APPENDIX A:
Biological Assessment

Volume III
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Convey Atchafalaya River Water to Northern Terrebonne Marshes And Multipurpose Operation of Houma Navigation Lock

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1.0 PURPOSE

Consistent with Congressional direction provided in Title VII of the Water Resources Development Act (WRDA) of 2007 authorizing the LCA program and Section 7006(e)(3), the U.S. Army Corps of Engineers (USACE), New Orleans District (CEMVN) proposes to convey Atchafalaya River water to the Northern Terrebonne Marshes. The purpose of this biological assessment (BA) is to evaluate the potential impacts of the Recommended Plan (RP) described in the draft environmental impact statement (DEIS) for Convey Atchafalaya River Water to Northern Terrebonne Marshes and Multipurpose Operation of Houma Navigation Lock, on Federally-listed threatened and endangered species, and their critical habitat. The RP includes features of wetland nourishment, protection, and creation in the Northern Terrebonne Marshes. This BA provides information to decision-makers to make determinations on whether to proceed with the construction of the RP.

2.0 LOCATIONS AND GENERAL DESCRIPTION OF THE PROJECT AREA

The LCA-ARTM Study Area (Figure 1.1) comprises approximately 1,100 square miles (700,000 acres) in Southern Louisiana in the vicinity of the City of Houma and Terrebonne Parish. The LCA-ARTM study area fits into the Louisiana Coastal Area Ecosystem Restoration Study (LCA Study) Area, which has been identified as the Louisiana coastal area from Mississippi to Texas. The proposed LCA-ARTM project is located in the Deltaic Plain within Subprovince 3, one of the four Subprovinces identified in the LCA Study Area.

The study area lies within the Barataria-Terrebonne estuary. This estuary extends from the west bank levees of the Mississippi River (north and east), to the East Guide Levee of the Atchafalaya River (west), to the Gulf of Mexico (south), and to the town of Morganza (north). The Barataria Basin covers about 1,551,800 acres while the Terrebonne Basin covers an area of about 2,063,500 acres. The study area lies within the southern end of the Terrebonne Basin and contains a complex of habitat types, including natural levees, lakes, swamps, marshes, and bayous formed from sediments of abandoned Mississippi River deltas. Elevations in the study area vary. Near Houma, the largest city in the area, the elevation is approximately 10 feet National Geodetic Vertical Datum (NGVD). The elevation along the bayou ridges is 4-5 feet NGVD and less than 1 foot NGVD along the southern portion near the Gulf of Mexico.

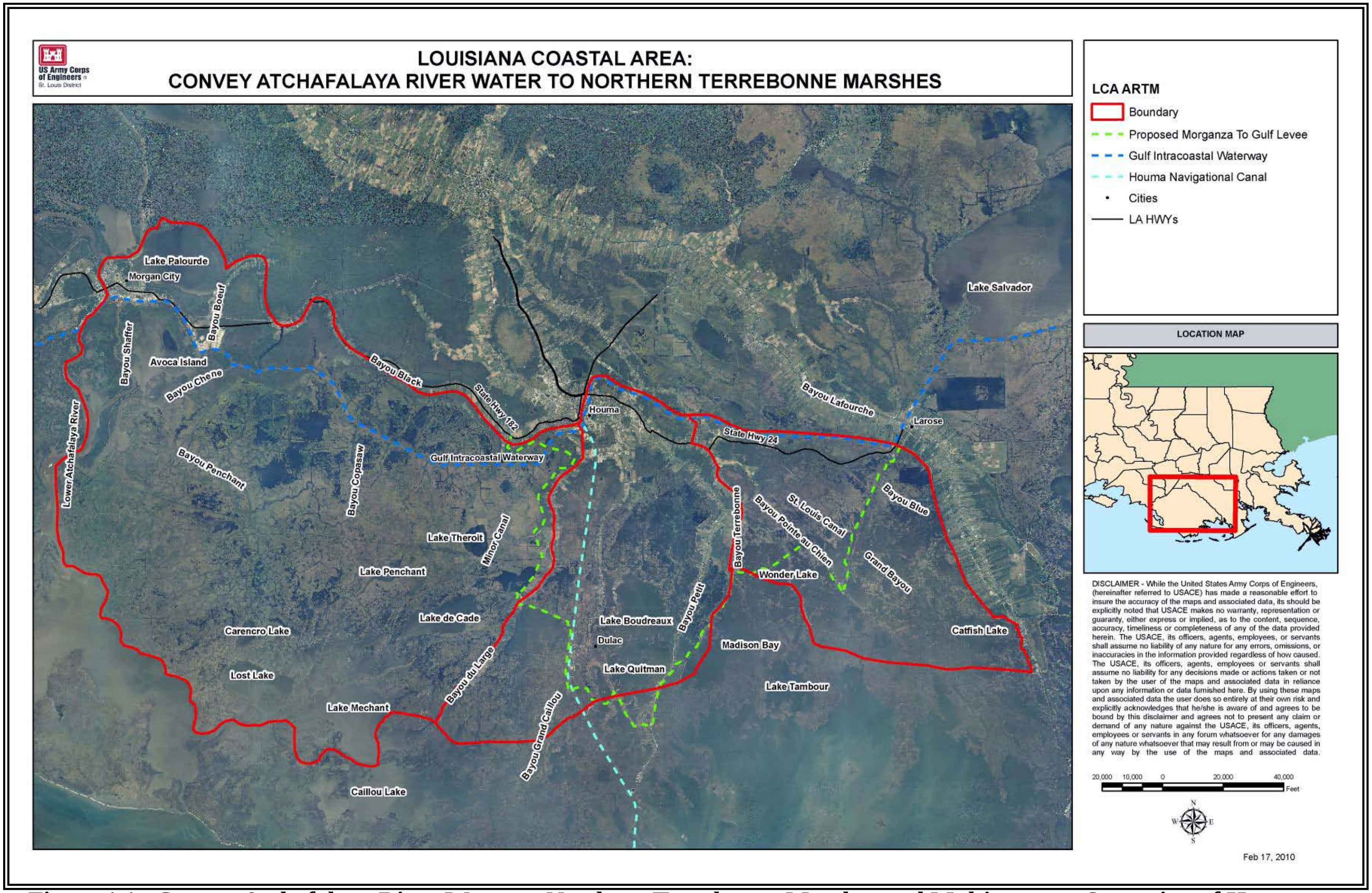

Figure 1.1. Convey Atchafalaya River Water to Northern Terrebonne Marshes and Multipurpose Operation of Houma Navigation Lock Project Area.

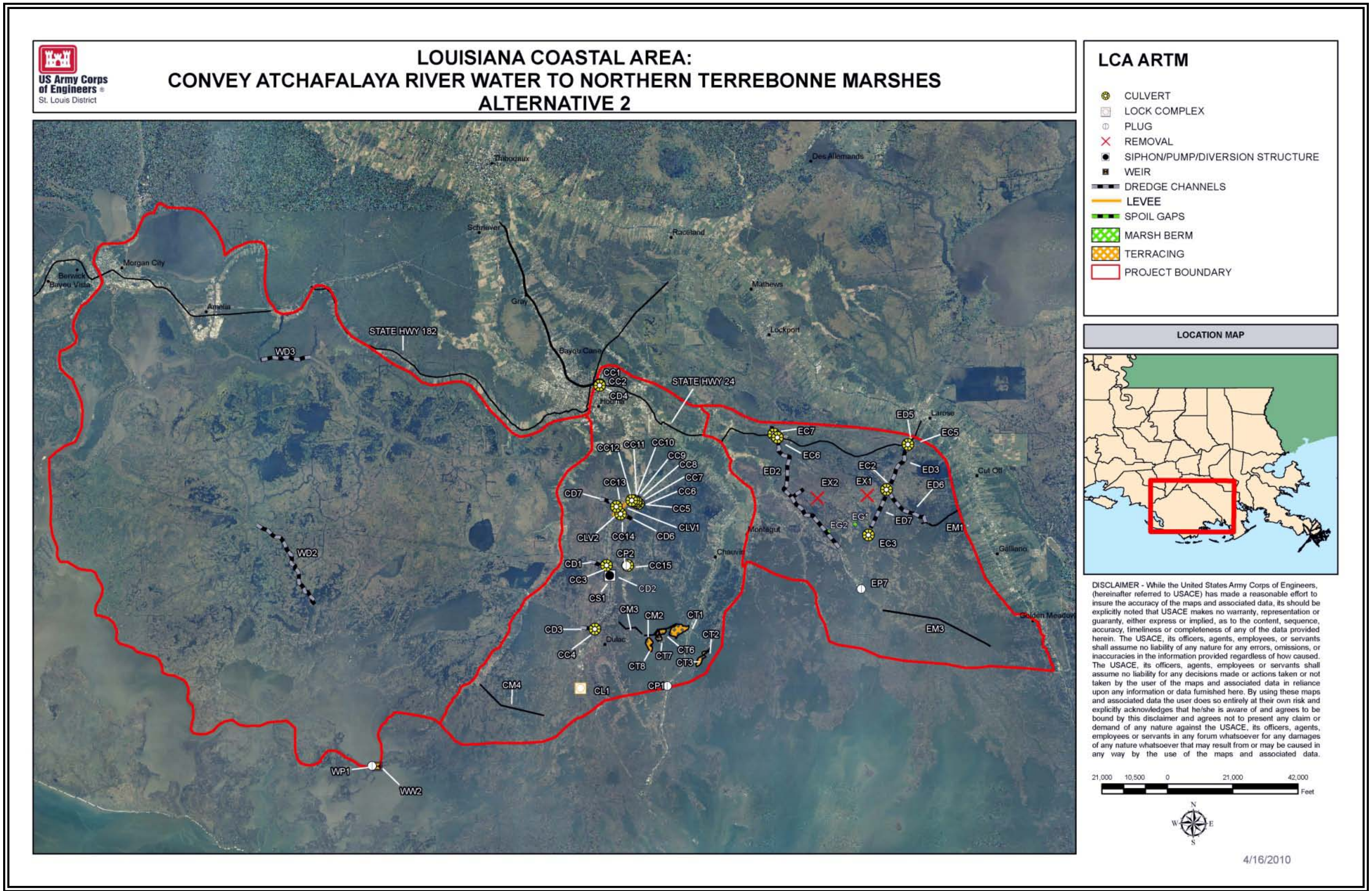

Figure 1.2. Features Associated with the Proposed Action.

