Essential Fish Habitat Assessment for the Alternative Sand Source Utilization Pinellas County Shore Protection Project Pinellas County, Florida

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1.0 INTRODUCTION

1.1 Project Location

The project area is located in Pinellas County on the West coast of Florida, near the central portion of the Florida peninsula, approximately 25 miles west of Tampa. The sites evaluated in this document include the nearshore and offshore areas of Sand Key, Long Key, and Treasure Island (Figure 1).

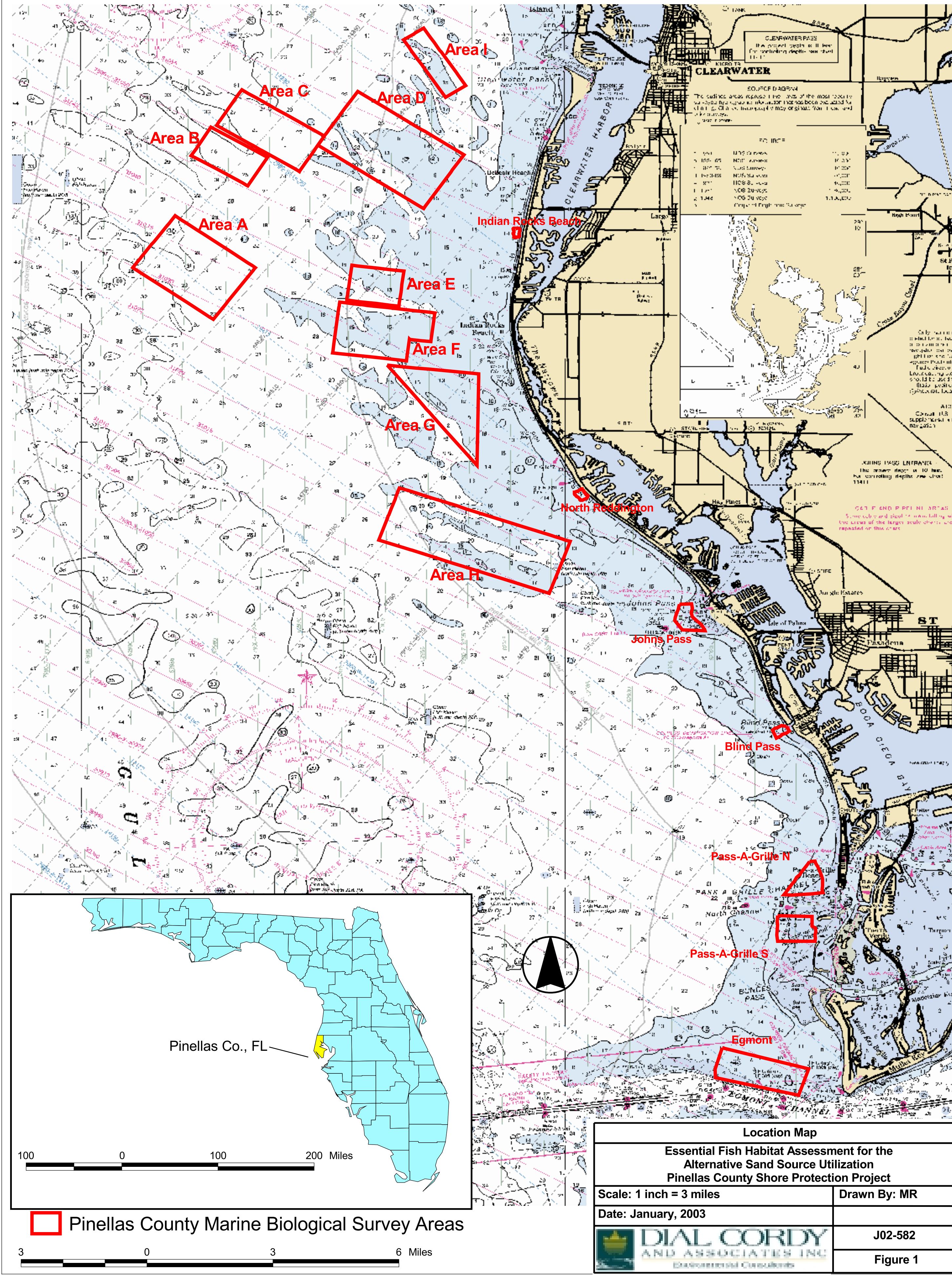
1.2 Project Need or Opportunity

Shoreline erosion and a lowered beach profile caused by storms, wave action, and currents have become a serious concern along Pinellas County barrier island beaches. As a means of controlling shoreline erosion and providing storm protection to these barrier islands, fill material has been placed along the shorelines. The Pinellas County Beach Erosion Control Project has historically obtained beach quality fill from inlet borrow areas and the Egmont Channel Shoal for nourishment of Pinellas County beaches. Nine offshore borrow areas and four ebb tidal shoal areas have been identified for future use. Bathymetry and side-scan sonar of nearshore marine habitats have also been performed. Marine habitats within these nearshore areas have been evaluated for occurrence and quality to facilitate minimization of impacts to these resources due to utilization of the offshore and ebb tidal shoal borrow areas.

1.3 Agency Goal or Objective

1.3.1 Objective

The objective of the Preferred Alternative is to utilize sand sources closer to the project areas previously authorized for maintenance renourishment activity. The currently authorized borrow area of Egmont Key Shoal is more than 20 miles away from the beaches authorized for renourishment. This is not always a cost effective alternative for small nourishment events. Borrow areas closer to the project areas would offer more cost effective construction options.



Location Map

Essential Fish Habitat Assessment for the Alternative Sand Source Utilization Pinellas County Shore Protection Project

Scale: 1 inch = 3 miles	Drawn By: MR
Date: January, 2003	
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J02-582
	Figure 1

1.3.2 Preferred Alternative

The Preferred Alternative would allow the U.S. Army Corps of Engineers (Corps) to utilize the nine offshore areas and four ebb tidal shoals as potential borrow areas for future beach nourishment/renourishment activities. These borrow areas would be utilized in lieu of/in addition to the authorized Egmont Shoal borrow area.

