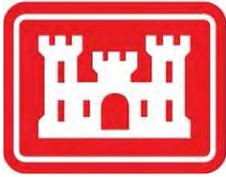


## **Appendix C-5**

**Fish and Wildlife Coordination Act –  
USFWS Planning Aid Letter,  
dated November 20,2017**



**U.S. Army Corps  
of Engineers**

**Galveston District  
Southwestern Division**

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## **Appendix C-5**

**Fish and Wildlife Coordination Act  
Supporting Documentation  
for the  
Coastal Texas Protection and Restoration Study  
Integrated Feasibility Report and  
Environmental Impact Statement**

**October 2018**

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**United States Department of the Interior**  
**FISH AND WILDLIFE SERVICE**  
Texas Coastal Ecological Services Field Office  
17629 El Camino Real, Suite 211  
Houston, Texas 77058  
281/286-8282 / (FAX) 281/488-5882



In Reply Refer To:  
FWS/R2/02ETT  
XX0-2016-CPA-  
0057

November 20, 2017

Colonel Lars Zetterstrom  
District Commander  
Attention: Janelle Stokes  
Galveston District, U.S. Army Corps of Engineers  
Post Office Box 1229  
Galveston, Texas 77553-1229

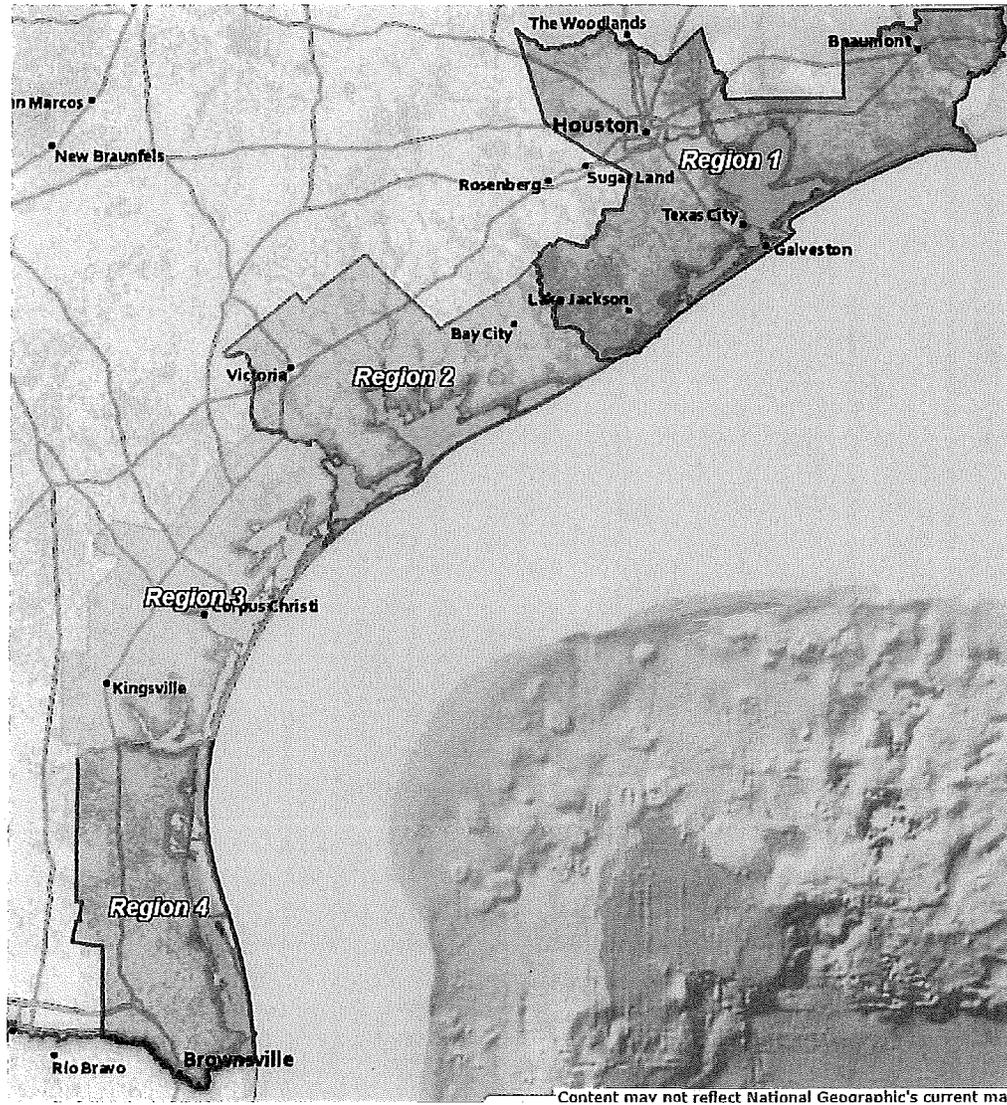
Dear Colonel Zetterstrom:

The U.S. Fish and Wildlife Service (Service) is collaborating with the U.S. Army Corps of Engineers (Corps) on the evaluation of the "Coastal Texas Storm Surge Protection and Restoration Study (Coastal Texas Study)". The study was authorized as part of the Water Resources Development Act of 2007 which directs the Corps to develop a comprehensive plan to determine the feasibility of carrying out projects for flood damage reduction, hurricane and storm damage reduction, and ecosystem restoration (ER) in the coastal areas of Texas. Further, the scope of the study provides for the protection, conservation, and restoration of wetlands, barrier islands, shorelines, and related lands and features that protect critical resources, habitat, and infrastructure from the impacts of coastal storms, hurricanes, erosion, and subsidence.

The purpose of this Planning Aid Letter (PAL) is to provide the Service's comments and recommendations regarding the Coastal Texas Study and identify planning constraints that have influence on the ability of the Service to fulfill our reporting responsibilities under Section 2(b) of the Fish and Wildlife Coordination Act (FWCA, 48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The PAL is prepared under the authority of the FWCA; however, it does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of the Act. Additionally, comments in this letter are provided under, the National Environmental Policy Act (NEPA) of 1969 (83 Stat. 852; 42 U.S.C. 4321 et seq.), the Endangered Species Act (Act) of 1973 and the Migratory Bird Treaty Act (MBTA) of 1918. The Service has provided copies of this letter to the National Marine Fisheries Service and the Texas Parks and Wildlife Department (TPWD); if any comments are received on this letter they will be forwarded under a separate cover letter.

As a result of the Corps compartmentalization of the Coastal Texas Study, only the ecological restoration portion of the study is addressed under this PAL and we expect to address storm surge reduction measures and associated impacts in a separate PAL as the information becomes available. Due to geographic span of the study, the Corps delineated the coast into four regions to be applied to both the ER and storm surge protection portions of the Coastal Texas Study (**Figure 1**) and will be utilized throughout both PALs.