The major streams located in the study area or that influence the study area are the Atchafalaya River, Bayou du Large, Bayou Grand Caillou, Bayou Petit Caillou, Bayou Terrebonne, Bayou Pointe au Chien, Bayou Lafourche, Bayou L'eau Blue, and Bayou Black. There are no scenic streams in the study area designated under the Louisiana Natural and Scenic River System. The Houma Navigation Canal runs north and south from the GIWW to the Gulf of Mexico mainly between Bayou du Large and Bayou Grand Caillou. The GIWW follows an east-west path in the northern portion of the study area. These two waterways, along with the natural channels in the area, have a strong influence on surface water in the area.

The natural processes of subsidence, habitat switching, and erosion, combined with human activities, have caused significant adverse impacts to the Northern Terrebonne Marshes, including accelerated wetland loss and ecosystem degradation.

Wetlands in the project area are deteriorating for several reasons: 1) subsidence, 2) lack of sediment and nutrient deposition, 3) erosion via tidal exchange, 4) channelization, and 5) saltwater intrusion. These activities have resulted in the loss of several thousand acres of solid, vegetated marsh. Deterioration will continue unless preventative measures are taken.

In the absence of supplemental freshwater from the Atchafalaya River, subsidence, sea-level rise, wave erosion, and saltwater intrusion will continue to be problems. Protection and enhancement of this area are dependent on providing a hydrologic regime that minimizes the physiological stress to wetland vegetation from saltwater intrusion and tidal energy and is conducive to the retention of locally provided freshwater and sediments. Several channels have been dredged which cut through the natural ridges increasing both drainage and tidal exchange in the project area, exposing the soil to erosive forces.

The wetland communities within the northwestern portion of Terrebonne Basin, including those located both north and south of the GIWW, have been, in part, separated from the influence of the Atchafalaya River. Instead, the hydrology of these areas is influenced by a widely variable pattern of Atchafalaya River backwater effect, rainfall runoff events, and marine processes. Major navigation channels in the subprovince are the Atchafalaya River, Wax Lake Outlet, Houma Navigation Canal, GIWW, and Lower Atchafalaya River (south of Morgan City). Each of these navigation channels introduces and/or compounds marine influences in many of the interior coastal wetlands and water bodies within the subprovince. Without action, the freshwater, intermediate, and brackish marshes in the northern and eastern areas of Terrebonne Basin would continue to deteriorate and disappear due to the combined effects of subsidence, saltwater intrusion, and a lack of riverine influence. To the south, the brackish marshes surrounding Lake Mechant would continue to deteriorate due to saltwater intrusion and a lack of riverine influence.

3.0 PROPOSED ACTION

The proposed action consists of increasing freshwater flows and associated nutrients into the project area. Project features designed to accomplish this (Figure 1.2) include deepening and/or widening constrictions in the Gulf Intracoastal Waterway, placement of a water control structure and dredge channel at the intersection of the GIWW and Grand Bayou, placement of water control structures, dredging of conveyance channels, gapping of spoil banks, and modification of the operation of the proposed Houma Navigation Canal lock complex. The result of the proposed action would be protection and nourishment of wetlands in the project area. When compared to the No Action Alternative, the proposed action would prevent the loss of approximately 9,655 acres of emergent marsh habitat over the 50-year period of analysis. According to the Wetland Value Assessment conducted on the proposed action, the project would provide 3,220 Average Annual Habitat Units to project area marshes over the 50-year period of analysis when compared to the No Action Alternative. A detailed description of the proposed action can be found in Chapter 3 of the Draft Environmental Impact Statement/Feasibility Study. Historic and existing conditions are discussed in Chapter 4. The future without project conditions, direct, indirect, and cumulative impacts of the proposed action can be found in Chapter 5.

4.0 SPECIES DESCRIPTIONS

Nine endangered or threatened species have been identified which may occur within the boundaries of the project area: Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), pallid sturgeon (*Scaphirhynchus albus*), piping plover (*Charadrius melodu*s), West Indian manatee (*Trichechus manatus*) and five species of sea turtles. Descriptions of these species follow.

4.1 FISH

4.1.1 Gulf Sturgeon

Status

On September 30, 1991, the Gulf sturgeon was listed as a threatened species under the ESA, and the USFWS designated critical habitat for this species throughout its range on February 28, 2003. In Louisiana, Gulf sturgeon critical habitat includes the Pearl River System in Washington and St. Tammany Parishes, the Bogue Chitto River, as well as Lake Pontchartrain, Lake Borgne, Lake Catherine, and the Rigolets.

Species and Habitat Description

The Gulf sturgeon, also known as the Gulf of Mexico sturgeon, is an anadromous fish (i.e. a fish that breeds in freshwater after migrating from marine or estuarine environments). The Gulf sturgeon inhabits coastal rivers from Louisiana to Florida during spring and summer, and the estuaries, bays, and marine environments of the Gulf of Mexico during fall and winter. It is a nearly cylindrical, primitive fish embedded with bony plates or scutes. The head ends in a hard, extended snout; the mouth is inferior and protrusible and is preceded by four conspicuous barbels. The tail (caudal fin) is distinctly asymmetrical; the upper lobe is longer than the lower lobe (heterocercal). Adults range from 4 to 8 feet (1.2 to 2.4 meters) in length, with adult females larger than adult males.

Gulf sturgeon are long-lived, with some individuals reaching at least 42 years of age (Huff 1975). Age at sexual maturity for females ranges from 8 to 17 years, and for males from 7 to 21 years (Huff 1975). In the spring (from late February to mid-April) when the river surface temperatures are 63 to 70 degrees Fahrenheit (ºF) (17 to 21 degrees Celsius [ºC]), sexually mature males and females migrate into rivers to spawn (Carr et al. 1996). It is believed that Gulf sturgeon exhibit a spawning periodicity similar to Atlantic sturgeon, with females spawning at intervals ranging from every 3 to 5 years, and males every 1 to 5 years (Smith 1985, see http://www.fws.gov).

Gulf sturgeon eggs are demersal (i.e. they sink to the bottom), adhesive, and vary in color from gray to brown to black (Vladykov and Greeley 1963; Huff 1975; Parauka et al. 1991). Sturgeon require hard substrates for eggs to adhere to and to provide shelter for developing larvae (Sulak and Clugston 1998, see http://www.fws.gov). Egg collection sites have consisted of limestone bluffs and outcroppings, cobble, limestone bedrock covered with gravel, and small cobble, gravel, and sand (Marchant and Shutters 1996, see http://www.fws.gov; Sulak and Clugston 1999, see http://www.fws.gov; Heise et al. 1999a, see http://www.fws.gov; Fox et al. 2000, see http://www.fws.gov; Craft et al. 2001, see http://www.fws.gov). Water depths at egg collection sites ranged between 4.6 to 26 ft (1.4 to 7.9 m), and temperatures ranged around 64.8 to 75.0°F (18.2 to 23.9°C) (Fox et al. 2000; Ross et al. 2000; Craft et al. 2001; Heise et. al. 2004). Laboratory experiments indicate that optimal water temperature for survival of Gulf sturgeon larvae is between 59 and 68°F (15 and 20°C), with low tolerance to temperatures above 77°F (25°C) (Chapman and Carr 1995, see http://www.fws.gov). Young-of-the-year Gulf sturgeon appear to disperse widely, using extensive portions of the river as nursery habitat. They are typically found on sandbars and sand shoals over rippled bottom and in shallow, relatively open, unstructured areas.

Gulf sturgeon feeding habits in freshwater vary depending on the fish's life history stage. Young-of-the-year Gulf sturgeon remain in freshwater feeding on aquatic invertebrates and detritus approximately 10 to 12 months after spawning occurs (Mason and Clugston 1993; Sulak and Clugston 1999, see http://www.fws.gov). Juveniles less than 11 lbs (5 kg) are believed to forage extensively and exploit scarce food resources throughout the river, including aquatic insects (e.g., mayflies and caddis flies), worms (oligochaetes), and bivalve mollusks (Huff 1975; Mason and Clugston 1993). Subadults (age 6 to sexual maturity) and adults (sexually mature) only feed in marine and estuarine habitats and are thought to forage opportunistically (Huff 1975) on primarily benthic (bottom dwelling) invertebrates. Gut content analyses have indicated that, at this life stage, the Gulf sturgeon's diet is predominantly amphipods, lancelets, polychaetes, gastropods, shrimp, isopods, mollusks, and crustaceans (Huff 1975; Mason and Clugston 1993; Carr et al. 1996b, see http://www.fws.gov; Fox et al. 2000, see http://www.fws.gov; Fox et al. 2002, see http://www.fws.gov).

Gulf sturgeon are believed to be indiscriminate benthic suctorial feeders (Gilbert 1989). Summaries of food habits data (Huff 1975; Mason and Clugston 1993, USFWS/GSMFC 1995; Wakeford 2001; Fox et al. 2002; Harris 2003) indicate that this species feeds on a wide variety of benthic prey. Examining the stomach contents of fish from the Suwannee River estuary, Mason and Clugston (1993) found the predominant prey of subadults to be brackish water amphipods (*Gammarus* sp. and haustorid amphipods), corophoiid amphipods (e.g., *Cerapus* sp. and *Corophium tuberculatum*), chironomid and ceratopogonid fly larvae, grass shrimp (*Palaemonetes* spp.), and mysid shrimp. Polychaetes and tubificid oligochaetes were also plentiful in the diet. Subadults fed on grass shrimp and the callianassid shrimp *Lepidophthalmus louisianensis.* Fish immigrating from offshore had lancelets (*Branchiostoma caribaeum*), brachiopods (*Glottidia pyramidata*), shrimp, polychaetes, molluscs, starfish and sea cucumbers in the stomachs. Also working in the Suwannee River estuary, Harris (2003) indicated that brachiopods were particularly important in the diet of gulf sturgeon although amphipods (*Ampelisca* spp.) and brittlestars (ophiouroids) were also frequent prey items. Based on these reports, especially those emphasizing the importance of brachiopods, lancelets, haustorid amphipods and the callianassid *L. louisianensis*, it would appear that sturgeon favor sandy bottomed areas for feeding.