2.0 ESSENTIAL FISH HABITAT DESIGNATION

In accordance with the Magnuson-Stevens Fishery Conservation and Management Act of 1976 and the 1996 Sustainable Fisheries Act, an Essential Fish Habitat (EFH) assessment is necessary for implementation of the Preferred Alternative. An EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." *Waters* include aquatic areas and their associated physical, chemical, and biological properties that are use by fishes and may include areas historically used by fishes. *Substrate* includes sediment, hardbottom, structures underlying the waters, and any associated biological communities. *Necessary* means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. *Spawning, breeding, feeding, or growth to maturity* covers all habitat types used by a species throughout its life cycle. Only species managed under a federal fishery management plan (FMP) are covered (50 C.F.R. 600). The act requires federal agencies to consult on activities that may adversely influence EFH designated in the FMPs. The activities may have direct (e.g., physical disruption) or indirect (e.g., loss of prey species) effects on EFH and may be site-specific or habitat-wide. The adverse result(s) must be evaluated individually and cumulatively.

2.1 Assessment

Assessments of marine resources within the proposed project area were conducted in 2001 and 2002 by Dial Cordy and Associates Inc. (Dial Cordy). Dominant aquatic community types were documented within and adjacent to the proposed borrow areas, pipeline corridors and nearshore areas. Surveys of the ebb tidal shoal areas and the Pass-a-Grille channel were also performed (Dial Cordy, 2001a; 2001b; 2002). Marine habitats identified during the survey included hardbottom, shell hash, and open sand habitat. The aquatic communities associated with these different bottom types and the water column have been identified as EFH in accordance with the amendment to the Fishery Management Plans of the Gulf of Mexico Fishery Management Council (GMFMC, 1998).

2.2 Managed Species

The Gulf of Mexico Fisheries Management Council (GMFMC) (1998) has designated unvegetated bottom, livebottom, and water column areas within the study area as EFH, in compliance with the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801-1882), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267). Managed species that commonly inhabit the study area are shown in Table 1. Consequently, the Project area has been designated as EFH for theses fishes, brown shrimp, white shrimp, pink shrimp, and spiny lobster (Table 1). Six coastal migratory pelagic fish species have been included owing to their distribution patterns along the Florida coast. In addition, the nearshore bottom and offshore hardbottom habitats of the Gulf coast of Florida have also been designated as EFH (GMFMC, 1998).

Table 1 Managed Species Identified by the Gulf of Mexico Fishery Management Council That Are Known to Occur in Pinellas County, Florida

Common Name	Taxa
Balistidae	
Gray Triggerfish	*Balistes capriscus*
Carangidae	
Yellow Jack	*Caranx bartholomaei*
Blue Runner	*Caranx crysos*
Crevalle Jack	*Caranx hippos*
Bar JackLesser Amberjack	*Caranx rubberSeriola fasciata*
Greater Amberjack	*Seriola dumerili*
Coryphaenidae	
Dolphin [1]	*Coryphaena hippurus*
Ephippidae	
Spadefish	*Chaetodipterus faber*
Haemulidae	
Black Margate	*Anisotremus surinamensis*
Porkfish	*Anisotremus virginicus*
Margate	*Haemulon album*
Tomtate	*Haemulon aurolineatum*
Smallmouth Grunt	*Haemulon chrysargyreum*
French Grunt	*Haemulon flavolineatum*
Spanish Grunt	*Haemulon macrostomum*
Cottonwick	*Haemulon melanurum*
Sailors Choice	*Haemulon parra*
White Grunt	*Haemulon plumieri*
Blue Stripe Grunt	*Haemulon sciurus*
Labridae	
Puddingwife	*Halichoeres radiatus*
Hogfish	*Lachnolaimus maximus*

Common Name	Taxa
Lutjanidae	
Mutton Snapper	*Lutjanus analis*
Vermillion Snapper	*Rhomboplites aurorubens*
Schoolmaster	*Lutjanus apodus*
Red Snapper	*Lutjanus campechanus*
Gray Snapper	*Lutjanus griseus*
Dog Snapper	*Lutjanus jocu*
Mahogany Snapper	*Lutjanus mahogoni*
Lane Snapper	*Lutjanus synagris*
Yellowtail Snapper	*Ocyurus chrysurus*
Rachycentridae	
Cobia [1]	*Rachycentron canadum*
Scombridae	
Little Tunny [1]	*Euthynnus alletteratus*
King Mackerel [1]	*Scomberomorus cavalla*
Spanish Mackerel [1]	*Scomberomorus maculates*
Cero [1]	*Scomberomorus regalis*
Serranidae	
Black Sea Bass	*Centropristis striata*
Rock HindScamp Grouper	*Epinephelus adscensionisMycteroperca phenax*
Goliath Grouper	*Epinephelus itajara*
Red Grouper	*Epinephelus morio*
Black Grouper	*Mycteroperca bonaci*
Gag	*Mycteroperca microlepis*
Sparidae	
Sheepshead	*Archosargus probatocephalus*
Jolthead Porgy	*Calamus arctifrons*
Invertebrates	
Brown Shrimp	*Farfantepenaeus aztecus*
Pink Shrimp	*Farfantepenaeus duorarum*
White Shrimp	*Litopenaeus setiferus*
Spiny Lobster	*Panulirus argus*

[1] Coastal Migratory Pelagic Fish Species

The species addressed in this section consist of fishes and invertebrates of both recreational and commercial importance that are managed under the Magnuson-Stevens Fishery Conservation and Management Act (PL94-265).