**Figure 1** Coastal Texas Regions as delineated by the Corps

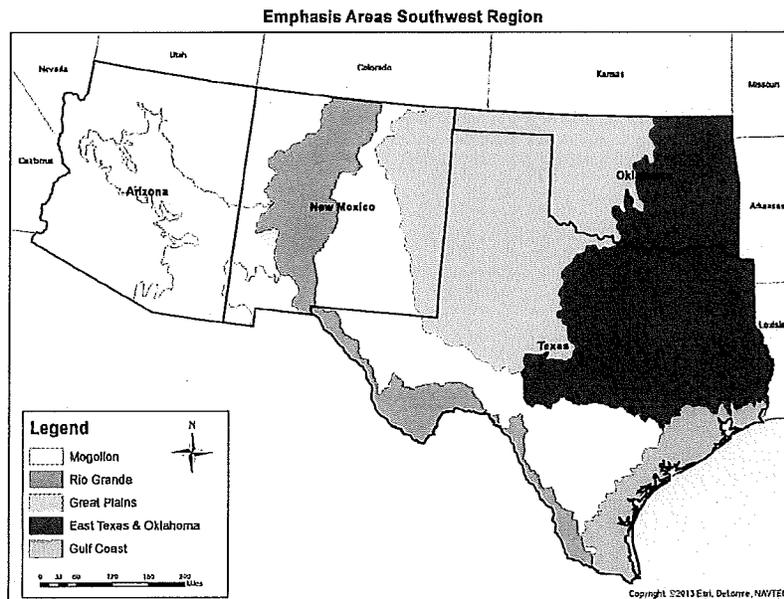
Source: Corps (2017)

Due to excessive delays by the Corps in processing a formal scope of work providing the Service the opportunity to formally comment under the FWCA, the Corps moved forward with a list of ecological restoration measures which mimic the Texas General Land Office's (TGLO) list of Coastal Resiliency Master Plan projects; a list compiled from ongoing Restore Council funding; and restoration measures from various other sources. Initial Service review of this project list revealed: previously completed projects; projects formerly vetted by the resource agencies and eliminated from further consideration;

inaccurate project descriptions; and projects not clearly defined as restoration. The Service recognizes that the TGLO is the Texas Coastal Study sponsor and there were time constraints imposed by the Corps Smart Planning Process. This may have resulted in the Corps not fully vetting these projects with the appropriate Service field offices and National Wildlife Refuges during the project scoping process.

The Service believes the Corps' identified restoration opportunities focused largely on protecting barrier islands and coastal and bay shorelines. While these are both important focal areas in light of concerns over sea level rise, the Service contends there is a critical need to restore and protect additional habitats not previously identified by the Corps' "project list" that should be included as part of the comprehensive ER plan. Adjacent areas such as coastal prairies, bottomland hardwood forests, and Tamaulipan thornscrub are rarities along the Texas coast providing habitat for a vast diversity of fish and wildlife species and were not addressed by the Corps. We have provided a summary of: key focal habitats; environmental concerns; possible study opportunities; the trust species that lie within the Coastal Texas Study's purview; and in some cases, current and future Service coordinated projects. While the coastal storm reduction measures are not addressed here, we believe the Corps should use this PAL to guide and identify measures aimed at avoiding impacts to: fish and wildlife; critical habitat areas; and actions that impede natural flows in the bays, bayous, rivers, and estuaries along the Texas coast.

The Service is dedicated to ensuring the protection and management not only of our federal trust resources (migratory birds, interjurisdictional fisheries, federally threatened and endangered species and public lands), but also for at-risk species and those of concern to our partners. As such, the Service established the Gulf Coast Emphasis Area and adopted a model to effectively establish long-term strategic conservation priorities aimed at creating the greatest return on our conservation investments. The Gulf Coast Emphasis Area (**Figure 2**) includes some of the most productive marsh and estuaries in North America. It encompasses near-coastal bottomland



**Figure 2** Service Emphasis Areas

hardwood forests and oak mottes, which are important to millions of migrating songbirds, shorebirds, wading birds and other wetland dependent species. The Service has a large conservation presence along the Texas Gulf Coast, roughly 450,000 acres that are either Service owned or managed for trust species

and to protect many of the most important wildlife habitats in Texas. We believe the Coastal Texas Study's comprehensive ecological restoration plan provides a unique opportunity to identify, protect, and restore degraded natural resources along the Texas coast to benefit future generations.

### **Fish and Wildlife Resources**

#### *Finfish and shellfish*

Close to 97 percent of all finfish and shellfish are dependent in some way on the coastal areas where fresh water from streams and rivers mix with salt water from the Gulf of Mexico creating food rich estuaries. Many species migrate into the estuaries to spawn, or use the estuaries for protection of young against predators with most fish and shellfish migrating back to the Gulf of Mexico as adults. Almost 85 percent of recreationally important fish species use coastal wetlands and estuarine habitats during at least one life stage. Marshlands adjacent to the bay systems tend to provide significant quantities of organic material which forms the base of the food chain in the estuaries.

Texas routinely accounts for almost a quarter of the red snapper *Lutjanus campechanus* harvested in the Gulf of Mexico, and one quarter of all domestic shrimp landed in the United States comes from Texas. In fact Texas Parks and Wildlife Department claims shrimp accounts for both 85 percent of landing and overall economic value of the Texas commercial fishing industry. In 2015, 52.6 million pounds of brown shrimp *Farfantepenaeus aztecus* and 16.6 million pounds of white shrimp *Litopenaeus setiferus* were landed with revenues of \$96.8 million and \$46.6 million respectively in Texas. Brown shrimp landing in Texas accounts for 49 percent of the total harvest in the Gulf of Mexico (Audubon Nature Institute, 2017).

Finfish are usually highly mobile therefore; any impacts to those species will be minimal and temporary. However, increases in suspended sediments and turbidity levels from dredging and disposal operations, could under certain conditions, result in adverse effects on marine animals and plants by reducing light penetration into the water column and by the actual physical disturbance. Likewise, shellfish can suffer from breathing problems associated with clogged and damaged feeding apparatus and young fish can have increased fatalities when sediments become trapped in their gills from heavily turbid waters (Wilbur & Clarke, 2001).

#### *Oyster Reef*

Where there is hard bottom in the bays, oysters typically grow as consolidated reefs providing important feeding and refuge habitat for well over 300 aquatic species. Oysters are filter-feeders, filtering up to six gallons of salt water per hour. They consume plankton helping to maintain good water quality in Texas bays and estuaries. Oysters support a valuable commercial fishery in Texas, with 22,760 acres of public reef and 2,321 acres of private reef available for harvesting. Texas A&M reports that Texas provides nearly 15 percent of the nation's total oyster harvest resulting in a \$50 million impact on the state's economy (Texas A&M University). Ninety percent of the public reefs utilized by commercial and recreational fisherman are found in Galveston, Matagorda and San Antonio Bays with Galveston Bay landings usually the highest. Galveston Bay's oyster reefs were hit particularly hard during Hurricane Ike in 2008 leaving many of the reefs buried in layers of sediment and debris ultimately smothering live oysters. This devastating event destroyed almost 60 percent of the oyster reef habitat in Galveston Bay, and 80 percent of the East Bay's oyster population. The oyster fishery was slow to bounce back from the devastation of Hurricane Ike. Extreme conditions of drought, algae, red tide, and extreme influxes of fresh water beginning in 2010 led Galveston County to declare a disaster declaration for the ailing oyster industry. Extreme rainfall events during the spring of 2015 and 2016 led to a catastrophic oyster die off in Galveston Bay resulting in 1.67 million pounds of oysters landed (half of the previous year's total landing). Local oyster industry officials suggest restoration of damaged oyster reefs may take \$20 to \$30

million (Houston Chronicle, 2015). Oyster reef restoration occurs throughout the Texas bay systems and can take several forms. Smaller “oyster gardening” projects are perfect to engage homeowners in active restoration efforts. However, the creation of larger artificially constructed reef pads is necessary to continue oyster reef growth in all of the Texas bay systems.