When river temperatures drop in the fall to about 63 to 72°F (17 to 22°C), Gulf sturgeon return to the coastal shelf areas of the Gulf of Mexico (Carr et al. 1996, see http://www.fws.gov). Most subadult and adult Gulf sturgeon spend the cooler months (October or November through March or April) in estuarine areas, bays, or the Gulf of Mexico feeding (Odenkirk 1989; Foster 1993; Clugston et al. 1995; Fox et al. 2002, see http://www.fws.gov). Winter habitats used by Gulf sturgeon coincide with the habitats of their prey. Along the Mississippi Sound barrier islands, Gulf sturgeon habitat typically consists of sandy substrates with an average depth of 6.2 to 19.4 ft (1.9 to 5.9 m). Gulf of Mexico near shore (less than 1 mi [1.6 km]) unconsolidated, fine-medium grain sand habitats, including natural inlets and passes from the Gulf to estuaries, support crustaceans such as mole crabs, sand fleas, various amphipod species, and lancelets (Menzel 1971, see http://www.fws.gov; Abele and Kim 1986, see http://www.fws.gov; American Fisheries Society 1989, see http://www.fws.gov; Brim, personal communication, 2002) where Gulf sturgeon are found. Estuary and bay unvegetated habitats have a preponderance of sandy substrates that support burrowing crustaceans, such as ghost shrimp, small crabs, various polychaete worms, and small bivalve mollusks (Menzel 1971, see http://www.fws.gov; Abele and Kim, 1986, see http://www.fws.gov; American Fisheries Society, 1989, see http://www.fws.gov) which are prey for Gulf sturgeon. Bony fish are seldom consumed. Detritus, both inorganic and organic, is consumed incidentally by Gulf sturgeon of all sizes as they feed on various prey (Mason et al. 1993, in USACE 2006). Non-spawning sturgeon appear to feed longer in the estuaries and bays prior to moving into the rivers than spawning adults (Fox et al. 2000, in USACE 2006).

Range and Population Dynamics

Historically, the Gulf sturgeon occurred from the Mississippi River east to Tampa Bay. Its present range extends from Lake Pontchartrain and the Pearl River system in

Louisiana and Mississippi, east to the Suwannee River in Florida (Wooley 1985), with infrequent sightings occurring west of the Mississippi River. In the late 19th century and early 20th century, the Gulf sturgeon supported an important commercial fishery, providing eggs for caviar, flesh for smoked fish, and swim bladders for isinglass, a gelatin used in food products and glues (Huff 1975; Carr 1983). Gulf sturgeon numbers declined due to over fishing throughout most of the 20th century. After 1950, the decline was exacerbated by habitat loss associated with the construction of water control structures, such as dams and sills (submerged ridges or vertical walls of relatively shallow depth separating two bodies of water). In several rivers throughout the species' range, dams have severely restricted sturgeon access to historic migration routes and spawning areas (Boschung 1976; Wooley and Crateau 1985; McDowall 1988). Gulf sturgeon exhibit a high degree of fidelity, with over 99 percent returning to spawn in the same river system in which they were hatched (USACE 2006).

The majority of recent Gulf sturgeon sightings in the Pearl River drainage have occurred downstream of the Pools Bluff Sill near Bogalusa, Louisiana, and downstream of the Bogue Chitto Sill on the Bogue Chitto River in St. Tammany Parish, Louisiana. Between 1992 and 1996, 257 Gulf sturgeon were captured from the Pearl River system (West Middle River, Bogue Chitto River, East Pearl River, and West Pearl River). The subpopulation in that system was estimated at 292 fish, of which only 2 to 3 percent were adults (Morrow et al. 1998b, see http://www.fws.gov). The annual mortality rate was calculated to be 25 percent.

Preliminary results from captures between 1992 and 2001 suggest a stable subpopulation of 430 fish, with approximately 300 adults (Rogillio et al. 2002, see http://www.fws.gov). Morrow et al. (1999, see http://www.fws.gov) suggested that the Pearl River Gulf sturgeon population would be self-sustaining if the number of adults was at least 100, recruitment was satisfactory, and annual mortality was less than about 15 percent. Based on those criteria and from data gathered during 2000 and 2001, it appears that the population is at least self-sustaining and may even be recovering. There may be as many as 300 adults. While mortality estimates may be somewhat biased, the rate is probably about half of the 15 percent deemed to be a minimum acceptable benchmark.

Management and Protection

Life history characteristics of Gulf sturgeon may complicate and protract recovery efforts. Gulf sturgeon cannot establish a breeding population rapidly because of the amount of time it takes them to reach sexual maturity. Further, Gulf sturgeon appear to be river-specific spawners, although immature Gulf sturgeon occasionally exhibit plasticity in movement from one river to another. Therefore, natural repopulation by Gulf sturgeon migrating from other rivers may be non-existent or very low.

The take of Gulf sturgeon is prohibited in the state waters of Louisiana, Mississippi, Alabama, and Florida. Section 6(a) of the ESA provides for extended cooperation with states for the purpose of conserving threatened and endangered species. Under that provision, the Departments of the Interior and Commerce may enter into cooperative agreements with a state, provided that state has an established program for the conservation of a listed species. The agreements authorize the states to implement the authorities and actions of the ESA relative to the listed species recovery. Specifically, the states are authorized: 1) to conduct investigations to determine the status and requirements for survival of resident species of fish and wildlife (this may include candidate species for listing), and 2) to establish programs, including acquisition of land or aquatic habitat or interests for the conservation of fish and wildlife. Federal funding is also provided to states under those agreements to implement the approved programs. All four of the above mentioned states have entered into Section 6 agreements with the USFWS.

4.1.2 Pallid Sturgeon

Status

The pallid sturgeon was listed as endangered on October 9, 1990. The reasons for listing were habitat modification, apparent lack of natural reproduction, commercial harvest, and hybridization in parts of its range. Critical habitat has not been proposed or designated for the pallid sturgeon.

Species and Habitat Description

Pallid sturgeon evolved from an ancient group of bony fishes, the subclass Paleopterygii. Most species in this subclass became extinct sometime in the Mesozoic Era. The living descendants of this group in North America include paddlefish and eight species of sturgeon.

The pallid sturgeon grows to lengths of over 6 feet, can weigh in excess of 80 pounds, and has a flattened, shovel-shaped snout, a long, slender, and completely armored caudal peduncle, and lacking a spiracle (Smith 1979). As with other sturgeon, the mouth is toothless, protrusible, and ventrally positioned under the snout. The skeletal structure is primarily cartilaginous (Gilbraith et al. 1988).

Forbes and Richardson (1905), Schmulbach et al. (1975), Kallemeyn (1983), and Gilbraith et al. (1988) describe the pallid sturgeon as being well adapted to life on the bottom in swift water of large, turbid, free-flowing rivers. Pallid sturgeon evolved in the diverse environments of the Missouri and Mississippi Rivers. Floodplains, backwaters, chutes, sloughs, islands, sandbars, and main channel waters formed the large-river ecosystem that provided macrohabitat requirements for pallid sturgeon and other native large-river fish, such as paddlefish and other sturgeon. Those habitats were historically in a constant state of change. Mayden and Kuhajda (1997) describe the natural habitat conditions to which pallid sturgeon are adapted as braided channels, irregular flow patterns, flooding of terrestrial habitats, extensive microhabitat diversity, and turbid waters. Those habitat conditions and much of the once naturally functioning ecosystem have been changed by human activities.

Bramblett (1996) noted important aspects of pallid sturgeon habitat use and movements. He also noted that the pallid sturgeon is specific and restrictive in use of macrohabitat selection. According to Bramblett’s (1996) study, pallid sturgeon were found most often in sinuous channels with islands or alluvial bars present. Straight channels, and channels with irregular patterns or irregular meanders were only rarely used by pallid sturgeon. The seral stage of islands or bars near pallid sturgeon occurrences was most often subclimax (Bramblett 1996). Bramblett (1996) found macrohabitats used by pallid sturgeon were diverse and dynamic. For example, pallid sturgeon used river reaches with sinuous channel patterns and islands and alluvial bars; those river reaches generally have more diverse depths, current velocities, and substrates than do relatively straight channels without islands or alluvial bars, as well as a high diversity of channel features such as backwaters and side channels. The subclimax riparian vegetational seres in those areas are indicative of a dynamic river channel and riparian zone (Johnson 1993).

In telemetry studies of pallid sturgeon on the middle Mississippi River, Sheehan et al. (1998) found a positive selection for main channel border and downstream islands tips, depositional areas between wing dams, and deep holes off wing dam tips. Sheehan et al. (1998) speculated that areas between wing dams and downstream island tips may be used as velocity refugia and/or feeding stations. Sturgeon were found most often in main channel habitat; however, they exhibited selection against that habitat type. Their occurrence in such habitat was not surprising, considering main channel habitat comprised approximately 65 percent of the available habitat in the study reach (Sheehan et al. 1998).

Constant et al. (1997) reported on radio-tracked sturgeon, and stated that sturgeon were most frequently found in low-slope areas and that such areas were used in proportion to their availability. No sturgeon were observed on extremely steep slopes. Constant et al. (1997) found that sand made up over 80 percent of the substrate in low-slope areas where over 90 percent of pallid sturgeon were located. Those authors stated that the preference for sand substrates in lowslope areas suggests that pallid sturgeon use such areas as current refugia. Sand substrates were found to have lower invertebrate densities than substrates of silt-clay, which were generally located on steep-slope areas that were exposed by swift currents. As such, it would have been energetically costly for pallid sturgeon to remain near those steep-slope areas for extended periods of time. Telemetry observations, however, showed that 55 percent of sturgeon locations occurred within 33 feet of steep slopes, suggesting that pallid sturgeon remained near areas of high food abundance (Constant et al. 1997). Reed and Ewing (1993) found sturgeon occurring in the man-made riprap lined outfall channels of the Old River Control Structure Complex (ORCSC) in Louisiana. Bramblett (1996) found that pallid sturgeon preferred sandy substrates, particularly sand dunes, and avoided substrates of gravel and cobble. Pallid sturgeon have adhesive eggs. Thus, spawning is thought to occur over hard substrates of gravel or cobble with moderate flow (USFWS 2000).