2.2.1 Crustacea

2.2.1.1 Life Histories

2.2.1.1.1 Brown Shrimp

Brown shrimp larvae occur offshore and migrate from offshore as post-larvae from January through November with peak migration from February through April. Post-larvae move into the estuaries primarily at night on incoming tides. Once in the estuaries, post-larvae seek out the soft silty/muddy substrate common to both vegetated and non-vegetated, shallow estuarine environments. This environment yields an abundance of detritus, algae, and microorganisms that comprise their diet at this developmental stage. Post-larvae have been collected in salinities ranging from zero to 69 ppt with maximum growth reported between 18° and 25°C, peaking at 32°C (Lassuy, 1983). Maximum growth, survival, and efficiency of food utilization has been reported at 26°C (Lassuy, 1983). The density of post-larvae and juveniles is highest among emergent marsh and submerged aquatic vegetation (Howe et al., 1999; Howe and Wallace, 2000), followed by tidal creeks, inner marsh, shallow non-vegetated water, and oyster reefs. The diet of juveniles consists primarily of detritus, algae, polychaetes, amphipods, nematodes, ostracods, chironomid larvae, and mysids (Lassuy, 1983). Although some of their potential prey will initially be lost during dredging activities, recovery will be rapid (Culter and Mahadevan, 1982; Saloman et al., 1982) and they can forage in adjacent areas that have not been impacted as they emigrate offshore. Emigration of sub-adults from the shallow estuarine areas to deeper, open water takes place between May through August, with June and July reported as peak months. The stimulus behind emigration appears to be a combination of increased tidal height and water velocities associated with new and full moons. After exiting the estuaries, adults seek out deeper (18 m), offshore waters in search of silt, muddy sand, and sandy substrates. Adults reach maturity in offshore waters within the first year of life.

2.2.1.1.2 Pink Shrimp

Of the three penaeid shrimp species, pink shrimp is the most prevalent in Florida waters. Consequently, the pink shrimp fishery is the most economically important of all fisheries in Florida. Spawning of pink shrimp occurs in oceanic waters at depths of 4 to 48 m and possibly deeper (Bielsa et al., 1983) where adult females lay demersal eggs. Spawning takes place year round in some areas (e.g., Tortugas Shelf), but peak spawning activity appears to coincide with maximum bottom water temperatures (Bielsa et al., 1983). Recruitment of planktonic post-larvae into estuarine and coastal bay nursery areas occurs in the spring and late fall during flood tides. Post-larvae become benthic at approximately 10 mm total length and prefer areas with a soft sand or mud substrate mixture containing sea grasses and turtle grass (Bielsa et al., 1983; Howe et al., 1999; Howe and Wallace, 2000). Pink shrimp spend from 2 to 6 months in the nursery ground prior to emigration. During the shift from post-larvae to juveniles there is a dietary shift from nauplii and microplankton to polychaetes, ostracods, caridean shrimps, nematodes, algae, diatoms, amphipods, mollusks, and mysids, (Bielsa et al., 1983). Although some of their potential prey will initially be lost during dredging activities, recovery will be rapid (Culter and Mahadevan, 1982; Saloman et al., 1982) and they can forage in adjacent areas that have not been impacted as they emigrate offshore. Emigration from the nursery grounds to offshore occurs year round with a peak during the fall and a smaller peak during the spring. The greatest concentrations of adults have been reported between 9 and 44 m, although some have been found as deep as 110 m in Florida waters. Although detailed dietary studies concerning adults are non-existent, Williams (1955) reported foraminiferans, gastropod shells, squid, annelids, crustaceans, small fishes, plant material, and debris in the stomachs of adults collected in North Carolina estuaries.

2.2.1.1.3 White Shrimp

White shrimp spawn along the South Atlantic coast from March to November, with May and June reported as peak months along the offshore waters of northeast Florida. Spawning takes place in water $\geq$ 9 m deep and within 9 km from the shore where they prefer salinities of $\geq$ 27 ppt (Muncy, 1984). The increase in bottom water temperature in the spring is thought to trigger spawning. After the demersal eggs hatch, the planktonic post-larvae live offshore for approximately 15-20 days. During the second post-larval stage, they enter Florida estuaries in April through early May by way of tidal currents and flood tides and become benthic. During this larval stage, the diet consists of zooplankton and phytoplankton. It has been documented that juvenile white shrimp tend to migrate further upstream than do juvenile pink or brown shrimp; as far as 210 km in northeast Florida (Pérez-Fartante, 1969). Juveniles prefer to inhabit shallow estuarine areas with a muddy substrate with loose peat and sandy mud and moderate salinity. Juvenile white shrimp are benthic omnivores (e.g., fecal pellets, detritus, chitin, bryozoans, sponges, corals, algae, annelids) and feed primarily at night. White shrimp usually become sexually mature at age one during the calendar year after they hatched. The emigration of sexually mature adults to offshore waters is influenced primarily by body size, age, and environmental conditions. Studies have shown that a decrease in water temperature in estuaries triggers emigration in the south Atlantic (Muncy, 1984). The life span of white shrimp usually does not extend beyond one year.

2.2.1.1.4 Spiny Lobster

The spiny lobster inhabits the coastal waters from North Carolina to Rio de Janeiro, Brazil, including Bermuda and the Gulf of Mexico. The Florida spiny lobster is a valuable species both commercially and recreationally, and supports Florida's second most valuable shellfishery. During its life cycle, the spiny lobster occupies three different habitats (Marx and Herrnkind, 1986). The phyllosoma larvae are planktonic and inhabit the epipelagic zone of the Caribbean, Gulf of Mexico, and the Straits of Florida. The duration of the phyllosome stage is approximately 6 to 12 months. A brief (several weeks) non-feeding, oceanic phase follows, where the larva metamorphoses into a puerulus offshore. The pueruli migrate to shore by night using specialized abdominal pleopods. Large concentrations of pueruli have been recorded along the southeast Florida coast and the southern shores of the Florida Keys year round, with a peak in the spring and a lesser peak in the fall. In addition, these large concentrations are usually associated with the new and first quarter lunar phases. When suitable inshore substrate is encountered by pueruli, they rapidly settle out of the water column and within days molt into the first juvenile stage. The specific factors that stimulate post-larval settlement is not well understood. Known nursery areas of young benthic larvae and juveniles consist of macroalgae beds along rocky shorelines interspersed with seagrasses where they live a solitary existence (Marx and Herrnkind, 1986). Juveniles larger than 20 mm carapace length tend to aggregate in biotic (e.g., sponges, small coral heads, sea urchins) and abiotic (ledges) structures in protected bays, including estuaries with high salinity. As adults, spiny lobsters inhabit coral reef crevices, rocky outcroppings, and ledges. Refuge availability plays an important role regarding population distribution because spiny lobsters do not have the ability to construct dens. However, in a study where additional artificial structures were placed in Biscayne Bay, FL, the population was re-distributed, but the number of spiny lobsters in the Bay did not increase (Marx and Herrnkind, 1986). Consequently, the south Florida population may be limited by recruitment, emigration, food, and other factors.