#### Recommendations

The Service recognizes the significant contribution of oysters to the aquatic ecosystems, supports the creation of oyster reef habitat throughout Texas bay systems, and is willing to assist with restoration site identification in conjunction with the other federal, state, and local natural resource agencies. Any oyster restoration or creation should be conducted within publicly harvestable or restricted or closed areas and not subject to lease by TPWD or others. Success criteria for created and restored sites should be coordinated with TPWD and harvest limited to sustainable levels.

#### *Migratory Birds*

##### *Piping Plover*

Listed as threatened and endangered species under the Act in 1986, the piping plover is a small stocky shorebird approximately 7 inches in length with a wingspan of about 15 inches (Palmer, 1967, Service, 2009). Plumage and descriptive characteristics include a pale back, nape, and crown, white under parts, a stubby bill, and orange legs and during the breeding season, the legs and bill are bright orange, the bill has a black tip, and a single black breast band and forehead bar are present. In winter, its legs become pale orange, its bill turns black, and the darker bands and bars are lost (Wilcox, 1959, Service 2009). The historic range of the piping plover has traditionally been divided into breeding and wintering ranges. The breeding range encompasses the northern Great Plains and Prairies, the Great Lakes, and the North Atlantic ecoregions of the United States and Canada while the wintering range extends along coastal areas of the U.S. from North Carolina to Texas and portions of Mexico and the Caribbean (Service, 2009). The species current range remains similar to its historic range except that piping plovers have been extirpated from several Great Lakes breeding areas (Service 2003).

On their migration and wintering range, piping plovers forage and roost among a mosaic of beach and bay habitats and move locally (within a home range) among these habitats in response to a variety of factors including tidal stage, weather conditions, human disturbance, and prey abundance (Drake, 2001, Cohen et al., 2008, Noe and Chandler 2008). Foraging habitats include bayside flats and islands, the intertidal zone of ocean beaches, wrack microhabitats, washover passes (channel cuts created by storm driven water), and shorelines of ephemeral ponds, lagoons, and salt marshes. Roosting habitats include back-beach areas, dunes, wrack microhabitats, inlets, and river mouths as roosting habitats (Arvin, 2009, Service, 2009).

Approximately 35 percent of the known global population of piping plovers winters along the Texas Gulf Coast, where they spend 60 to 70 percent of the year (Haig & Elliott-Smith, 2004). Piping plovers are a common migrant and rare to uncommon winter resident on the upper Texas coast most likely due to habitat conditions (Lockwood, 2004). Plovers on the wintering grounds suggest that they show some site fidelity, returning to the same stretch of beach year after year. On the lower Texas coast, piping plovers are known to use areas about 3,000 acres in size, moving two miles or more between foraging sites as tidal movements shift the availability of productive tidal flats.

##### *Red knot*

The red knot *Calidris cantus rufa* is considered a threatened species under the Act and generally flies more than 9,300 miles from south to north every spring and fall without stopping, making this species one of the longest-distance migrants in the animal kingdom (Morrison, Ross, & Niles, 2004). Breeding takes

place in the Canadian Arctic with arrival beginning in late May or early June varying with snowmelt conditions. Most adult and juvenile red knots leave the breeding grounds in late July however some remain as late as mid-August. Red knots occupy all wintering areas as early as September and as late as May in Texas. In addition, the birds are found in coastal bays, estuaries, and inlets returning to the same wintering ground yearly. Declines in the red knot population occurred in the 2000s primarily from reduced food availability from increased harvest of horseshoe crabs in Delaware Bay (the main stop over point for red knots). While red knot numbers may have stabilized some in the past few years, their numbers remain at low levels relative to earlier decades and warranted federal protection on January 12, 2015.

#### *Whooping crane*

The endangered whooping crane *Grus Americana*, with less than 600 birds in the wild, winters along the marshes of the central Texas coast and feeds on aquatic invertebrates such as insects, blue crabs, small vertebrate fish, amphibians, birds, mammals, and plants commonly found in freshwater to brackish marsh regimes and coastal prairies. A portion of the original wild flock (defined as always living in natural circumstances) winters at the Aransas National Wildlife Refuge September through April each year and then migrates north to breed at Wood Buffalo National Park in Canada. With occasional use of upper Texas coastal marsh habitat, a non-essential experimental population of 59 whooping cranes is yearlong residents of the marsh and rice fields of southwest Louisiana. Across the Texas coast, the primary threat to whooping cranes remains habitat loss; however, adequate food supplies are critical to whooping cranes. Lack of freshwater inflows can create saline conditions not favorable for key forage species and can threaten whooping crane overwinter and migration success. Migration flights to and from the breeding grounds are not direct or non-stop and stop overs are required for rest and refueling. Healthy wetlands (of all types) on the wintering grounds and along the migratory route continue to play an integral part into the whooping crane's survival and should be preserved. Due to the location of potential restoration project within coastal salt marsh, there is the potential for occurrences of the federally listed endangered whooping crane along the upper and mid Texas coast where they are known to utilize similar salt marshes outside of the historic wintering grounds.

#### *Colonial Waterbirds*

Colonial waterbirds are birds that gather in large groups called rookeries or colonies during the nesting season and they obtain all or most of their food from the water. While many species of colonial waterbirds appear to have incredibly large populations, they face many threats such as oil pollution associated with increased tanker traffic and spills, direct mortality from entanglement and drowning in commercial fishing gear, depletion of forage fish due to overexploitation by commercial fisheries, habitat limitations, and the presence of predators at nesting sites. Texas islands host nesting colonies for most North America seabirds as well as many of the last populations of endemic landbird species.

Comprehensive restoration of priority islands for breeding birds is needed as many islands are still overrun by invasive species. The Service identified 18 historic colonial waterbird colonies within the project area. These islands or sites are no longer suitable due to: the presence of invasive predator species; overgrown vegetation; lack of open ground nesting habitat; erosion or subsidence; and no longer have appropriate elevations to support nesting birds, or the lack of available forage sites in close proximity to nesting habitat. The Texas Colonial Waterbird Society (TCWBS) recognizes over 500 active and historic colony and sub colony sites within the study area. Since 1978, the TCWBS annually surveys 23 colonial waterbird species to identify population trends and make management recommendations to our partners along the coast. Recent trends (2000 through 2014) indicate a decline for many of the surveyed species which may be attributed to predator presence (including humans) and habitat erosion or conversion. The once endangered brown pelican *Pelecanus occidentalis*, considered a

major conservation success story, was delisted in 2009 in large part to intensive rookery management and island creation in Texas promoting optimal breeding and foraging habitats.