Caution must be used in interpreting the results of habitat preference studies conducted in today’s highly altered river environments. The results of studies conducted by Bramblett (1996) under fairly unaltered riverine conditions, however, provide additional information on habitat conditions preferred by this species. Characteristics of microhabitat used by pallid sturgeon have recently been described. Much of the microhabitat research to date has been conducted in significantly altered environments.

That research does not necessarily indicate preferred or required habitats; instead it may only indicate which habitats of those presently available the pallid sturgeon uses. Also, capture locations may have conditions representing seasonal habitat preferences. Hurley (1996) found that pallid sturgeon were selecting downstream island tips although the island tips were not abundant within the study area. Constant et al. (1997) found pallid sturgeon in the Atchafalaya and Mississippi Rivers at mean depths of 49.9 feet and observed pallid sturgeon at depths of 23.0 and 68.9 feet with greater frequency than such areas were available. The range of depth used by pallid sturgeon is likely related to the available habitat within the river segment (USFWS 2000).

Pallid sturgeon spawning occurs from March through July depending on location (Forbes and Richardson 1905; Gilbraith et al. 1988). Keenlyne and Jenkins (1993) estimate that spawning probably begins in March in the lower Mississippi and Atchafalaya Rivers; in late April or early May in the lower Missouri and middle Mississippi Rivers; and in late May or early June in the upper Missouri River.

All sturgeon species spawn in the spring or early summer, are multiple spawners, and release their eggs at intervals. In the wild, the adhesive eggs are released in deep channels or rapids and are left unattended (Gilbraith et al. 1988). The larvae of Acipenserids are generally pelagic, becoming buoyant or active immediately after hatching (Moyle and Cech 1982). Although the behavior of young pallid sturgeon is poorly understood, work by Kynard et al. (1998) indicates that a downstream migration period for larval pallid sturgeon begins at hatching and continues up to day 13. With this information it has been possible to use water velocities to roughly estimate that larval pallid sturgeon may drift in the water column for a distance of 40 to over 400 miles (USFWS 2000).

Although benthic macroinvertebrates, characteristic of river habitats, are important pallid sturgeon dietary components (Modde and Schmulbach 1977; Carlson et al. 1985), the occurrence of lake and terrestrial invertebrates in sturgeon stomachs suggest that drifting invertebrates may also be important forage organisms (Modde and Schmulbach 1977; Constant et al. 1997). Aquatic invertebrates (principally the immature stages of insects) compose most of the diet of shovelnose sturgeon, while adult pallid sturgeon and hybrids consume a greater proportion of fish (mostly cyprinids). Other researchers also reported a higher incidence of fish in the diet of adult pallid sturgeon than in the diet of shovelnose sturgeon (Cross 1967; Held 1969).

Range and Population Dynamics

The pallid sturgeon is endemic to the Yellowstone, Missouri, Middle and Lower Mississippi Rivers, and the lower reaches of their major tributaries. Within Louisiana, the pallid sturgeon is found in both the Mississippi and Atchafalaya Rivers (with known concentrations in the vicinity of the ORCSC); it is possibly found in the Red River as well. The historic range of pallid sturgeon, as described by Bailey and Cross (1954), encompassed the middle and lower Mississippi River, the Missouri River, and the lower reaches of the Platte, Kansas, and Yellowstone Rivers. Duffy et al. (1996) stated that the historic range of pallid sturgeon once included the Mississippi River upstream to Keokuk, Iowa, before the river was converted into a series of locks and dams for commercial navigation (Coker 1930).

The pallid sturgeon appears nearly extirpated from large segments of its former range. In 1991, pallid sturgeon were discovered in the Atchafalaya River in Louisiana (Constant et al. 1997). Today, they are only occasionally found in a few selected areas. Since 1980, reports of most frequent occurrence are from the Missouri River, the Mississippi River, and the Atchafalaya River at the ORCSC (USFWS 1993). Of 872 pallid sturgeon records prior to 1998, 70 percent were reported from the Missouri River. Nine percent of the total records came from the Yellowstone River, 5 percent from the Mississippi River, 14 percent from the Atchafalaya River, and less than 2 percent from the St. Francis, Platte, Ohio, Kansas, and Big Sunflower Rivers (USFWS 2000). Keenlyne (1989) updated previously published and unpublished information on distribution and abundance of pallid sturgeon.

The Missouri River has been modified significantly, with approximately 36 percent of the riverine habitat inundated by reservoirs, 40 percent channelized, and the remaining 24 percent altered due to dam operations (USFWS 1993). Most of the major tributaries of the Missouri and Mississippi Rivers have also been altered to various degrees by dams, water depletions, channelization, and riparian corridor modifications.

Levee construction on the lower Mississippi River from the Ohio River to near the Gulf of Mexico has eliminated the river's major natural floodway and reduced the area of the floodplain connected to the river by more than 90 percent (Fremling et al. 1989). Fremling et al. (1989) also reported that levee construction isolated many floodplain lakes and raised riverbanks. Destruction and alteration of big-river ecologic functions and habitat once provided by the Missouri and Mississippi Rivers is believed to be the primary cause of declines in reproduction, growth, and survival of pallid sturgeon (USFWS 1993). In spite of efforts to constrict and control the Missouri and Mississippi Rivers with reservoirs, stabilized banks, jetties, dikes, levees, and revetments, remnant reaches of the Missouri River and Mississippi River from the Missouri River confluence to the Gulf of Mexico still provide habitat usable by pallid sturgeon for certain life stages.

Since 1988, pallid sturgeon researchers have collaborated on studies to gather information about the species (Keenlyne 1995). Tag and recapture data indicate that 50 to 100 pallid sturgeon remain in the Missouri River above Fort Peck Dam in Montana, and between 200 and 300 pallid sturgeon remain between the Garrison Dam in North Dakota and Fort Peck Dam, including the lower Yellowstone River (USFWS 2000). One to five pallid sturgeon sightings per year have been recorded between the headwaters of Oahe Reservoir in South Dakota to the Garrison Dam and from the riverine reach in the Missouri River above Gavins Dam to Fort Randall Dam, suggesting that perhaps as many as 25 to 50 pallid sturgeon may remain in each of these areas. A small population also exists between Oahe Dam and Big Bend Dam on the Missouri River in South Dakota with perhaps 50 to 100 individuals remaining in that riverine section. There is no evidence that the upper Missouri River system populations are successfully reproducing (Keenlyne 1989; Duffy et al. 1996).

Glen Constant, while conducting research at Louisiana State University, estimated the pallid sturgeon population in the Atchafalaya River to range from 2,750 to 4,100 fish. A high rate of hybridization is occurring in the Atchafalaya and Mississippi Rivers (Keenlyne et al. 1994); that makes estimation of the number of pure pallid sturgeon in those river systems difficult (Duffy et al. 1996).

In recent years, pallid sturgeon populations have been augmented by release of hatchery-reared fish. In 1994, the Missouri Department of Conservation (MDC) released approximately 7,000 fingerlings in the Missouri and Mississippi Rivers, and an additional 3,000 fingerlings were stocked in 1997 (Graham 1997, 1999). Since stocking in 1994, approximately 86 pallid sturgeon returns have been reported, mostly in the Mississippi River downstream of St. Louis (Graham 1999). Thirty-five 12- to 14-inch pallid sturgeon raised at Natchitoches NFH were stocked in the lower Mississippi River in 1998 (Kilpatrick 1999). Also in 1998, 745 hatchery-reared yearling pallid sturgeon were released at three sites in the Missouri River above Fort Peck Reservoir (Gardner 1999) and another 750 yearling sturgeon were released near the confluence of the Yellowstone and Missouri Rivers (USFWS 2000).

Evidence of successful pallid sturgeon reproduction is rare throughout the range of the species. Recent work in the Atchafalaya River has revealed pallid sturgeon of several age groups, suggesting that some reproduction and recruitment may also occur in the Atchafalaya River. The only physical evidence of reproduction, however, were three gravid females reported by Constant et al. (1997). According to their data, pallid sturgeon collected in the Atchafalaya River and other areas of the Mississippi River have averaged less than 6.6 pounds and length-at age estimates calculated according to Fogle (1963) indicated that even the smallest fish were over age 6, with the oldest perhaps over age 14. The age of fish in their study indicates the most recent recruitment of pallid sturgeon to be from the 1988-year class (Constant et al. 1997).

Management and Protection

Habitat destruction and alteration is believed to be the primary cause of declines in pallid sturgeon reproduction, growth, and survival. It is unlikely that successfully reproducing pallid sturgeon populations can be recovered without restoring the habitat elements (morphology, hydrology, temperature regime, cover, and sediment/organic matter transport) of the Missouri and Mississippi Rivers necessary for the species' continued survival (USFWS 1993). In spite of efforts to control the Missouri and Mississippi Rivers with reservoirs, stabilized banks, jetties, dikes, levees, and revetments, remnant reaches of the Missouri and Mississippi Rivers still provide habitat believed to be usable by the pallid sturgeon. Those habitat remnants are priority areas for implementation of recovery actions (USFWS 1993).

Mortality of pallid sturgeon occurs from both sport and commercial fishing activities. The states of North Dakota, South Dakota, and Louisiana require the release of all sturgeon whether taken commercially or for sport. Neither Montana nor Kansas allow commercial harvest of sturgeon. Sturgeon continued to be harvested as a bycatch of commercial fishing operations in Nebraska, Iowa, Missouri, Illinois, Kentucky, Tennessee, Arkansas, and Mississippi (USFWS 1993).