2.2.1.1.5 Stone Crabs

The stone crab (*Menippe mercenaria*) is a commercially important species along the West Coast of Florida. Adult stone crabs use burrows under rock ledges, hardbottom features, dead shell, or vegetative clumps. Stone crabs may also be abundant in seagrass flats, particularly turtle grass (*Thalassia testudinum*). Juveniles of the species usually do not dig burrows but inhabit available hiding places in naturally occurring features. Occasionally juveniles will be associated with shell hash habitat, sponges, and, occasionally, mats of seagrass.

Stone crab have a planktonic larvae that drift with ocean currents and then settle out. The most productive habitat for stone crabs occurs within Florida Bay. The area of the Gulf of Mexico in the vicinity of Tampa Bay (Pinellas County) is also an important recruitment ground. Stone crabs are dependent upon estuaries for prey production. These areas provide cover and prey species important to stone crab recruitment and development. Seagrass areas may be especially important for producing prey species (GMFMC 1994).

2.2.1.2 Summary of Impacts to Shrimp, Stone Crabs and Spiny Lobsters

As outlined by GMFMC (1998), EFH for penaeid shrimps includes coastal inlets and both state identified overwintering areas and nursery habitats. Seagrass beds common to the bays of Florida are particularly important areas. Essential fish habitats for stone crab and spiny lobster are varied including nearshore shelf/oceanic waters, shallow, benthic subtidal areas, seagrass beds, soft sediment, coral and both live and hardbottom, sponges, algal communities, mangroves (GMFMC, 1998; SAFMC, 1998).

The Project area includes sand bottom, sand-veneered hardbottom, hardbottom, and water column that may be used by all three penaeid species, stone crabs, and spiny lobster as post-larvae, juvenile, and adults. The Preferred Alternative would impact a relatively small area of the sand and hardbottoms, and the impacts would be minor. Some possible refuge may be lost in regards to the impact to the hardbottom areas within pipeline corridors; however, additional refuge would be created by the construction of artificial reefs to serve as replacement habitat. Penaeid shrimp and spiny lobster would be temporarily displaced, but would quickly return to the Project area.

2.2.2 Coral and Live Hardbottom Habitat

The Gulf of Mexico Fisheries Management Council has designated hardbottom areas within the study site as EFH. Over 60 species of coral can occur off the coast of Florida all of which fall under the protection of the management plan (GMFMC, 1998). Fourteen of these coral species are listed as endangered by the Florida Committee on Rare and Endangered Plants and Animals (SAFMC, 1998). A list of coral and other species observed in hardbottom habitats within the study area during recent surveys is included in Table 2.

Table 2 Benthic Taxa Observed During Borrow Area Surveys (Dial Cordy 2001a, 2002)

Scientific Name	Common Name
Sponges	
Cribrochalina vasculum	Brown Bowl Sponge
Xestospongia muta	Giant Barrel Sponge
Spheciospongia vesparium	Loggerhead Sponge
Ircinia sp.	Ball Sponge
Calyx podatypa	Dark Volcano Sponge
Anthosigmella varians	Brown Variable Sponge
Amphimedon compressa	Erect Rope Sponge
Scleractin Corals	
Cladocora arbuscula	Tube Coral
Stephanocoenia mitchelinii	Blushing Star Coral
Isophyllia sinuosa	Cactus Coral
Siderastrea sp.	Starlet Coral
Solenastrea hyades	Knobby Star Coral
Scolymia lacera	Mushroom Coral
Phyllangia americana	Hidden Cup Coral
Manicina aereolata	Rose Coral

Scientific Name	Common Name
Montastrea annularis	Boulder Star Coral
Oculina robusta	Robust Ivory Tree Coral
Millepora alcicornis	Branching Fire Coral
Octocorals	
Eunicea succinea	Shelf-knob Sea Rod
Eunicea calyculata	Warty Sea Rod
Plexaurella nutans	Giant Slit-Pore Sea Rod
Muricea laxa	Delicate Spiny Sea Rod
Muricea elongata	Orange Spiny Sea Rod
Pseudoterogorgia sp.	Sea Plume
Pterogorgia citrina	Yellow Sea Whip
Leptogorgia virgulata	Colorful Sea Whip
Pseudoceratina crassa	Branching Tube Sponge
Echinoderms	
Linckia guildingii	Common Comet Star
Astropecten articulatus	Beaded Sea Star
Echinaster spinulosus	Orange-Ridged Sea Star
Luidia clathara	Striped Sea Star
Luidia sp.	Sea Star
Luidia alternata	Banded Sea Star
Echinometra lucunter	Rock-boring Urchin
Lytechinus variegates	Variegated Urchin
Mollusks	
Pinna carnea	Penshell
Charonia variegata	Tritons Trumpet
Busycon contrarium	Lightning Whelk
Pleuroploca gigantean	Florida Horse Conch
Crustaceans	
Menippe mercenaria	Florida Stone Crab
Tunicates	
Clavelina sp.	Colonial Tunicate
Family Didemnidae	Overgrowing Tunicates
Eudistoma sp.	Condiminium Tunciate

2.2.2.1 Summary of Impacts to Coral and Hardbottom Habitat

Hardbottom impacts associated with the Preferred Alternative will be limited to impacts associated with pipeline placement in the surveyed pipeline corridors and staging areas (Dial Cordy 2001a, Dial Cordy 2001b, Dial Cordy 2002). No impacts are anticipated within the offshore borrow areas. Exclusionary buffers (200 feet) have been established around all documented hardbottom features within the proposed borrow areas to eliminate any direct or indirect impacts to these features from dredging activities. Any impacts to hardbottom/livebottom resources within the pipeline and staging areas from dredging equipment placement will be determined from surveys conducted during construction and mitigation in the form of artificial reef creation will be performed.