The construction of bird islands using new work dredged material is well documented, but it was not until the 1970s that the importance of this dredged material to nesting waterbirds was realized (Golder, Allen, Cameron, & Wilder, 2008). Dredge spoil islands created out of local sand and clays provide immediate nesting opportunities for bare ground nesters such as terns and skimmers. Successional vegetation including mangroves, baccharis, and other shrub species provide suitable nesting habitat for three species of egrets, five species of herons, white ibis *Eudocimus albus*, and rosette spoonbills *Platalea ajaja*. This and subsequent projects could positively contribute to the colonial waterbird populations across the Gulf of Mexico.

#### *Waterfowl*

Most waterfowl depend upon wetlands for some or all stages of their lifecycles. The mottled duck *Angus fulvigula*, a medium sized dabbling and non-migratory duck, is the only duck species adapted to breed in the southern wet coastal prairies and marshes of the Texas gulf coast. Not federally listed under the Act, but a focal species for the Service and many others, mottled ducks spend their entire life on the coastal prairie and adjacent marshes relying on the availability of coastal marsh for its existence (Merendino et al, 2005). Once abundant along the Texas coast, the mottled duck is primarily found along preserved and development free areas with highest densities often observed in fresh and intermediate coastal marshes of the Texas Chenier Plain and moderate densities found in the coastal marshes of the Texas Mid-Coast. Most common habitats include fresh to brackish coastal marsh ponds, emergent freshwater wetlands, and flooded rice fields of the prairie. In south Texas, mottled ducks are frequently found in resacas of the Rio Grande Valley and freshwater ponds associated with coastal grasslands. Mottled duck populations have declined over the years mostly attributing to the loss of suitable nesting and brood-rearing habitat (Krainyk & Ballard, 2015) which include grasslands and palustrine and estuarine wetlands.

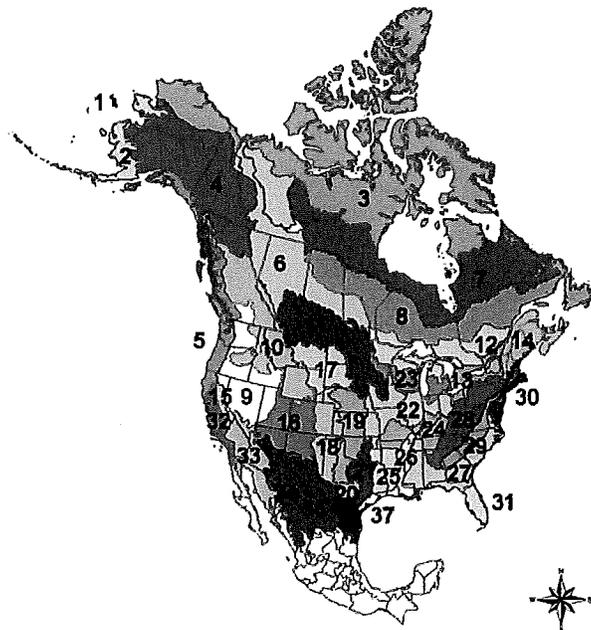
Although the amount of Gulf coastal prairie is small, it provides wintering habitat for large concentrations of waterfowl: 95 percent of gadwall, 90 percent of mottled duck, 80 percent of green-winged teal, 80 percent of redheads, 60 percent of lesser scaup, 25 percent of pintails, and mid-continent lesser snow and white-fronted geese (Ducks Unlimited). Additionally, coastal prairie provides migration habitat for most of the blue-winged teal that winter in Central and South America. With such large waterfowl populations migrating through or wintering in coastal Texas, federal and state partners have set aside land specifically aimed to conserve wetlands and coastal prairies for the benefit of waterfowl.

#### *Other Migrating Birds*

The Service published the *Birds of Conservation Concern 2008* (BCC) in December 2008 as a result of the 1988 amendment to the FWCA that mandates the Service to identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Act. The BCC is divided into Bird Conservation Regions (BCR). Within the Coastal Texas Study area lies BCRs 36, Tamaulipan Bushlands and 37 Gulf Coastal Prairie U.S. portion only (**Figure 3**) with a full species lists included as an appendix. We expect many of the species identified in BCR 37 will be present within the Texas Coastal Study footprint.

Marsh, bird islands, and placement areas created by large scale Corps projects all are suitable habitat for resident and migratory birds to forage, nest, and may play a critical life cycle role as other coastal habitats erode and become less suitable. The recent State of North America's Birds 2016 (North American Bird Conservation Initiative, 2016) identifies seabirds as declining. This guild continues to be severely threatened by invasive predators on nesting islands, accidental bycatch by commercial fishing vessels, as

well as overfishing of forage fish stocks, pollution, and climate change. By adopting broad best management practices such as the continued building of bird islands, managing invasive species and vegetation on existing islands and placement areas, the Corps will help to ensure the growth of colonial waterbird populations and shorebirds along the Texas mid coast and at the broader Gulf of Mexico level for years to come.



**Figure 3** Birds of Conservation Concern Region Map

Most Texas birds are not year-round residents and are considered to be seasonal residents or migrants. The Texas mid coast is critically important habitat for migrating birds due to their use of uplands, wetlands, beaches and marshes as feeding, resting and nesting sites. The Matagorda Bay area is located within the path of the Central flyway. In existence today, there are 338 Neotropical North American species, 333 have been documented in Texas (Haggerty & Meuth, 2015). The coastal and bay shorelines provide stop over and fall-out habitat for many neotropical birds migrating across the Gulf of Mexico to their summer grounds in the northern United States and Canada. These weary and energy-drained birds seek wooded areas to feed and recharge before taking flight again. Various species of hawks and raptors are found in the project area throughout the year, however most are migrants and are found primarily during the winter months. Eagles, owls, and hawks are resident and are common on the landscape.

As of December 2013, the Service documents 1,026 avian species protected under the Migratory Bird Treaty Act of 1918. The Act makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nest, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations. While the purpose of the PAL is to identify key focal habitats within the study area and pinpoint means to minimize impacts to trust resources if alternatives are presented, we recommend the Corps evaluate each ER and coastal storm surge reduction study measures for negative impacts to resident and migratory bird species, specifically those that are listed on the BCC and the North American Bird Conservation Initiative. We recommend the use of the Service's Nationwide Standard Conservation Measures as guidance to reducing

impacts to birds and their habitats. The guidelines can be accessed at <https://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures/nationwide-standard-conservation-measures.php>.

