at the Surf City Pier (Stan Sherman, pers. comm).

2.06.2 Water Quality Classification

All surface waters in North Carolina are assigned a primary classification by the NC Division of Water Quality (NCDWQ)(15A NC Administrative Code 02B .0301 to .0317). Waters in the vicinity of Topsail Island fall into three of these classifications. Waters of the Atlantic Ocean between Drum Inlet and Baldhead Island are classified as "SB," and are suitable for primary recreation, including frequent or organized swimming and all "SC" uses (secondary recreation such as fishing, boating, and other activities involving minimal skin contact; aquatic life propagation and survival; and wildlife). Stormwater controls are required under the Coastal Area Management Act (CAMA), and there are no categorical restrictions on discharges.

All other surface waters of the vicinity, including the New River, Atlantic Intracoastal Waterway (AIWW), Topsail Sound, and Banks Channel, meet the "SA HQW" classification and are suitable for shellfishing for marketing purposes as well as all "SB" and "SC" uses (See Appendix A, Figure A-5). All "SA" waters are "HQW" (High Quality Waters) by definition, and stormwater controls are required and domestic discharges are prohibited. Waters of the AIWW from Daybeacon # 17 (between Chadwick Bay and Alligator Bay) to Morris Landing (south of Spicer Bay) and waters of Topsail Sound southward from approximately New Topsail Inlet to Middle Sound are classified as "SA ORW." The "ORW" (Outstanding Resource Waters) designation is a supplemental classification intended to protect unique and special waters having excellent water quality and an exceptional state or national ecological or recreational significance. Waters of this classification must have one of the following outstanding resource values:

- Outstanding fish habitat or fisheries,
- Unusually high level of water based recreation,
- Some special designation such as North Carolina or National Wild/Scenic/Natural/Recreational River, National Wildlife Refuge, etc.,
- Important component of state or national park or forest, or
- Special ecological or scientific significance (rare or endangered species habitat, research, or educational areas).
- No new or expanded wastewater discharges are allowed in these waters. ORW are HQW by definition.

2.06.3 Groundwater

The sole source of water supply for both public and private systems in Pender County is groundwater. A vast aquifer system from which potable water can be drawn lies below the County. The water bearing groundwater units on Topsail Island are the surficial aquifer and the deeper cretaceous aquifer. The cretaceous aquifer is used as the water source for the various communities located on Topsail Island. The Town of Topsail Beach has 3 wells that draw from the cretaceous aquifer that is recharged on the mainland (Town of Topsail Beach Core Land Use Plan 2005). Regionally, the horizontal groundwater movement is eastward with some southeast movement. The resultant groundwater movement is toward the coast.

2.07 Other Significant Resources (Section 122, P.L. 91-611)

Section 122 of P.L. 91-611 identifies other significant resources that must be considered during project development. These resources, and their occurrence in the study area, are described below.

2.07.1 Air, Noise, and Water Pollution

Areas of the country where air pollution levels persistently exceed the national ambient air quality standards may be designated "non-attainment." All of Topsail Island is in an attainment area. There are no known air quality problems in the study area.

Noise is a prominent feature in the study area due to the sound of the breakers and at times, tourists and traffic on the beach. The sounds of breakers are tranquil and add to the pleasure experienced by visitors. Noise at Topsail Beach is regulated by a noise ordinance that is enforced 24 hours a day.

Water quality is discussed in Section 2.06.2 and in the Section 404(b)(1) (PL 95-217) evaluation that is included as Attachment G of this document.

2.07.2 Man-made and Natural Resources, Esthetic Values, Community Cohesion, and the Availability of Public Facilities and Services

Only one pier, Jolly Roger Pier, is located at Topsail Beach and it is within the proposed beach fill area. The Jolly Roger pier complex includes a convenience store and bait and tackle shop with small restaurant facilities. This 854-foot ocean pier, at the southern end of the island, is open from March through November. Esthetic values are discussed in Section 2.04.2.

The Town's drainage system is comprised of several street catch basins, drop inlets and sock tile drains installed by the North Carolina Department of Transportation (NCDOT), and a few ditches to alleviate water runoff. There are no stormwater drainage outlets that discharge to the beach.

Water is supplied to Topsail Beach via three town water wells that draw water from a deep aquifer. The wells are located between Banks Channel and Highway NC50. No wells are located near the beach. The water systems of Topsail Beach and Surf City are connected and have an agreement for emergency use and to purchase water when necessary. (Town of Topsail Beach Core Land Use Plan 2005)

Septic tanks and two privately owned wastewater treatment plants handle the sanitary waste disposal needs of the community. Pender East Emergency Medical Services squad provides rescue and advanced life support services within the Town's limits. Electricity is provided by Jones-Onslow Electric Membership Corporation. Sprint provides telecommunications service within the town limits, and the cable television franchise is operated by Charter Communications.

Topsail Beach is the home of the Karen Beasley Sea Turtle Rehabilitation and Rescue Center, which is open to the Public during the summer months.