2.2.2.2 Beach and Sand Bottom Habitat

Shoreline erosion and a lowered beach profile caused by storms, wave action, and currents have become a serious concern along Pinellas County barrier island beaches. Species richness is usually low in these habitats, but localized species can be abundant. Typical beach fauna in the proposed Project area includes the mole crab (*Emerita talpoida*), surf clam (*Donax variabilis*) and ghost crab (*Ocypode quadrata*). These and other beach infauna provide food for a wide variety of shorebirds such as plovers (*Charadrius spp.)*, willets *(Catoptrophorous semipalmatus*), and ruddy turnstones (*Arenaria interpres*). Drift algae and *Sargassum* stranded on the beach may support large numbers of insects and other invertebrate life. Beyond the beach, polychaetes, gastropods, portunid crabs, and burrowing shrimp are the most abundant fauna in shallow, softbottom habitats. As depth increases, these habitats are dominated by amphipods, polychaetes, and bivalves (*Donax* sp., *Tellina* sp.). This nearshore habitat is managed under the Magnuson-Stevens Fishery Conservation and Management Act (L 94-265).

2.2.2.3 Summary of Impacts to Beach and Sand Bottom Habitat

Several studies have examined the effects of beach nourishment on benthic fauna and sediments. Nelson (1989) reviewed literature regarding the effects of beach nourishment on beach sand fauna and concluded that minimal biological effects occurred. Mortality of some organisms may occur where grain size is a poor match to existing sediments; however, recovery was rapid. Common beach invertebrates of the southeastern U.S. including the mole crab (*Emerita talpoida*), the surf clam (*Donax* sp.), and the ghost crab (*Ocypode quadrata*) did not exhibit any significant impacts resulting from beach nourishment (Nelson, 1989). In a review of beach nourishment effects on beach fauna, Hackney, et al. (1996) came to the same conclusions as Nelson (1989), with the suggestion that beach nourishment should take place during the winter months to minimize the impacts, and that the sand should match as closely as possible.

In a beach renourishment project in Panama City Beach, Florida, Culter and Mahadevan (1982) concluded that the initial destruction of the benthic community at the borrow sites was followed by a rapid recovery which was virtually complete after one year. There were minor differences in sediment parameters, but no differences in fauna in or out of the borrow sites were observed. The benthic community at this borrow area consisted primarily of polychaetes, bivalves, gastropods, amphipods, brachyuruns, and amphipods. No species that required a permanent attachment site and only a few tube dwelling organisms were present at this site. The overall findings were that no long-term adverse environmental effects as a result of beach renourishment existed within the nearshore area and that no adverse conditions were present at the borrow sites.

In another study conducted along Panama City Beach, Saloman, et al. (1982) observed an immediate decline in the benthic community followed by a rapid recovery within 8 - 12 months as indicated by species richness, abundance, and diversity. The benthic community was composed of primarily annelids, arthropods, mollusks, and to a much lesser extent platyhelminths, nematodes, echinoderms, and hemichordates. After one year post-dredging, some short-term ecological changes including minor alterations in sediment, and a small decline in the diversity and abundance of benthic invertebrates were reported. However, no long-term effects were observed regarding the benthic community, sediments, and water quality along the shore and in and around the borrow sites.

The removal of sediment from the proposed borrow areas will directly impact the benthic habitat including both the infaunal and epifaunal community. Initially, this will result in a significant, but localized reduction in the abundance, diversity, and biomass of the immediate fauna. Species affected most are those that have limited capabilities or are incapable in avoiding the dredging activities. The fauna most affected will include predominantly invertebrates such as crustaceans, echinoderms, mollusks, and annelids, as well as finfish larvae. However, due to the relatively small area that will be impacted as viewed on a spatial scale, impacts to the benthic community will be minimal due to the relatively short period of recovery regarding infaunal communities following dredging activities (Culter and Mahadevan, 1982; Saloman, et al., 1982). Adjacent areas not impacted will most likely be the primary source of recruitment to the impacted area. To minimize any adverse effects to beach fauna, the Preferred Alternative will be implemented during the winter months, outside the recruitment window for many impacted species, and a high quality source of sand containing a small percentage of fine material will be used. The Preferred Alternative will not have any significant, long lasting impacts on the beach sand infaunal communities.

2.2.3 Reef Fish

Pinellas County, Florida is designated as EFH for 13 species of reef fishes (Table 1) that are listed under the Gulf of Mexico Fishery Management Council Comprehensive EFH Amendment (GMFMC, 1998). The association of these fishes with coral or hardbottom structure, vegetated and unvegetated inshore areas during some period of their life cycle, and their contribution to a reef fishery ecosystem is why they are included in the reef fish plan. A discussion of how these fishes utilize the different inshore habitats and the hardbottom and reef communities follows.

2.2.3.1 Life History

2.2.3.1.1 Balistidae

Pinella County is designated as EFH for one species of triggerfish (Table 1). The gray triggerfish inhabits shallow inshore areas (e.g., bays, harbors, lagoons, sandy areas, grassy areas, rubble rock, coral reefs, artificial reefs, or dropoffs adjacent to offshore reefs) to offshore waters as deep as 275 m. This triggerfish is an important component of the reef assemblage of both natural and artificial reefs (Vose and Nelson, 1994). Information regarding balistid reproduction is limited and varied (Thresher, 1984). The basic balistid (e.g., gray triggerfish) spawning behavior involves the production of dermersal, adhesive eggs that are thought to stick to corals and algae near or on the bottom. Unfortunately, egg and larval development is poorly understood regarding most species; however, a long (≥ 1 year) planktonic stage appears common for many species. As juveniles, it has been suggested that they are planktonic, taking refuge among floating masses of *Sargassum* (Johnson and Saloman, 1984). During this stage of development, the diet consists of primarily zooplankton associated with the *Sargassum* or drifting in the water column. The exact timing or the environmental cues that trigger settlement is not well understood. However, juvenile gray triggerfish as small as 16 - 17 cm standard length have been reported to colonize hardbottom habitats (Thresher, 1984). After juveniles take on a benthic existence, their diet shifts to benthic fauna including algae, hydroids, barnacles, and polychaetes. All triggerfish feed diurnally and are well adapted to prey upon hard-shell invertebrates, especially adults. Adult gray triggerfish feed primarily on sea urchins, but in their absence, will shift to other benthic invertebrates such as crabs, chiton, and sand dollars (Frazer, et al., 1991; Vose and Nelson, 1994). Triggerfishes are commercially important in the aquarium trade and to some extent as a gamefish.