#### *Sea turtles*

The Service and NOAA share joint jurisdiction over five species of sea turtles found in U.S. waters and nesting on U.S. beaches: leatherback, hawksbill, loggerhead, green and Kemp's ridley. NOAA retains jurisdiction when sea turtles are in a marine environment and the Service picks up jurisdiction when sea turtles emerge to nest. The leatherback, hawksbill and green sea turtles rarely nest in the southeastern U.S., but offshore waters are important feeding, resting, and migratory corridors. Texas sea turtle nesting season occurs from March 15 to October 1 with the Kemp's ridley, green, and loggerhead sea turtles known to nest along the Texas coast. Kemp's ridley sea turtles nest bi-annually with most nesting occurring along the Tamaulipan coast of Mexico. However, during the 2017 nesting season, Kemp's ridley sea turtles laid a record setting 352 nests along the Texas coast (Shaver, 2017). These turtles return to their natal beaches to nest and can lay more than one clutch in a season. Should the Corps determine that beach nourishment or shoreline protection are viable options under this study, the Service recommends the Corps evaluate these actions for specific impacts to nesting sea turtles under Section 7 of the Act. Similarly, impacts to sea turtles in the marine environment should be evaluated and coordination with NOAA's Protected Resource Division Permitting Office at 877-376-4877.

#### *Threatened and Endangered Species Consultation*

The Service recommends the Corps conduct a review for threatened and endangered species two years prior to construction. In order to obtain information regarding fish and wildlife resources concerning a specific project or project area, we recommend that the Corps first utilize the Service developed Information, Planning, and Conservation (IPaC) System. The IPaC system provides information about natural resources the Service has responsibility for and assists project proponents in planning their activities within the context of natural resource conservation. Additionally the system can assist people through the various regulatory consultation, permitting and approval processes administered by the Service, achieving more effective and efficient results for both the project proponents and natural resources. The IPaC system can be found at: <http://ecos.fws.gov/ipac/>.

#### *Critical Habitat*

Critical habitat is the specific areas occupied by the species at the time it was listed that contain the physical or biological features essential to the conservation of endangered and threatened species. Critical habitat may also include areas not occupied by the species at the time of listing but are essential to its conservation. The Act requires Federal agencies to use their authorities to conserve endangered and threatened species and to consult with the USFWS about actions that they carry out, fund, or authorize to ensure that they will not destroy or adversely modify critical habitat. The prohibition against destruction and adverse modification of critical habitat protects such areas in the interest of conservation.

We have reviewed our files and determined that critical habitat for the federally endangered piping plover and whooping crane lie within the study area boundaries and are outlined in yellow in **Figures 4, 5, 6 and 7**. Further analysis for specific habitat units impacted by this study should be conducted and we also recommend coordination pursuant to the "Act" with the Service's Texas Coastal Ecological Services Office prior to the commencement of any restoration activities.

Critical habitat was designated for all wintering piping plovers on July 10, 2001 (66 FR 36038). This designation aimed to provide sufficient wintering habitat to support the piping plover at the population level and geographic distribution necessary for recovery of the species. This designation included

142 conservation units along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. A total of approximately 165,211 acres or 1,798 miles were designated. There were 37 critical habitat units (approximately 62,454 acres, 797 miles) designated in Texas (**Figures 4, 5, and 7**). These areas were believed to contain the essential physical and biological elements for the conservation of wintering piping plovers, and the physical features necessary for maintaining the natural processes that provide appropriate foraging, roosting, and sheltering habitat components.

Critical habitat for the endangered whooping crane was finalized in 1978 and occurs on the Aransas National Wildlife Refuge as depicted in **Figure 6** and includes salt marshes and tidal flats on the mainland and barrier islands, dominated by salt grass *Distichlis spicata*, saltwort *Kali turgida*, smooth cordgrass *Spartina alterniflora*, glassworts *Salicornia* spp. and sea ox-eye daisy *Borrichia frutescens*. The cranes occasionally fly to upland sites when attracted by fresh water or foods such as acorns, snails, crayfish and insects, and then return to the marsh to roost. Uplands are particularly attractive to the cranes when partially flooded by rainfall, burned to reduce plant cover or when food is less available in the salt flats and marshes.

At this time there is no critical habitat designation for the red knot; however, the Corps should analyze effects of the project for all threatened and endangered species pursuant to Section 7 of the Act prior to the commencement of any construction. The Service's Critical Habitat Mapper provides information regarding threatened and endangered species critical habitat designation that may be of use during project design and evaluation and is found at <https://ecos.fws.gov/ecp/report/table/critical-habitat.html>?

#### *Essential Fish Habitat*

Estuarine wetlands and associated shallow waters within the project area have been identified as Essential Fish Habitat (EFH) for post larval, juvenile and sub-adult stages of brown shrimp *Crangon crangon*, white shrimp *Litopenaeus setiferus*, and red drum *Sciaenops ocellatus*. EFH requirements vary depending upon the species and life stage with categories within the project area including estuarine emergent wetlands, estuarine water column, submerged aquatic vegetation, and estuarine water bottoms. Detailed information on federally managed fisheries and their EFH is provided in the 2005 generic amendment of the Fishery Management Plans for the Gulf of Mexico, prepared by the Gulf of Mexico.

Fishery Management Council (GMFMC) and can be found at <http://gulfcouncil.org/fishery-management/>. That generic amendment was prepared in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), (P.L. 104-297).

We recommend the Corps initiate consultation with National Marine Fisheries Services, Southeast Regional Office, Habitat Conservation in Galveston, Texas at 409-766-3699 to determine specific impacts to EFH as a result of the proposed ecological restoration measures of the Texas Coastal Study.

#### **Bird Island Creation**

Since 1973, the Service along with other federal, state, local non-governmental agencies and private citizens monitored several hundred coastal colonial waterbird sites along the Texas coast. While some islands are natural, most are man-made and are the result of nearby dredging activities. The creation of man-made islands usually occurs in waters adjacent to a shipping channel, cut, or pass and thereby may be subject to increased rates of erosion. In general, spoil islands provide suitable bare ground nesting habitat and subsequent vegetation succession can create shrub and tree habitat for other colonial nesters.



Figure 4 Upper Texas Coast Critical Habitat (piping plover)



Figure 5 Mid Coast Critical Habitat (piping plover)