Pollution is also a likely threat to the pallid sturgeon over much of its range. Further investigations are needed to identify sources of contaminants in the Missouri and Mississippi Rivers, and to assess the role of contaminants in the decline of pallid sturgeon populations (USFWS 1993).

The pallid sturgeon is known to hybridize with the shovelnose sturgeon (Carlson et al. 1985). Keenlyne et al. (1992) concluded that hybridization might be occurring in half of the river reaches within the pallid sturgeon's range. Hybridization may be related to environmental degradation. Presumably, the loss of habitat diversity caused by human-induced environmental changes inhibits the reproductive isolating mechanisms that naturally occur among fish species. Also, the loss of available spawning habitat forces sharing of suitable habitat areas by similar species, with resultant increased hybridization (USFWS 1993).

4.2 BIRDS

4.2.1 Piping Plover

Status
On January 10, 1986, the piping plover was Federally listed as endangered in the Great Lakes watershed, and as threatened elsewhere in its range. Critical habitat for the wintering population was designated in 2001; that designation included 142 areas along the coast of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas, to provide sufficient wintering habitat to support the piping plover at the population level and geographic distribution necessary for recovery of the species. Critical habitat for breeding populations in the Great Lakes and Great Plains was designated in 2001 and 2002, respectively.

Species and Habitat Description
The piping plover, named for its melodious mating call, is a small North American shorebird approximately 8 inches long with a wingspread of about 15 inches (Palmer 1967). Its light sandcolored plumage blends in well with beaches and sand flats, part of its primary habitat. During the breeding season, the legs are bright orange, and the short bill is orange with a black tip. There are two single dark bands, one around the neck and one across the forehead between the eyes. The black breast band and brow bar are generally more pronounced in breeding males than females (Wilcox 1959). Breeding birds have white underparts, a light beige back and crown, a white rump, and a black upper tail with a white edge. In flight, each wing shows a single, white wing stripe with black highlights at the wrist joints and along the trailing edges. In winter, the bill turns black, the legs remain orange but pale, and the black plumage bands are lost on the head and neck. Chicks have speckled gray, buff, and brown down, a black beak, orange legs, and a white collar around the neck. Juveniles resemble wintering adults and obtain their adult plumage the spring after they fledge (Prater et al. 1977). The primary constituent

elements for piping plover critical habitat (wintering) are found in geologically dynamic coastal areas that contain intertidal beaches and flats (between annual low tide and annual high tide), associated dune systems, and flats above annual high tide. Primary constituent elements of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important for roosting plovers (USFWS 2002). Northward migration to the breeding grounds occurs during late February, March and early April (Patterson 1988; MacIvor 1990). Plovers will breed at 1 year of age (MacIvor 1990; Strauss 1990; Haig 1992) and are monogamous, but usually shift mates between years (Wilcox 1959; Haig and Oring 1988; MacIvor 1990). Southward migration to the wintering grounds along the southern Atlantic coast and Gulf of Mexico shoreline extends from late July through September. Individuals can be found on their wintering grounds throughout the year but sightings are rare in May, June, and early July (USFWS 2001b). In general, wintering piping plovers feed extensively on intertidal beaches, mudflats, sand flats, algal flats, and wash-over passes with no or very sparse emergent vegetation; they also require unvegetated or sparsely vegetated areas for roosting. Roosting areas may have debris, detritus, or micro-topographic relief offering refuge to plovers from high winds and cold weather. In most areas, wintering piping plovers are dependent on a mosaic of sites distributed through the landscape, as the suitability of a particular site for foraging or roosting is dependent on local weather and tidal conditions. Plovers move among sites as environmental conditions change. The following units are designated critical habitat in Louisiana: (1) Texas/Louisiana border to Cheniere au Tigre in Cameron and Vermilion Parishes; (2) Atchafalaya River Delta in St. Mary Parish; (3) Point Au Fer Island in Terrebonne Parish; (4) Isles Dernieres in Terrebonne Parish; (5) Timbalier Island to East Grand Terre Island in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes; (6) Mississippi River Delta in Plaquemines Parish, and (7) Breton Islands and Chandeleur Island Chain in Plaquemines and St. Bernard Parishes (see 50 CFR Part 17, pages 36127 to 36131, or http://plover.fws.gov/#maps, for detailed descriptions and/or maps).

Range and Population Dynamics

Piping plovers breed only in North America within three geographic regions encompassing three distinct breeding populations: the Northern Great Plains, the Great Lakes, and the Atlantic Coast. The piping plover's primary winter range is along the Atlantic and Gulf coasts from North Carolina to Mexico and into the Bahamas and West Indies (USFWS 1988, 1989a, 1989b, 1996, 2002). Loss and degradation of habitat due to development and shoreline stabilization have been major contributors to the species' decline. Recreational activity, coastal development, and dune stabilization have resulted in loss of suitable sandy beaches and other littoral habitats. Breeding success continues to be affected by human disturbance (foot and vehicular traffic), which destroys nests and young (USFWS 1989b, 1996). Since piping plovers spend 55 to 80 percent of their annual cycle associated with wintering areas, factors that affect their well being on the wintering grounds can substantially affect their survival and recovery (USFWS 1996). Between 1986 and 1987, there were an estimated 1,258 to 1,326 breeding pairs of piping plovers in the Northern Great Plains breeding population. The 1991 International Piping Plover Census estimated that there were 1,486 breeding pairs in the Northern Great Plains. The 1996 census for that population indicated that it numbered about 3,284 adults, which would be the largest of the three breeding populations (i.e., Northern Great Plains, Great Lakes, and Atlantic Coast). Russell (1983) reviewed historic records and estimated pre-settlement Great Lakes piping plover populations at 492 to 682 breeding pairs; those totals may be high, but there are no other estimates of pre-settlement population. Coinciding with major industrial development, piping plovers were extirpated from most of the Great Lakes beaches in the late 1970s and early 1980s. In 1977, the Great Lakes population was estimated at 31 nesting pairs (Lambert and Ratcliff 1979), but declined to 17 pairs by 1985 (USFWS 1985). Since 1986, nests have been recorded at 30 breeding sites with populations ranging from 12 to 25 breeding pairs. Historical trends for the Atlantic Coast piping plover population have been gathered from largely qualitative records. In the nineteenth century, piping plovers were a common summer resident along the Atlantic Coast; by the twentieth century, uncontrolled hunting and egg collecting greatly reduced their populations. Following the passage of the Migratory Bird Treaty Act in 1918, piping plover numbers recovered to some extent. Raithel (1984) showed that Rhode Island piping plover numbers reached a twentieth century peak following a 1938 hurricane, which flattened sand dunes and shoreline developments. After World War II, populations declined due to dune stabilization efforts and construction of summer homes. The population partially recovered following another severe hurricane in 1954, but then began a decline that continued through the early 1980s. Recent population estimates indicate that, since the late 1980s, piping plover populations have increased steadily along the Atlantic Coast from 790 adults in 1986 to 1,349 adults in 1995 (USFWS 1996) and 2,581 adults in 1996 (USFWS 1999b).

Management and Protection

Habitat alterations such as marina construction, erosion control measures, and residential development affect the dynamic nature of the beach ecosystem by altering sediment patterns and hydrology, and inhibiting dune formation. Those actions may degrade or destroy habitat for a variety of marine plants and animals (USFWS 1996, 1997; Cuthbert et al. 1998). Off-road vehicles and high levels of foot traffic may erode sand dunes and result in direct mortality by trampling (Bowles et al. 1990; USFWS 1997). The piping plover is currently protected by Federal and state laws, which are enforced by the USFWS and the LDWF, respectively. Critical habitat is also protected under management programs on Federal lands (i.e., NWRs).

4.2.2 Brown Pelican

Status

The brown pelican was listed as endangered when project endangered species coordination with USFWS began in early 2009. However, due to successful recovery efforts, the brown pelican was removed from the Federal list of endangered and threatened wildlife effective December 17, 2009 (Federal Register, Volume 74, Number 220) and will not be addressed further in this document.

4.3 MAMMALS

4.3.1 West Indian Manatee

Status

The West Indian manatee was listed as endangered throughout its range for both the Florida and Antillean subspecies in 1967, and received Federal protection with the passage of the ESA in 1973. Critical habitat was designated in 1976, 1994, 1998, 2002, and 2003 for the Florida subspecies.

Species and Habitat Description

The West Indian manatee is a large gray or brown aquatic mammal. Adults average approximately 10 feet (3 m) in length and weigh up to 2,200 pounds (999 kg). They have no hind limbs, and their forelimbs are modified as flippers. Manatee tails are flattened horizontally and rounded. Their body is covered with sparse hairs and their muzzles with stiff whiskers (USFWS 2001c). The nostrils, located on the upper snout, open and close by means of muscular valves as the animal surfaces and dives (Husar 1977; Hartman 1979). Manatees will consume any aquatic vegetation (i.e., submerged, floating, and emergent) available to them and sometimes even shoreline vegetation. Although primarily herbivorous, they will occasionally feed on fish. Manatees may spend about five hours a day feeding, and may consume four to nine percent of their body weight per day.

Observations of mating herds indicate that females mate with a number of males during their 2 to 4 week estrus period, and then they go through a pregnancy estimated to last 12 to 14 months (O'Shea et al. 1992). Births occur during all months of the year with a slight drop during winter months. Manatee cows usually bear a single calf, but 1.5 percent of births are twins. Calves reach sexual maturity at three to six years of age. Mature females may give birth every two to five years (USFWS 2001c).

Manatees inhabit both salt and freshwater of sufficient depth (5 feet [1.5 m] to usually less than 20 feet [6.1 m]) throughout their range. Shallow grassbeds with ready access to deep channels are preferred feeding areas in coastal and riverine habitats (USFWS 2001c). They may also be encountered in canals, rivers, estuarine habitats, saltwater bays, and have been observed as much as 3.7 miles (6.0 km) off the Florida Gulf Coast. Between October and April, Florida manatees concentrate in areas of warmer water. Severe cold fronts have been known to kill manatees when the animals did not have access to warm water refuges. During warmer months they appear to choose areas based on an adequate food supply, water depth, and proximity to fresh water. Manatees may not need fresh water, but they are frequently observed drinking water from hoses, sewage outfalls, and culverts.