2.2.3.1.2 Carangidae

Pinellas County is designated as EFH for two carangids (Table 1) because they utilize the offshore and possibly inshore areas adjacent to the study area. Although spawning data regarding the greater amberjack does not exist, it is assumed that it is similar to the other carangid species. Based on collections of juvenile carangid species, there is some indication that there is a mobile, northward population of developing young in the Gulf Stream that developed from spawning that occurred in more southern waters (Berry, 1959). The greater amberjack is a far ranging species that inhabits inlets, shallow reefs, rock outcrops, and wrecks with reef fishes such as snappers, sea bass, grunts, and porgies (Manooch and Potts, 1997a). They are generally restricted to the continental shelf to depths as great as 350 m (Manooch and Haimovici, 1983). Small individuals (< 1 m SL) are usually found in water < 10 m deep while larger individuals frequent waters 18 - 72 m deep (Manooch and Potts, 1997b). Greater amberjack are a fast growing species and are recruited to the headboat fishery in the Gulf by age four and fully recruited to the fishery by age eight (Manooch and Potts, 1997a; 1997b).

All carangids are popular sport fishes among recreational fishers, but not as popular commercially where they are harvested using handlines, bottom longlines, and in some cases traps and trawls. Some Florida fishers feel that amberjack are being exposed to too much fishing pressure, especially owing to their attraction to reefs which make them an easy target for overfishing (Manooch and Potts, 1997a). However, as of 1997 there is no evidence of overfishing in either the Gulf of Mexico or southeast Florida (Manooch and Potts, 1997b).

2.2.3.1.3 Lutjanidae

Pinellas County is designated as EFH for four species of snapper (Table 1). Collectively, the EFH of these snappers ranges from shallow estuarine areas (e.g., vegetated sand bottom, mangroves, jetties, pilings, bays, channels, mud bottom) to offshore areas (e.g., hard and livebottom, coral reefs, rocky bottom) as deep as 400 m (Allen, 1985; Bortone and Williams, 1986). Like most snappers, these species participate in group spawning, which indicates either an offshore migration or a tendency for larger, mature individuals to take residency in deeper, offshore waters. Data suggests that adults tend to remain in one area. Both the eggs and larvae of these snappers are pelagic (Richards, et al., 1994). After an unspecified period of time in the water column, the planktivorous larvae move inshore and become demersal juveniles. The diet of these newly settled juveniles consists of benthic crustaceans and fishes. Juveniles inhabit a variety of shallow, estuarine areas including vegetated sand bottom, bays, mangroves, finger coral, and seagrass beds. As adults, most are common to deeper offshore areas such as live and hardbottoms, coral reefs, and rock rubble. However, adult gray, and lane snapper also inhabit vegetated sand bottoms with gray snapper less frequently occurring in estuaries and mangroves (Bortone and Williams, 1986). The diet of adult snappers includes a variety fishes, shrimps, crabs, gastropods, cephalopods, worms, and plankton. All four species are of commercial and/or recreational importance In particular, gray, lane, and yellowtail snapper comprise the major portion of Florida's snapper fishery (Bortone and Williams, 1986).

2.2.3.1.4 Serranidae

Pinellas County is designated as EFH for four species of sea bass (Table 1). Collectively, the EFH of these sea bass ranges from shallow estuarine areas (e.g., seagrass beds, jetties, mangrove swamps) to offshore waters as deep as 300 m (Heemstra and Randall, 1993; Jory and Iverson, 1989; Mercer, 1989). Like all other serranids, these species are protogynous hermaphrodites; functioning initially as females only to undergo a sexual transformation at a later time to become functional males. In addition, like all other serrranids, these species produce offshore planktonic eggs, moving into shallow, inshore water during their post-larval benthic stage. Juveniles inhabit estuarine, shallow areas such as seagrass beds, bays, harbors, jetties, piers, shell bottom, mangrove swamps, and inshore reefs. Juveniles feed on estuarine dependent prey such as invertebrates, primarily crustaceans, that comprise the majority of their diet at this developmental stage. As sub-adults and adults, they migrate further offshore taking refuge along rocky, hard, or livebottom, on artificial or coral reefs, in crevices, ledges, or caverns associated with rocky reefs. During this stage in their lives, the bulk of their diet consists of fishes, supplemented with crustaceans, crabs, shrimps, and cephalopods. Except for the Goliath grouper, the other species discussed in this section have some importance to commercial and/or recreational fisheries.

2.2.3.2 Summary of the Impacts to the Reef Fishes

The project area includes sand bottom, sand-veneered hardbottom, hardbottom, and water column that may be used by these managed fishes and their prey. The Preferred Alternative would impact a relatively small area of the sand and hardbottoms, and the impacts would be minor and short-term. Some possible refuge and related prey may be lost in regards to the impact to the hardbottom and sand areas; however, additional refuge would be created by the construction of artificial reefs to serve as replacement habitat. The Preferred Alternative will cause localized turbidity during construction; however, turbidity would be minimized using the management practices outlined in the Environmental Assessment, so that any impacts would be minor and temporary. These fishes and possible prey would be temporarily displaced, but should quickly return to the Project area.

2.2.4 Coastal Migratory Pelagics Complex

Pinellas County, Florida is designated as EFH for six species of coastal migratory pelagic fishes that are listed under the Generic Amendment for Addressing Essential Fish Habitat Requirements (GMFMC, 1998). Collectively, these six species, representing three different families, are all members of the Coastal Migratory Pelagics Fish Species as outlined by GMFMC (1998). The association of these fishes or their prey with coral or hardbottom structure, or inshore waters during some period of their life cycle and their contribution to a reef fishery ecosystem is why they are included in this complex. A discussion of how these fishes utilize the different inshore habitats and the hardbottom and reef communities follows.