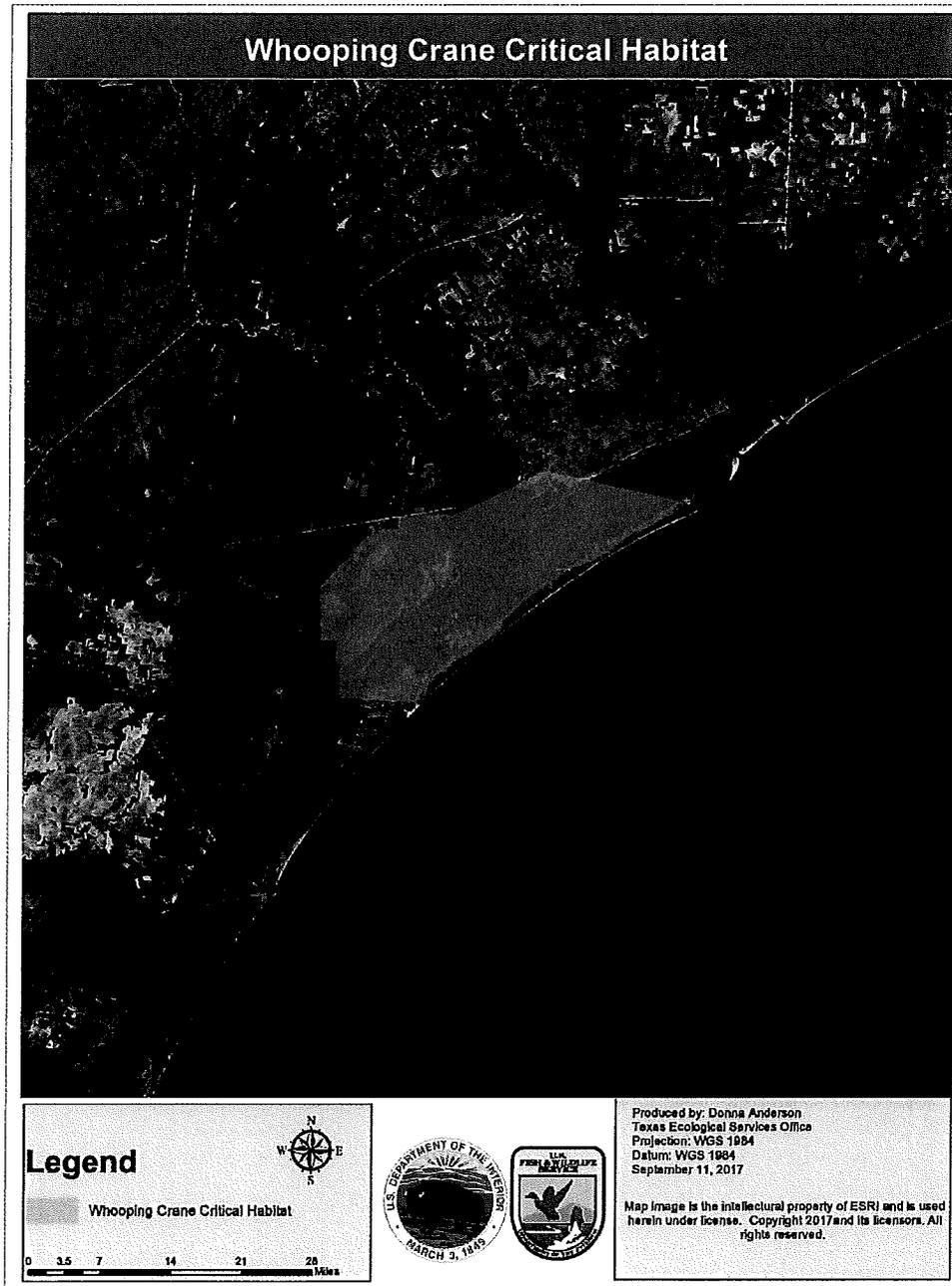
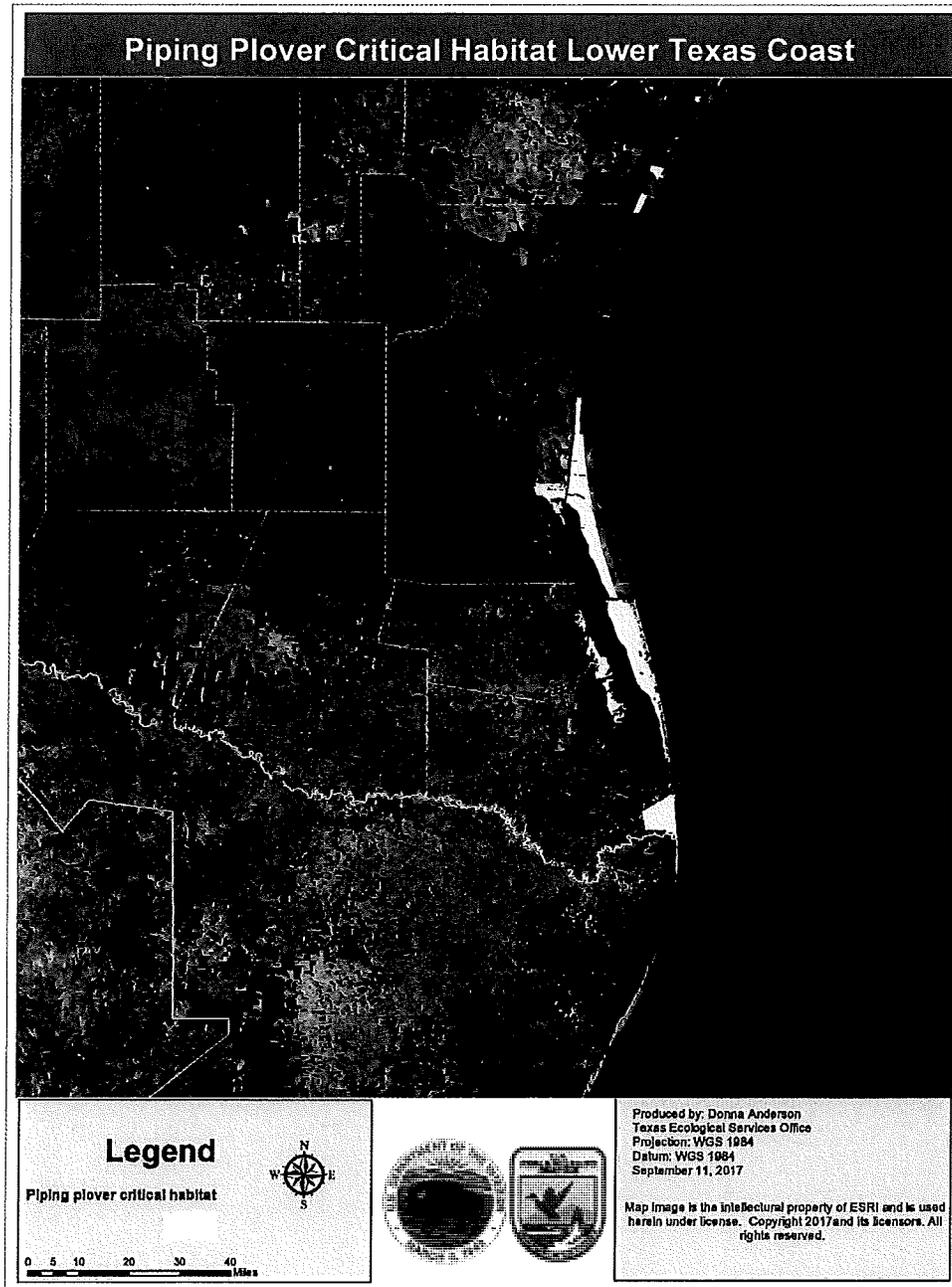


Figure 6 Mid Coast Critical Habitat cont'd (whooping crane)



**Figure 7** Lower Coast Critical Habitat (piping plover)

The importance of coastal rookeries to bay ecosystems is well documented in terms of fisheries, recreational opportunities, and photography. Audubon Texas (2016) conducted studies to quantify erosion along Texas rookery islands and project future land loss. Fourteen islands were rated as the highest priority in need of protection and eight of those islands are predicted to experience a complete land loss within 50 years. Audubon Texas (2017) authored a comprehensive Texas Coastal Rookery Conservation Plan (Plan) that identified all current and historical colonial waterbird islands as well as birds commonly found breeding at each site. Additionally it identified management needs and challenges for each island. Many coastal rookery islands face erosion issues as a result of increased storm frequency and intensity, sea level rise, and wave fetch caused by increased size and number of commercial and recreational vessel traffic.