Range and Population Dynamics

During winter months, the United States' manatee population confines itself to the coastal waters of the southern half of peninsular Florida and to springs and warm water outfalls as far north as southeast Georgia. Power plant and paper mill outfalls create most of the artificial warm water refuges utilized by manatees.

During summer months, they migrate as far north as coastal Virginia on the east coast and the Louisiana coast in the Gulf of Mexico. During summer months, manatees disperse from winter aggregation areas, and are commonly found almost anywhere in Florida where water depths and access channels are greater than 3.3 to 6.6 feet (1.0 to 2.0 m) (O'Shea 1988). In the warmer months, manatees usually occur alone or in pairs, although interacting groups of five to ten animals are not unusual (USFWS 2001c).

In the early 1980s, scientists tried to develop procedures for estimating the overall manatee population in the southeastern United States (USFWS 2001c). The best estimate throughout the State of Florida was 1,200 manatees (Reynolds and Wilcox 1987). In the early 1990s, the State of Florida initiated a statewide aerial survey in potential winter habitats during periods of severe cold weather (Ackerman 1995), and the highest count of 3,276 manatees was recorded in January 2001.

Management and Protection

The most significant problem faced by manatees in Florida is death or injury from boat strikes (USFWS 2001c). Minimum flows and levels for warm water refuges need to be established to ensure their long-term availability for manatees. Their survival will depend on maintaining the ecosystems and habitat sufficient to support a viable manatee population (USFWS 2001c). The focus of recovery is on implementing, monitoring, and addressing the effectiveness of conservation measures to reduce or remove threats that will lead to a healthy and self-sustaining population (USFWS 2001c).

The West Indian manatee is also protected under the Marine Mammal Protection Act (MMPA) of 1972. The MMPA establishes a national policy for the maintenance of health and stability of marine ecosystems and for obtaining and maintaining optimum sustainable populations of marine mammals. It includes a moratorium on the taking of marine mammals. The recovery planning under the ESA includes conservation planning under the MMPA (USFWS 2001c).

4.4 REPTILES

4.4.1 Green Sea Turtle (*Chelonia mydas*)

Status

The green sea turtle was listed as endangered/threatened on July 28, 1978. The breeding populations off Florida and the Pacific coast of Mexico are listed as endangered while all others are threatened (USFWS 1991; National Marine Fisheries Service [NMFS] www.nmfs.noaa.gov/). This species' current status in Louisiana is unknown (USFWS 1990b).

Species and Habitat Description

Although green sea turtles are found worldwide in oceans and gulfs with water temperatures greater than 68°F (20°C), their distribution can be correlated to grassbed distribution, location of nesting beaches, and associated ocean currents (Hirth 1971). Long migrations are often made between feeding and nesting grounds (Carr and Hirth 1962). Within Louisiana waters, these turtles probably occur all along the coast and may nest on the Chandeleur Islands (Dundee and Rossman 1989). Population decline has been attributed to heavy fishing pressure and human nest predation (Dundee and Rossman 1989). Historically, green sea turtles were fished off the Louisiana coast (Rebel 1974); exploitation and incidental drowning in shrimp trawls has contributed to the decline of this species and its eventual listing (King 1981). During their first year of life, green sea turtles are primarily carnivorous, feeding mainly on invertebrates. As adults they feed almost exclusively on seagrasses growing in shallow water flats (Fritts et al. 1983), but also feed on invertebrates and carrion (Dundee and Rossman 1989).

Green sea turtles feed in shallow water areas with abundant seagrasses or algae. The turtles migrate from nesting areas to feeding grounds, which are sometimes several thousand miles away. Most turtles migrate along the coasts, but some populations are known to migrate across the ocean from nesting area to feeding grounds. The major nesting beaches are always found in places where the seawater temperature is greater than 77°F (25°C). As a species that migrates long distances, these turtles face special problems associated with differing attitudes toward conservation in different countries.

Range and Population Dynamics

In the southeastern United States, green sea turtles are found around the U.S. Virgin Islands, Puerto Rico, and the continental U.S. from Texas to Massachusetts. Important feeding grounds in Florida include Indian River Lagoon, the Florida Keys, Florida Bay, Homosassa, Crystal River and Cedar Key. The primary nesting sites in U.S. Atlantic waters are along the east coast of Florida, with additional sites in the U.S. Virgin Islands and Puerto Rico.

Green sea turtles are also found throughout the North Pacific, ranging as far north as Eliza Harbor, Admiralty Island, Alaska, and Ucluelet, British Columbia. In the eastern North Pacific, green sea turtles have been sighted from Baja California to southern Alaska. In the central Pacific, green sea turtles can be found at most tropical islands. In U.S. Hawaiian waters, green sea turtles are found around most of the islands in the Hawaiian Archipelago. The primary nesting site is at French Frigate Shoals (http://www.nmfs.noaa.gov/prot_res/species/turtles/green.html). Females deposit up to seven clutches, and the number of nests has been estimated to be between 350 to 2,300 nests annually. Green sea turtles nest at two-, three-, or four-year intervals. This nesting activity indicates a population of less than 1,000 females in the breeding population of Florida and Mexico.

Management and Protection

Recovery plan objectives consider the delisting of green sea turtles if, over a period of 25 years, the following conditions are met: 1) the level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years (nesting data must be based on standardized surveys), 2) at least 25 percent (41 mi^2/105 km^2) of all available nesting beaches (162 mi^2/420 km^2) is in public ownership and encompasses at least 50 percent of the nesting activity, and 3) a reduction in age class mortality is reflected in higher counts of individuals on foraging grounds. The 1995 Biological Assessment lists degradation of foraging grounds as one of the impediments to population recovery. There is evidence that supports foraging site as well as nesting site fidelity by green sea turtles (Renaud

1995). The recovery plans include prevention of marine pollution of green sea turtle habitat and protection of the nesting sites.

4.4.2 Hawksbill Sea Turtle (*Eretmochelys imbricata*)

Status

The hawksbill was listed as an endangered species in June 1970 (USFWS 1991) and its current status in Louisiana is unknown (USFWS 1990).

Species and Habitat Description

Only one record of a hawksbill in Louisiana has been reported (Fuller and Tappen 1986). This species is an omnivore, feeding primarily on invertebrates and marine vegetation (Dundee and Rossman 1989). Hawksbill turtles are observed regularly in Florida and Texas. Florida is considered foraging habitat for those turtles, and Texas may be foraging habitat for hatchlings and juveniles (77 observations of small turtles were reported between 1972 and 1984) from the nesting sites in Mexico (NMFS and USFWS 1993).

Range and Population Dynamics

The hawksbill occurs in tropical and subtropical seas of the Atlantic, Pacific and Indian Oceans. The species is widely distributed in the Caribbean Sea and western Atlantic Ocean, with representatives of at least some life history stages regularly occurring in southern Florida and the northern Gulf of Mexico (especially Texas); in the Greater and Lesser Antilles; and along the Central American mainland south to Brazil. Within the United States, hawksbills are most common in Puerto Rico and its associated islands, and in the U.S. Virgin Islands. In the continental U.S., the species is recorded from all the Gulf of Mexico states and from along the eastern seaboard as far north as Massachusetts, but sightings north of Florida are rare.

Hawksbills are observed in Florida with some regularity on the reefs off Palm Beach County and in the Florida Keys. Texas is the only other state where hawksbills are sighted with any regularity. Most sightings involve post hatchlings and juveniles, which are believed to originate from nesting beaches in Mexico. Nesting within the southeastern United States occurs principally in Puerto Rico and the U.S. Virgin Islands. Within the continental United States, nesting is restricted to the southeast coast of Florida and the Florida Keys.

Hawksbill turtles nest at low densities in aggregations of one to one hundred adults; in contrast, other sea turtles have concentrated nesting sites and aggregations of thousands of adults. The Yucatan Peninsula of Mexico is the most concentrated nesting site, where approximately 178 to 222 adult females nest each year (NMFS and USFWS 1993). Most of the countries in the Caribbean report less than 100 females nesting annually; less than two nests annually have been observed in Florida (NMFS and USFWS 1993) and Texas (htpp://www.noaa.gov).

Management and Protection

Recovery criteria are directed at nesting beaches with U.S. jurisdiction in the Caribbean Sea, including Mona Island, Puerto Rico, and the Virgin Islands. The hawksbill turtle can be delisted if the adult female population has an increasing trend over 25 years, as evidenced by increases in annual number of nests at five index beaches, including Mona Island. Numbers of turtles of all classes must show an increasing trend on at least five key foraging areas within Puerto Rico, the U.S. Virgin Islands, and Florida to meet recovery criteria. Actions needed to achieve recovery include long-term protection of foraging habitat and nesting beaches, and reduction of illegal exploitation (NMFS and USFWS 1993).

4.4.3 Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

Status

On December 2, 1970 the Kemp's Ridley sea turtle was designated as endangered across its entire range (USFWS 1991) and has continued to decline in Louisiana (USFWS 1990).