2.2.4.1 Life History

<u>2.2.4.1.1 Coryphaenidae</u>

The dolphin is oceanic and distributed worldwide in both tropical and subtropical waters. Data suggest that this species may be involved in northward migrations during the spring and summer with some occasional movements and migrations being controlled by drifting objects in open waters. Spawning which is poorly documented, it thought to take place in oceanic waters where pairing of the sexes occurs (Ditty, et al., 1994). Based on the occurrence of young dolphin in the Florida Current, spawning may be almost year round (November - July) with peak activity in January through March (Palko et al., 1982). Owing to the oceanic distribution of this species, it is not surprising that both the egg and larval stages are pelagic. Upon hatching, this species experiences rapid growth throughout its life with both sexes reaching sexually maturity within the first year (Palko et al., 1982). In the Straits of Florida, female dolphin begin to mature at 350 mm FL and become fully mature at 550 mm FL. On the other hand, the smallest, mature male on record is 427 mm FL. The maximum life span of dolphin is estimated at 4 years. The diet of dolphin alters throughout its life cycle (Palko, et al, 1982). As larvae, they feed primarily on crustaceans, with copepods as the primary prey item. Adult dolphin are opportunistic, top-level predators. They feed upon a variety of fishes (e.g., flyingfish) and crustaceans, especially those species commonly associated with drifting flotsam and *Sargassum* in the Florida Current. As a prized food, dolphin are sought by both commercial and sport fishers. They are most commonly taken using hook and line around the edges of the continental shelf. In southern Florida, based on recreational catches, they appear most frequently March through August and then again September through February (Palko, et al., 1982).

2.2.4.1.2 Rachycentridae

Cobia are distributed worldwide in tropical, subtropical, and warm temperate waters where they inhabit estuarine and shelf waters depending of their life stage. They appear to associate with structures such as pilings, wrecks and other forms of vertical relief (e.g. oil and gas platforms) and favor the shade from these structures (Mills, 2000). Cobia spawn offshore where external fertilization takes place in large spawning aggregations; however, the pelagic eggs have been collected at both inshore and offshore stations. Based on past collections of gravid females, spawning takes place from mid May, extending through the end of August off South Carolina (Shaffer and Nakamura, 1989). Consequently, spawning may start slightly early off the southeast coast of Florida. Eggs have been collected in the lower Chesapeake Bay inlets, North Carolina estuaries, in coastal waters 20 - 49 m deep, and near the edge of the Florida Current and the Gulf Stream (Ditty and Shaw, 1992). Ditty and Shaw (1992) suggested that cobia spawn during the day since all the embryos they examined were at similar stages of development. Cobia exhibit rapid growth and may attain a length of 2 m total length and are known to live 10 years (Shaffer and Nakamura, 1989). Although females grow faster than males, they attain sexual maturity later in life. Sexual maturity is attained by males at approximately 52 cm total length during the second year and at approximately 70 cm total length for females during their third year (Shaffer and Nakamura, 1989). They are adaptable to their environment and can utilize a variety of habitats and prey. Cobia are voracious predators that forage primarily near the bottom, but on occasion do take some prey near the surface. Their favorite benthic prey are crabs, and to a much less extent other benthic invertebrates and fishes. No predator studies have been conducted, but dolphin fish have been known to feed on small cobia. Adults may be found solitary or in small groups and are known to associate with rays, sharks, and other larger fishes. Cobia is fished both commercially and recreationally; however, the commercial harvest is mostly incidental in both the hook and line and net fisheries. The recreational harvest is primarily through charter boats, party boats, and fishers fishing from piers and jetties. Tagging studies have documented a north-south, spring-fall migration along the southeast United States and an inshore-offshore, spring-fall migration off South Carolina (Ditty and Shaw, 1992).

2.2.4.1.3 Scombridae

Pinellas County is designated as EFH for six scombrid species (Table 1). Collectively, the EFH of these epipelagic scombrids ranges from clear waters around coral reefs, and inshore and continental shelf waters (Collette and Nauen, 1983). Spawning of king and Spanish mackerel takes place May through September with peaks in July and August. The cero is thought to spawn year round with peaks in April through October, whereas little tunny spawn from April to November. Batch spawning takes place in tropical and subtropical waters, frequently inshore. The eggs are pelagic and hatch into planktonic larvae. Both king and Spanish mackerel are involved in migrations along the western Atlantic coast. With increasing water temperatures, Spanish mackerel move northward from Florida to Rhode Island between late February and July, and back in the fall (Collette and Nauen, 1983). King mackerel have been reported to migrate along the western Atlantic coast in large schools; however, there appears to be a resident population in south Florida as this species is available to sport fishers year round (Collette and Nauen, 1983). Although the little tunny is epipelagic, it typically inhabits inshore waters in schools of similar size fish and/or with other scombrids (Collette and Nauen, 1983). The diet of these scombrids consists of primarily fishes and to a lesser extent penaeid shrimp and cephalopods. The fishes that make up the bulk of their diet are small schooling clupeids (e.g., menhaden, alewives, thread herring, anchovies), atherinids, and to a lesser extent jack mackerels, snappers, grunts, and half beaks (Collette and Nauen, 1983). The king and Spanish mackerel are important both commercially and recreationally. The king mackerel is a valued sport fish year round in Florida while the sport fisheries for Spanish mackerel in southern Florida is concentrated in the winter months. The little tunny is not of commercial or recreational interest.

2.2.5 Summary of Impacts to the Coastal Migratory Pelagics Complex Fishes

The project area includes sand bottom, sand-veneered hardbottom, hardbottom, and water column that may be used by these managed fishes and their prey. The Preferred Alternative would impact a relatively small area of the sand and hardbottoms, and the impacts would be minor and short-term. Some possible refuge and related prey may be lost in regards to the impact to the hardbottom and sand areas; however, additional refuge would be created by the construction of artificial reefs to serve as replacement habitat. These fishes and possible prey would be temporarily displaced, but should quickly return to the project area.

2.3 Associated Species

Associated species consists of living resources that occur in conjunction with the managed species discussed earlier. These living resources would include the primary prey species and other fauna that occupy similar habitats.

2.3.1 Invertebrates

The removal of sediment from an inshore borrow site will directly impact the benthic habitat including both the infaunal and epifaunal community. Initially this will result in a significant, but localized reduction in the abundance, diversity, and biomass of the immediate fauna. Species affected most are those that have limited capabilities or are incapable in avoiding the dredging activities. The fauna most affected would include predominantly invertebrates such as crustaceans, echinoderms, mollusks, and annelids. However, due to the relatively small area that will be impacted as viewed on a spatial scale, impacts to the benthic community will be minimal due to the relatively short period of recovery regarding infaunal communities following dredging activities (Culter and Mahadevan, 1982; Saloman, et al., 1982). Adjacent areas not impacted would most likely be the primary source of recruitment to the impacted area.