Some Texas bay systems appear to be more resilient in terms of bird nesting which may be associated with frequency of dredge events and placement options. Sabine Lake had four active rookery sites however; predator presence, subsidence, and erosion have eliminated all nesting sites as of 2013. Maintenance dredge material from the Sabine Neches Water Way is either placed in upland confinement or pumped offshore and new work material necessary for island creation is seldom available.

The Galveston Bay rookeries experience high rates of erosion and predator presence at most nesting sites. Many sites are Corps dredge spoil islands that are not maintained or managed and are located adjacent to the mainland or near to the Houston Ship Channel. While dredging frequency and material are plentiful, placement of additional dredge material at Galveston Bay rookeries remains a challenging due to limited pumping distances and costs. Jigsaw, Rollover Pass, Struvey Lucy, Marker 52, Vingt-et-un, and Smith Point islands all experience some level of erosion, most likely from increased wind fetch and wave energy, and would benefit from added dredge material and rock protection measures.

Like the Sabine Bay system, Matagorda Bay and the smaller feeder bay systems have few islands suitable for colonial nesters. Chester Island (Matagorda Bay) and Lavaca Bay Spoil (63-77) (Lavaca Bay) line the Matagorda Ship Channel, are both eroding dredge spoil islands, and provide the only nesting habitat for most of the Matagorda Bay systems. The Mouth of Chocolate Bayou, Lavaca Bay Spoils (51-63), Point Comfort-AICOA, Mouth of Lavaca River, and Matagorda Bay Spoils (39-51), Coon Island sites lack sufficient elevation to support nesting birds and most likely contribute to the declines in nesting bird populations along this portion of the coast during the late 1990s and early 2000s. Increasing nesting opportunities by creating islands strategically placed in Matagorda Bay system may be an alternative to armoring the existing two islands. Designing islands with a suite of habitats to provide nesting and foraging opportunities will attract the greatest diversity of colonial nesters.

The Laguna Madre is a critically important area for natural resources supporting a rich diversity of birds throughout the year. Historically, the Laguna Madre supported 42 colonial waterbird islands; mainly constructed during the original dredging of the Gulf Intercoastal Water Way (GIWW). However, many of these constructed sites (like other Texas bay systems) now lack suitable elevations to support colonial nesters. The Texas Colonial Waterbird Society (2017) reported a declining trend for colonial waterbird populations where habitat availability and predator presence may be limiting factors. While some of these islands receive periodic dredge maintenance material, others have not. Many islands have and continue to erode warranting additional protection measures.

#### *Recommendations*

The Service recommends the Corps evaluate bird rookery island design, construction, and restoration opportunities along the entire Texas coast in conjunction with the other federal, state, local resource agencies, and local partners, due to the decline in available nesting habitat in all the major bay systems.

We believe this evaluation will demonstrate the need for both the restoration of the historic islands and the construction of new nesting island or suite of islands. Island design should strongly consider proximity to mainland, sea level rise, erosive forces if placed in high wave energy environments, and should contain habitat suitable for a variety of guilds. In addition, as a study opportunity, the Service recommends research funding be dedicated to identifying colonial waterbird foraging habitats, optimum island capacity, migratory patterns of focal colonial waterbird species, optimal elevation for colony islands, and analysis of preferred island locations and marginal habitat sites. We believe these studies will yield valuable data and would be used to guide site selection, island design, and construction methods. The Study's Comprehensive Plan should also capture migratory bird research needs such as understanding beach recolonization of benthic communities, understanding avian movement in and within adjacent habitats, and optimal foraging distances from nesting areas.

Close coordination with natural resource agencies, academia, and NGOs with expertise in nesting colonial waterbirds and island design is highly recommended to further develop research needs.

### **Beach Nourishment and Dune Restoration**

Beach nourishment is a process that occurs regularly along the Texas Coast and utilizes sand from various sources, either onshore or offshore, to replace sand from beaches suffering erosion. Beach nourishment is often proposed as an alternate to other hard structure alternatives such as seawalls and usually requires an ongoing commitment of public funding. Texas shorelines typically advance or retreat depending on the actions of waves, currents, tides, and availability of sediment in the littoral system. The availability of sediment is hampered largely by natural and anthropogenic means such as increased frequency of hurricane level events, recurring dredging activities, and the presences of jetties, dykes, and groins. Most sediment is either permanently removed from the system or transported far enough offshore that smaller waves are unable to carry the material back to the beach resulting in sand starved beaches. Changes in shoreline location are of enormous importance to Texas residents, industry, local governments, and can result in millions of lost tourist revenue, damages to homes, commercial and industrial businesses, infrastructure (roads, bridges, power lines etc.), and pipelines. These natural and anthropogenic changes generally negatively impact shoreline ecosystems, wildlife, and human recreation activities.

Increased intensity and frequency of natural coastal processes (hurricane and storm events) can reduce the efficiency of dune ecosystems along the Texas coast resulting in severe shoreline and dune degradation. In some coastal areas, overtopping during storm events compromise dune structures, alter ingress and egress flows of historically fresh marsh areas, and can result in the conversion to open water habitat displacing fish and wildlife. The reduction and loss of shoreline habitat can be directly correlated with the status of seven federally threatened and endangered species. With the creation of dunes and forebeach, we expect suitable habitat will be provided for threatened and endangered species such as the piping plover, red knot, nesting Kemp's Ridley, loggerhead, and green sea turtles, hawksbill sea turtles, and the leatherback sea turtle. Historic use of Texas beaches for these species is well documented; however, current habitat conditions may not be favorable (limited sand and dune availability) along some portions of the coast resulting in avoidance or diminished use.

Much of the Texas coast remains severely eroded by hurricane events, sea level rise, regular high tides, and reduced sediment supplies resulting in the loss of dunes and coastal shorelines. Beach nourishment projects provide protection of forebeach, back dune wetlands, and create additional nesting, resting, and foraging opportunities for listed and non-listed migratory shorebirds, sea turtles, and fish species of commercial and recreational importance.

### *Recommendations*

Generally, the Service supports the overall concept of beach renourishment, dune creation, and debris removal along the entire Texas coast. However, the Service recommends the Corps assess and identify the causes for site specific shoreline erosion and provide long term solutions for shoreline stabilization. The Service recommends the Corps work in coordination with local, state and federal resource agencies to identify beach habitat in immediate need of restoration and develop a schedule for recurring renourishment (based on engineering, monitoring, and adaptive management) events in lieu of one-time placement opportunities. We suggest the Corps adopt long term perpetual funding mechanisms for beach nourishment aimed at ensuring future ecosystem benefits to trust resources. The selection of suitable sediment sources is critical and must be dependent upon consistent grain size, color, and mineralogy, is the same quality as the existing beach sediments, and does not contain toxic materials. Beach and dunes should shall be designed and constructed to complement existing conditions or if necessary, constructed to meet historic elevations where the system was once resilient. All beach nourishment projects should include monitoring efforts specific to benthic organisms aimed at assessing impacts or benefits to threatened and endangered species that utilize beach habitat. The Corps should coordinate with state and federal natural resource agencies for site specific beach nourishment recommendations prior to conducting nourishment activities.