Species and Habitat Description

This small sea turtle is believed to be the most frequently encountered (Dundee and Rossman 1989), if not the most abundant sea turtle, off the Louisiana coast (Viosca 1961). Predation on eggs by humans, other mammals, birds, and crabs, in addition to the capture of diurnal nesting females has contributed to the decline of the Kemp's Ridley. Recent causes of mortality are fishing activities and accidental capture in shrimp trawls (Fuller 1978; Pritchard and Marquez 1973). These sea turtles are commonly captured by shrimpers off the Texas coast, as well as in heavily trawled areas off the coasts and in the bays of Louisiana and Alabama (Dundee and Rossman 1989; Carr 1980; Pritchard and Marquez 1973). Inshore areas of the Gulf of Mexico appear to be important habitat for Kemp's Ridleys, as they tend to concentrate around the mouths of major rivers (Frazier 1980). Members of this genus are characteristically found in waters of low salinity and high turbidity and organic content, where shrimp are abundant (Hughes 1972, as cited in Frazier 1980; Zwinenberg 1977). Kemp's Ridleys have been collected in Louisiana from Lake Borgne, Barataria and Terrebonne Bays, and near Calcasieu Pass (Dundee and Rossman 1989). Occurrence of these sea turtles in bays and estuaries along the Louisiana coast would not be unexpected, as many of their primary food items occur there. Stomach analyses of specimens collected in shrimp trawls off Louisiana revealed crabs, gastropods, and clams (Dobie et al. 1961). Although Kemp's Ridleys are considered primarily carnivorous benthic feeders (Ernst and Barbour 1972), jellyfish as well as by-catch from shrimp trawlers have been reported as part of their diet (Landry 1986). Trends in Kemp's Ridley sea turtle populations in the Gulf of Mexico are identified through monitoring of their most accessible life stages on the nesting beaches, where hatchling production and the status of adult females can be directly measured. Most Kemp's Ridley nesting occurs on a single beach at Rancho Nuevo, Mexico, about 30 kilometers south of the Rio Grande, with sporadic nesting along the Texas coast. Protection and monitoring by Mexico and the United States has occurred on that nesting beach since 1978. Nest production plummeted to only 742 nests in 1985, but has been steadily increasing since that time. Over 1,500 nests were observed during the 1994 nesting season. The latest data available show that the number of nests increased during 1994 through 2000; in 2000, 5,751 nests were observed. The possibility of Kemp's Ridley nesting on the Louisiana coast has been suggested (Viosca 1961), but no documentation exists.

Range and Population Dynamics

The known range of this species includes the Gulf of Mexico and the Atlantic Ocean. The current range for Kemp's Ridley in the United States includes marine habitat of the following coastal states: Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas.

Management and Protection

The Recovery Plan for the Kemp's Ridley sea turtle (NMFS and USFWS 1992) identified a recovery criterion of 10,000 nesting females in one season as a prerequisite for downlisting to threatened status. Considering that 58 percent of all adult females appear to nest in any given year, and each female lays an estimated 2.7 nests, the 5,751 nests documented in the year 2000 represent approximately 3,700 adult female Kemp's Ridleys in the entire population; that is about one third of the amount included in the downlisting criteria identified in the Recovery Plan. Continued protection of all life stages of the Kemp's Ridley is necessary to increase recruitment to the reproducing population and insure recovery of the species.

4.4.4 Leatherback Sea Turtle (*Dermochelys coriacea*)

Status

The leatherback sea turtle was listed as an endangered species throughout its range in June 1970 (USFWS 199l).

Species and Habitat Description

The leatherback is the largest living turtle, and is so distinctive as to be placed in a separate taxonomic family, *Dermochelyidae*. The carapace is distinguished by a rubber-like texture, about 1.5 in (4 cm) thick, and made primarily of tough, oil-saturated connective tissue. No sharp angle is formed between the carapace and the plastron, resulting in the animal being somewhat barrel-shaped. The average curved carapace length for adult turtles is 5 ft (155 cm) and weight ranges from 440 to 1,543 lbs (200 to 700 kg). Hatchlings are dorsally mostly black and are covered with tiny scales; the flippers are margined in white, and rows of white scales appear as stripes along the length of the back. Hatchlings average 2.4 in (61.3 mm) long and 0.1 lbs (45.8 g) in weight. In the adult, the skin is black and scaleless. The undersurface is mottled pinkish-white and black. The front flippers are proportionally longer than in any other sea turtle, and may span 8.9 ft (270 cm) in an adult. In both adults and hatchlings, the upper jaw bears two tooth-like projections at the premaxillary-maxillary sutures. Age at sexual maturity is unknown (http://www.nmfs.noaa.gov/prot_res/species/turtles/leatherback.html).

The leatherback sea turtle occurs mostly in continental shelf waters, but will occasionally enter shallow waters and estuaries. Adults are highly migratory, and are believed to be the most pelagic of all sea turtles (NMFS and USFWS 1992). Habitat requirements for juvenile and post-hatchling leatherbacks are unknown.

Leatherback turtles are omnivorous but feed primarily on jellyfish and other cnidarians, and have been associated with large schools of cabbage head jellyfish *(Stomolophus meleagris)*. Fritts et al. (1983) reported that these turtles also ingest plastic, apparently mistaking it for food.

Range and Population Dynamics

The leatherback is found throughout the tropical waters of the Atlantic, Pacific, and Indian Oceans (Ernst and Barbour 1972), the Gulf of Mexico, and the Caribbean (Carr 1952). Critical habitat for the leatherback includes the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands, up to and inclusive of the waters from the hundred fathom curve shoreward to the level of mean high tide with boundaries at 17°42'12" N and 64°50'00" W. This turtle exhibits seasonal fluctuations in distribution in response to the Gulf Stream and other warm water features (Fritts et al. 1983; Hirth 1980; Pritchard 1971). During the summer, leatherbacks tend to be found along the east coast of the U.S. from the Gulf of Maine south to mid-Florida.

Nesting occurs from February through July at sites located from Georgia to the U.S. Virgin Islands. Nesting leatherbacks occur along beaches in Florida, Nicaragua, and islands in the West Indies; however, no nesting has been reported in Louisiana (Gunter 1981; Dundee and Rossman 1989). In Louisiana, leatherbacks are believed to occur offshore in deep waters; however, they have been sighted in Cameron Parish, Atchafalaya Bay, Timbalier Bay, and Chandeleur Sound (Dundee and Rossman 1989).

Leatherbacks are seriously declining at all major nesting beaches throughout the Pacific. The decline is dramatic along the Pacific coasts of Mexico, Costa Rica and Malaysia. Nesting along the Pacific coast of Mexico declined at an annual rate of 22 percent over the last twelve years, and the Malaysian population represents one percent of the levels recorded in the 1950s. The collapse of those nesting populations was precipitated by a tremendous over-harvest of eggs, direct harvest of adults, and incidental mortality from fishing. In the Atlantic and Caribbean, the largest nesting assemblages are found in the U.S. Virgin Islands, Puerto Rico, and Florida. Nesting data for these locations have been collected since the early 1980s and indicate that the annual number of nests is likely stable; however, information regarding the status of the entire leatherback population in the Atlantic is lacking. Nesting activity has also declined in French Guiana due to erosion of nesting beaches. The population appears to have shifted to Surinam, where annual numbers of nests rose from less than 100 in 1967 to 5,565 in 1977 and 9,816 in 1987. Current estimates are that 20,000 to 30,000 female leatherbacks exist worldwide.

Management and Protection

Habitat destruction, incidental catch in commercial fisheries, and the harvest of eggs and flesh are the greatest threats to the survival of the leatherback. Recovery plans are directed at all leatherbacks in the U.S. portion of Caribbean, Atlantic, and Gulf of Mexico waters, whether they are nesting within this area or elsewhere. Stranding data for the United States shores indicate that stranded turtles are adult or near adult size, suggesting that leatherback turtles utilize the United States' coastal waters for foraging as well as nesting (NMFS and USFWS 1992). Leatherbacks begin nesting in February or March; other sea turtles begin nesting in May. Leatherback strandings are highest (84 percent) from October to April. Beach patrols are in place in May in most areas; however, few strandings (16 percent) occur from May to September. Aerial surveys indicate the presence of leatherback turtles in the southeastern U.S. in the winter months (NMFS and USFWS 1992). The recovery plan for the leatherback sea turtle concludes that nesting trends in the United States appear stable, but that the population faces significant threats from incidental take as a result of commercial fishing and marine pollution.

4.4.5 Loggerhead Sea Turtle (*Caretta caretta*)

Status

The loggerhead sea turtle was listed as a threatened species in July 1978 (USFWS 1991) and has continued to decline in Louisiana (USFWS 1990).

Species and Habitat Description

Loggerheads are capable of living in a variety of environments, such as in brackish waters of coastal lagoons and river mouths. During the winter, they may remain dormant, buried in the mud at the bottom of sounds, bays, and estuaries. The major nesting beaches are located in the southeastern United States, primarily along the Atlantic coast of Florida, North Carolina, South Carolina, and Georgia. Only minor and solitary nesting has been recorded along the coasts of the Gulf of Mexico.

The largest of the hard-shell sea turtles, the loggerhead is distributed worldwide in temperate and tropical bays and open oceans. Loggerheads probably range all along the Louisiana coast; however, Dundee and Rossman (1989) reported specimens only from Chandeleur Sound, Barataria Bay, and Cameron Parish. The population decline of loggerheads can be attributed to egg and nestling predation by mammals and birds (Dundee and Rossman 1989).

Nesting on the Gulf Coast occurs between the months of April and August, with 90 percent of the nesting effort occurring on the south-central Gulf Coast of Florida (Hildebrand 1981). Although loggerheads have been documented as nesting on the Chandeleurs in 1962 and Grand Isle in the 1930s, it is doubtful whether this species currently successfully nests on the Louisiana coast (Hildebrand 1981; Dundee and Rossman 1989). The loggerhead's diet includes marine invertebrates such as mollusks, shrimp, crabs, sponges, jellyfish, squid, sea urchins, and basket stars (Caldwell et al. 1955; Hendrickson 1980; Nelson 1986). Landry (1986) suggested that these turtles may also feed on discarded by-catch from shrimp trawling. Adult loggerheads feed in waters less than 164 ft (50 m) deep, while the primary foraging areas for juveniles appears to be in estuaries and bays (Nelson 1986; Rabalais and Rabalais 1980).

Nesting in the U.S. accounts for about one third of the Federally listed threatened loggerhead worldwide population. Ninety-one percent of nesting occurs in Florida, particularly within the Archie Carr NWR; the remaining U.S. nesting includes 6.5 percent in South Carolina, 1.5 percent in Georgia, and 1 percent in North Carolina. Nests are constructed from May through September in the United States. According to Gosselink, Coleman, and Stewart (http://biology.usgs.gov/s+t/SNT/noframe/cg138.htm), the only loggerhead turtle nesting sites observed in Louisiana were on the Chandeleur Islands. Because of storm processes, the Chandeleur Islands may no longer contain high beach and dune surfaces, i.e., beach structure suitable for nesting. Recent surveys by USFWS Refuge personnel have found no loggerhead nests in the area (James Harris, Southeast Louisiana Refuges, personal communication).