Public Accesses from public roads and streets to the beach are provided at 22 designated access points. There are a total of 374 parking spaces available to the general public near these access points. In addition, the town has indicated in a more recent count during the summer of 2004, there may be at least 300 additional parking spaces unaccounted for on the rights of way (ROW) along town streets. (Appendix F)

2.07.3 Contaminated Sediments

Due to past military activities in the project area, the presence of contaminated sediments warrants discussion. The potential for encountering contaminated sediments in the project area is discussed below as documented in the Defense Environmental Restoration Program For Formerly Used Defense Sites (DERP-FUDS), Ordnance And Explosive Waste, Archives Search Report, Findings For The Former Camp Davis, Holly Ridge, North Carolina, Project Number 104nc001702, May 1994.

In 1941 Camp Davis was established as an Anti-Aircraft Training Center at Holly Ridge, North Carolina. Acquisition of land for Camp Davis took place from 1941 through 1943. A total of approximately 46,682 acres was acquired by lease from numerous individuals, corporations, and governmental agencies by the War Department for a World War II Army Air Corps training facility. The Training Center was later used as a convalescent hospital and rehabilitation center and became home to various military units. Coast Artillery Anti-Aircraft Regiments were the dominant groups, moving thousands of recruits through basic training and anti-aircraft weaponry. Although the main part of Camp Davis was located on the mainland, northwest of Topsail Island, the Coastal Gunnery Range Emplacement Area was located on Topsail Island near the Surf City bridge and the Coastal Gunnery Potential Range Impact Area was located offshore of Topsail Island (Figure A-1, Appendix A).

The Gunnery Emplacement area, was located four and a half miles southeast of the main portion of the former Camp Davis. The site was known as the Sears Landing and

occupied a narrow strip of land between the inland waterway and the Ocean. As a gun emplacement, the ordnance used on site would have been fired or returned to the point of issue; therefore, the possibility of ordnance residue is extremely remote. The inspection team did not observe any Ordnance or Explosive Wastes (OEW) in this area and there were no reports of OEW within the gun emplacement area.

The Coastal Gunnery Range Impact Area, which was located offshore of Topsail Island, was viewed by inspectors from the beach and no offshore survey was conducted. Inspectors only surveyed the beach area to the water's edge. The AA coastal gunnery range impact area has potential ordnance contamination based upon its use when it was active, however, no evidence of residual OEW contamination has been found or documented since the anti-aircraft gunnery range was closed. No records or documentation were located as to the exact types of ordnance used, although it is presumed that mostly practice rounds were used based upon the fact that gunners fired at a target that was pulled/towed behind an aircraft. Practice round sizes would have varied, but are presumed to include the following: 37 mm (1.46 inches), 40 mm (1.57 inches), 3-Inch, 90 mm (3.54 inches), 105 mm (4.13 inches), and 155 mm (6.10 inches).

After World War II, Camp Davis was assumed by the Navy for their secret guided missile testing program, code-named "Operation Bumblebee." Topsail Island was the third of three widespread test sites established along the Atlantic seaboard in the closing years of World War II, and the first permanent ground for missile testing. The Topsail Island site, placed in operation in March 1947, incorporated rigid structures that were designed and built for specific uses related to the assembly, firing, monitoring and perfecting of experimental ramjet missiles. The Navy used only a small portion of Camp Davis for the testing of rocket motor propulsion systems. An arsenal center for the assembly and storage of rockets was built on the sound-side of the island, and launching pads were constructed on the oceanfront. Concrete observation towers were built throughout the island to monitor the experimental launchings and many of the military structures remain standing today. During the 18 months that Operation Bumblebee was active at Topsail, an estimated 200 experimental rockets, each measuring six inches in diameter and between three and 13 feet in length, were fabricated at the Assembly Building, dispatched to the launch site, and fired along a northeasterly angular deflection of 15 degrees to the shoreline for a maximum clear distance of 40 miles. Despite the initial success of the US Naval Ordnance Testing facility at Topsail Island, its location did not fulfill completely the needs of a permanent base because weather conditions and increased sea traffic interfered with testing, and the facility was abandoned and its equipment moved to other sites (<http://www.cr.nps.gov/nr/travel/aviation/usn.htm>).

Although, over 200 rocket launchings took place on the island between 1946 and 1948, no OEW was associated with the testing procedures and all leased land was returned to the original landowners. Currently, most of the former Camp Davis lands are being used for state wildlife game lands (Holly Shelter) and for the production of forestry products.

Several databases were reviewed to obtain information pertaining to releases, treatment, storage, and disposal of hazardous substances in the project area. These databases

included EPA Superfund (Comprehensive Environmental Response, Contamination and Liability Information System (CERCLIS)), Resource Conservation and Recovery Act (RCRA) and Brownsfields. Also reviewed was the State listing of hazardous wastes sites. Based on this review and the review of the Camp Davis Archives Search Report, referenced above, there are no documented active or inactive hazardous waste sites on Topsail Island.