Zooplankton are primarily filter feeders and suspended inorganic particles can foul the fine structures associated with the feeding appendages. Zooplankton that feed by ciliary action (e.g., echinoderm larvae) would also be susceptible to mechanical affects of suspended particles (Sullivan and Hancock, 1977). Zooplankton mortality is assumed from the physical trauma associated with dredging activities (Reine and Clark, 1998). The overall impact on the zooplankton community should be minimal due to the limited extent and transient nature of the sediment plume.

2.3.2 Fishes

The larvae of the managed fish species discussed in this document are hatched from planktonic eggs (excluding the gray triggerfish) and the larvae are also planktonic. The primary source of larval food is microzooplankton with a dietary overlap in many species and specialization (Sale, 1991). Algae is most likely food for only the youngest larval stages of certain species or for those larvae that are very small after hatching, and then only for a short time. The algae-eating larvae eventually switch to animal food while they are still small. At this time, varying life history stages of copepods become the dominant food and to a lesser extent cladocerans, tunicate and gastropod larvae, isopods, amphipods, and other crustacea.

Larval feeding efficiency depends on many factors such as light intensity, temperature, prey evasiveness, food density, larva experience, and olfaction to mention a few (Gerking, 1994).

Larval fishes are visual feeders that depend on adequate light levels in the water column which reduces the reaction distance between larval fish and prey. Suspended sediment and dispersion due to dredging activities will increase turbidity levels in the Project area temporarily. This will reduce light levels within the water column which may have a short term negative effect regarding feeding efficiency. In addition, turbidity can affect light scattering which will impede fish predation (Benfield and Minello, 1996). However, because the sediment plumes are transient and temporary, and the area to be impacted is relatively small when examined on a spatial scale, the overall impact to the larval fish population and consequently, the adult population should be minimal (Sale, 1991). The majority of larval fish mortality will be attributed to the physical trauma associated with the dredging activities.

Similar to larval fishes, both juvenile and adult fishes are primarily visual feeders. Consequently, the visual effects of turbidity as outlined above will apply. Also, suspended sediment can impair feeding ability by clogging the interraker space of the gill raker or the mucous layer of filter feeding species (Gerking, 1994). However, because these fishes have the ability to migrate away from the dredging activities, the impact of the sediment plumes which are transient and temporary should be minimal. Although few adult fishes have been entrained by dredging operations (McGraw and Armstrong, 1988; Reine and Clark, 1998), most juvenile and adult fishes again have the ability to migrate away from the dredging activities. Consequently, dredging operations would have minimal effects on juvenile and adult fishes in the area. In addition, the reduction of benthic epifaunal and infaunal prey, and pelagic prey in the immediate area would have little affect on juvenile and adult fishes because they can migrate to adjacent areas that have not been impacted to feed.

In addition to the managed fish species discussed in this document, many other inshore and pelagic fishes in various stages of life occur in the Project area (Moe and Martin, 1965; Saloman and Naughton, 1979). Fishes off of the Pinellas County coast are comprised of both reef and pelagic species. Moe and Martin (1965) collected over 2,300 individual fishes from 41 species during sampling conducted at nine separate locations offshore of Pinellas County. The most common fishes collected during this survey included sand perch (*Diplectrum fromosum*), pigfish (*Orthopristus chrysopterus*), silver perch (*Bairdiella chrysura*), spot (*Leiostomus xanthurus*), and pinfish (*Lagodon rhomboides*). Other species collected in this study included searobins (*Prionotus tribulus crassiceps* and *Prionotus scitulus latfirons*), and three species of flounder (*Etropus rimosus*, *Etropus crossotus atlanticus*, and *Syacium papillosum*).

Pelagic species also occur throughout the Gulf of Mexico in the nearshore and offshore waters. Major coastal pelagic families include Rachycentridae (cobia), Mugilidae (mullets), Pomatomidae (bluefish), Caranagidae (jacks), Scombridae (tunas and mackerels), Engraulidae (anchovies), and Carahahinidae (requiem sharks). Many of these pelagic species form large schools (e.g. jacks, mullet, mackerel, etc.), while others travel singly or in small groups (e.g. cobia). Distribution of these species can vary seasonally and usually depends on water column attributes that vary seasonally.

These nearshore hardbottom habitats may actually serve several nursery-related roles such as, 1) a centrally located refuge for incoming early life stages that would exhibit considerably greater mortality if shelter were not available, 2) habitat for juvenile fishes (e.g., gray snapper, blue stripe grunt) that emigrate out of inlets to offshore waters, and 3) an area to promote growth because of the greater availability of prey at these hardbottom habitats.

2.3.3 Summary of Impacts to Associated Species

Many of the fishes associated with nearshore hardbottom habitats as observed in past studies (Moe and Martin, 1965; Saloman and Naughton, 1979), would be common along Pinellas County. The majority of juvenile and adult fishes would be displaced to adjacent habitat during dredging operations, consequently, mortality of these fishes should be minimal. Only those species that produce demersal eggs and that comprise the demersal ichthyofauna could potentially be impacted more heavily than their pelagic counterparts. Mortality of demersal eggs and larvae would be expected from the physical trauma associated with dredging operations. Suspended sediments produced by these operations can affect the feeding activity of pelagics as outlined earlier; however, the impact to these fishes should be minimal due to the limited extent and transient nature of the sediment plume.

3.0 CONCLUSIONS

The Preferred Alternative will impact unvegetated, sand bottom, hardbottom, sand-veneered hardbottom, and water column. The use of the management practices outlined in the attached Environmental Assessment will help to lessen impacts associated with water quality and turbidity in the project area. Construction of a mitigation reef will create quality hardbottom habitat similar to what is available within the study area. Construction of the mitigation reef should occur either before or concurrently with the construction of the beach nourishment to counteract the loss of fish diversity found in similar beach protection projects (Lindeman and Snyder, 1999). Significant adverse impacts to those species associated with EFH within the project area are not expected.

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