Range and Population Dynamics

Loggerheads are circumglobal, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. In the Atlantic, the loggerhead turtle's range extends from Newfoundland to as far south as Argentina. During the summer, nesting occurs in the lower latitudes. The primary Atlantic nesting sites are along the east coast of Florida, with additional sites in Georgia, and the Carolinas; some nesting also occurs on the Gulf Coast of Florida. In the eastern Pacific, loggerheads are reported as far north as Alaska, and as far south as Chile. Occasional sightings are also reported from the coast of Washington, but most records are of juveniles off the coast of California. Southern Japan is the only known breeding area in the North Pacific (NMFS, http://www.nmfs.noaa.gov/prot_res/species/turtles/loggerhead.html).

Management and Protection

The Recovery Plan is currently being revised, but its recovery criteria for delisting loggerhead sea turtles in the U.S. population include: 1) return to pre-listing nesting levels for North Carolina, South Carolina, and Georgia, and 2) demonstration of an increase in the adult female population of Florida (NMFS and USFWS 1993). Nesting trends are stable in Florida, but appear to be declining in Georgia and South Carolina; current trends in North Carolina have not been identified. Recent aerial survey data indicate a current population of 14,150 adult females. Female turtles deposit a mean of 4.1 nests per year, which would be approximately 58,000 nests in the southeastern U.S. That figure is supported by aerial and ground surveys that estimated between 50,000 and 70,000 nests annually in the southeastern U.S. Increasing the hatch success will necessitate improvement of nesting habitat and minimizing mortality from commercial fisheries.

5.0 POTENTIAL EFFECTS OF THE PROPOSED ACTION

The potential exists that any of the endangered or threatened species listed may be present during proposed construction activities. However, while individuals may be affected, whole populations are not likely to be adversely affected by implementation of the proposed action.

5.1 FISH

5.1.1 Gulf Sturgeon

The Gulf Sturgeon in the Gulf of Mexico is primarily found between Tampa Bay Florida and the Mississippi River (Wooley 1985).Very few records exist for the Gulf sturgeon occurring west of the Mississippi River (Wooley 1985; Todd Slack, ERDC, personal communication 2010). There is no critical habitat located in the project area. The project is not likely to have an adverse effect on the Gulf Sturgeon due to its low probability of occurrence and lack of suitable habitat in the project area.

5.1.2 Pallid Sturgeon

While there are records of the pallid sturgeon occurring in the Atchafalaya River, there are none for the project area itself (Schramm 2008; Paul Hartfield, USFWS, personal communication 2010; Jack Kilgore, ERDC, personal communication 2010). The pallid sturgeon is a river species that rarely travels into the adjacent marshes where construction of project features would take place. Accordingly, the proposed activities are not likely to adversely affect the pallid sturgeon.

5.2 BIRDS

5.2.1 Piping Plover

It is possible that piping plovers may be found utilizing exposed sand, mud, or algal flats in the southern portions of the proposed project boundaries. However, piping plovers are more likely to be foraging and roosting on barrier island and barrier headland habitats located farther south of the project boundaries. The proposed project area would be located well north of any designated critical habitat units for the piping plover. Accordingly, the proposed activities are not likely to adversely affect the piping plover. (Ronald Paille, USFWS, personal communication 2010).

5.3 MAMMALS

5.3.1 West Indian Manatee

Sightings of the West Indian manatee in Louisiana have occurred in the Amite, Blind, Tchefuncte, Tickfaw, and Atchafalaya Rivers, MRGO, and in canals within the adjacent coastal marshes of Louisiana. However, there is no known population thriving in the State. Should any manatees be encountered during the proposed activities, an on-board observer would notify the proper personnel, and harmful activities (e.g., dredging) would be temporarily suspended until the animal(s) moves out of the area of operations. Any disturbance to the manatee would only be temporary during construction activities, and would result in temporary displacement. The manatees would likely move and relocate to other nearby areas for foraging or resting purposes. Because the West Indian manatee may occur in the project vicinity, the Contractor shall instruct all personnel associated with the project of the potential presence of manatees in the area, and the need to avoid collisions with these animals. All construction personnel shall be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. The Contractor shall be held responsible for any manatee harmed, harassed, or killed as a result of construction activities not conducted in accordance with these specifications.

a. Special Operating Conditions If Manatees Are Present in the Project Area
(1) If a manatee(s) is sighted within 100 yards (91 m) of the project area, all appropriate precautions shall be implemented by the Contractor to ensure protection of the manatee. These precautions shall include the operation of all moving equipment no closer than 50 ft (15.2 m) from a manatee. If a manatee is closer than 50 ft (15.2 m) to moving equipment or the project area, the equipment will be shut down and all construction activities will cease to ensure protection of the manatee. Construction activities will not resume until the manatee has departed and the 50-foot (15.2 m) buffer has been re-established.

(2) If a manatee(s) is sighted in the project area, all vessels associated with the project shall operate at "no wake/idle" speeds at all times while in waters where the draft of the vessel provides less than a four-foot (1.2 m) clearance from the bottom, and vessels will follow routes of deep water whenever possible. Boats used to transport personnel shall be shallow-draft vessels, preferably of the light-displacement category, where navigational safety permits.

(3) If siltation barriers are used, they will be made of material in which manatees cannot become entangled, are properly secured, and are regularly monitored to avoid manatee entrapment.

(4) Manatee Signs. Prior to commencement of construction, each vessel involved in construction activities shall display at the vessel control station or in a prominent location, visible to all employees operating the vessel, a temporary sign at least 8-1/2" x11" (21.6 x 27.9 cm) reading, "CAUTION: MANATEE HABITAT/IDLE SPEED IS REQUIRED IN CONSTRUCTION AREA." In the absence of a vessel, a temporary 3' x 4' (0.9 x 1.2 m) sign reading "CAUTION: MANATEE AREA" will be posted adjacent to the issued construction permit. A second temporary sign measuring 8-1/2" x 11" (21.6 x 27.9 cm) reading "CAUTION: MANATEE HABITAT. EQUIPMENT MUST BE SHUTDOWN IMMEDIATELY IF A MANATEE COMES WITHIN 50 FEET OF OPERATION" will be posted at the dredge operator control station and at a location prominently adjacent to the issued construction permit. The Contractor shall remove the signs upon completion of construction.

b. Manatee Sighting Reports
Any sightings of manatees, or collisions with a manatee, will be reported immediately to the Corps of Engineers. The point of contact within the CEMVN will be Edward Creef, (504) 862- 2521, FAX (504) 862-2317.

5.4 REPTILES

5.4.1 Green Sea Turtle

Due to the lack of extensive seagrass beds in coastal Louisiana and the low incidence of sightings and strandings, the proposed action is not likely to impact green sea turtle populations.

5.4.2 Hawksbill Sea Turtle

Due to its rarity along the Louisiana coast, the proposed action is not likely to impact hawksbill sea turtle populations.

5.4.3 Kemp's Ridley Sea Turtle

Kemp's Ridley sea turtles concentrate near the mouths of rivers and in areas of low salinity with high turbidity to forage for prey, including shrimp. Construction efforts would not occur in this immediate area. The proposed wetland nourishment features would provide more suitable inshore habitat (characterized by low salinity, and high turbidity and organic content, where shrimp and blue crabs are abundant) utilized by this species when foraging. Potential adverse project induced impacts are not likely to adversely affect Kemp's Ridley sea turtle populations.

5.4.4 Leatherback Sea Turtle

Leatherback sea turtles occur mostly in continental shelf waters more than 164 ft (50 m) in depth. There are no known nesting records for this species reported for Louisiana. Hence, the proposed action is not likely to adversely affect populations of leatherback sea turtles.

5.4.5 Loggerhead Sea Turtle

The population decline of the loggerhead sea turtle can be attributed to egg and nestling predation by mammals and birds. The only loggerhead sea turtle nesting sites historically observed in Louisiana were on the Chandeleur Islands. The proposed action would have no impacts on existing barrier habitats. Hence, the proposed action is not likely to adversely affect loggerhead sea turtle populations.

6.0 SUMMARY OF DETERMINATIONS

6.1 FISH

The Gulf sturgeon has only been recorded west of the Mississippi River on a few occasions (Todd Slack, ERDC, personal communication). The project is not likely to have an adverse effect on the Gulf sturgeon due to its low probability of occurrence and lack of suitable habitat in the project area.

Pallid sturgeon telemetry studies in the Atchafalaya River have not located the pallid sturgeon in the vicinity of the project area. The fish is a species that is usually confined to the river and would not be expected in the project area itself where any construction activities would take place. The proposed action is not likely to adversely affect the pallid sturgeon.

6.2 BIRDS

Potential impacts to piping plovers could be avoided by conducting proposed construction activities outside the wintering season. If any proposed projects cannot be scheduled to take place outside the wintering season, piping plovers would be able to avoid areas of temporary disturbance as long as there are feeding and/or roosting areas available along the coast. Because any plovers remaining in the action area during construction would be temporarily displaced to other suitable habitats in the vicinity, the proposed action is not likely to adversely affect the piping plover. There is no piping plover critical habitat in the project area and the project will not have any effect on piping plover critical habitat (Ronald Paille, USFWS, personal communication 2010).

6.3 MAMMALS

The West Indian manatee is known to occur periodically in the coastal waters of Louisiana. If a manatee were to stray into the project area, it may be attracted to noise from proposed construction activities. Consequently, an onboard observer would be present to alert the proper personnel, and harmful activities (e.g., dredging) would be temporarily suspended until the animal could move to safety. Should a manatee be sighted within any work areas, the USFWS's Lafayette, Louisiana, Field Office would be contacted immediately. Therefore, the proposed action is not likely to adversely affect the West Indian manatee.

6.4 REPTILES

The proposed action is not likely to adversely affect green, hawksbill, Kemp's ridley, leatherback, or loggerhead sea turtle populations. Most of those species are either rare along the Louisiana Gulf coast or feed in nearby waters.

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