### **Gulf Coastal Prairies**

Native grasslands and prairies, with their ecologically complex plant and animal communities, were important components of the landscape of early Texas. The Texas coast was once home to 6.5 million acres of extensive coastal prairies interspersed with a maze of marshes that serve as wildlife nursery and refuge for many wildlife species. Some estimate less than 1 percent of the coastal prairie ecosystem remains in relatively pristine condition and many migratory and grassland bird species utilize coastal prairie habitat for portions of their life cycle. Plants once thought common within coastal prairie habitat have disappeared due to conversion to agriculture, urban sprawl, residential and commercial development, as well as numerous transportation systems. Gulf coastal prairie is a relatively flat and treeless region with rich productive soils suitable for rice production and cattle grazing increases water infiltration and water yield, increases water supply by reducing erosion and reservoir sedimentation, and increases water quality due to the lack of fertilizer, pesticide, and herbicide use. Prairie provide rare native habitat for birds, butterflies, insects, reptile, and other small wildlife and usually are composed of plants seldom found in other habitats. Many tall grass prairie bird populations such as the federally listed Atwater's prairie chicken *Tympanuchus cupido attwateri*, whooping crane, aplomado falcon *Falco femoralis*, and state listed white-tailed hawk *Geranoaetus albicaudatus* were once common on the prairie landscape but are now in decline due to current land practices such as conversion to agriculture, commercial and residential development, and oil and gas exploration. The resulting landscape is fragmented, degraded, and fraught with invasive species.

Historically, once one of the most abundant resident birds of Texas and Louisiana tall grass prairie ecosystems, the critically endangered Atwater's prairie chicken remain on the coastal prairie with only two wild populations (a total of 52 males were counted as part of the annual census). Presently, less than 200,000 fragmented acres of coastal prairie persist, leaving the birds scattered among two Texas counties. The Service's Attwater's Prairie Chicken National Wildlife Refuge is managed specifically for Attwater's prairie chicken; however, recovery activities stretch far beyond the refuge's boundaries. Pressure from coastal development, habitat fragmentation, climate change, predators, and the prolific spread of fire ants negatively affects this imperiled bird. Captive zoo and federal facility rearing programs located across the state show some promise and the Service continues to diligently work with partners to recover this species and acquire coastal prairie habitat.

The endangered aplomado falcon is a medium sized raptor 15 to 18 inches in length, a wingspan of 32 to 36 inches, and is a permanent resident in Texas. Unfortunately, aplomado falcon's numbers were reduced to zero in the United States during the 1930s with small numbers scattered throughout Mexico. Sound recovery efforts along with habitat management strategies allowed the aplomado falcon to become a permanent resident on south Texas coastal prairies, savannahs, marshes and tidal flats, and open grasslands with scattered trees. Release of captive reared birds into the wild and the installation of nest boxes have increased nesting success in South Texas resulting in a stable to increasing population at the present.

#### *Recommendations*

The Corps does not readily recognize this habitat type as one to be included within the purview of this study. The Service disagrees and recommends full consideration for the preservation, restoration, and acquisition of remaining coastal prairie habitats benefiting nationally recognized and recreationally important wildlife species. Prairies, in general, provide excellent stopover resting and feeding habitat for migratory birds. Supporting coastal prairie and grasslands through large scale preservation and restoration will sustain threatened grassland birds and wildlife species while improving watershed quality. The Service can work with the Corps to identify parcels for permanent conservation status aimed at reducing landscape fragmentation and enhancing current restoration efforts.

#### **Bottomland Hardwood Forests**

Hardwood bottomland forests are some of the most widely distributed, biologically diverse, and productive of tree-dominated communities throughout southern regions of North America (Rosiere, Nelson, & Cowley, 2013). Bottomland hardwood forests, spanning over one million acres, are one of the most biologically productive ecosystems along the Texas Gulf Coast from Mexico to Louisiana. These riverine forested habitats play a significant role in the migration of millions of birds across Texas while maintaining river water quality, controlling sediments, and filtering pollutants (Kellison & Young, 1997). Further, these forests increase the quantity and quality of groundwater recharge, retard flood flows, and minimize erosion by providing dense root systems to bind soil material. More than 85 percent of the historical bottomland hardwood forests in Texas were lost (Texas Conservation Alliance) to development.

Bottomland hardwood forests occur within the floodplains of rivers and streams that cross the middle and upper coastal plains in Texas. The Sabine, Neches, Trinity, and Brazos Rivers have broad floodplains that support extensive forested wetlands. Most upper coast bottomland hardwood forests are dominated by willow oak *Quercus phellos*, water oak *Quercus nigra*, overcup oak *Quercus lyrata*, cherry bark oak *Quercus pagoda*, laurel oak *Quercus laurifolia*, green ash *Fraxinus pennsylvanica*, red maple *Acer rubrum*, black willow *Salix nigra*, and water tupelo *Nyssa aquatica*. The mid-coast forests typically exhibit pecan *Carya illinoensis*, water hickory *Carya aquatica*, American elm *Ulmus americana*, cedar elm *Ulmus crassifolia*, water oak, live oak *Quercus virginiana*, green ash, hackberry *Celtis laevigata*, sycamore *Plantanus occidentalis* and a robust list of understory vegetation are similar along the entire coast. Old-growth examples of this habitat type are very rare. Large tracts of bottomland hardwood forest remain but most are either second or third growth stands.

The Columbia Bottomlands historically covered over 699,300 acres long the Brazos, Colorado, and San Bernard Rivers, but has since been reduced to 25 percent of its former extent (177,900 acres), remains highly fragmented, are threatened by residential and commercial development, agricultural conversion, timber removal, and infestation by invasive plants. The ecological importance, productivity, and diversity of these forests are well documented. Bottomland forests provide temporary or permanent residence as well as critical stopover and staging habitat for Neartic-Neoptropical migratory landbirds, and are consistently used year to year though migration patterns can shift. The diversity of the Columbia

Bottomlands is well documented and known to support upwards of 239 million birds representing 237 species. These birds migrate through, overwinter or are found to breed in the Columbia Bottomland forests. Because of the critical significance of bottomland hardwood forests to avian ecology, the Service authored the Columbia Bottomlands Conservation Plan (U.S. Fish and Wildlife Service, 1997) with two objectives: 1) to illustrate strategies that combine federal habitat protection efforts with conservation efforts of local communities and 2) to describe vegetation characteristics of a mature Columbia Bottomlands forest remnant as a formative step in guiding the evaluation, acquisition, and management of other protected tracks. The accelerating loss of habitat, particularly large stands with mature composition and structure, heightened the need to move forward with the plan's outlined protection measures.

Similarly to Columbia bottomland forests, east Texas bottomland hardwoods (from Galveston to Sabine) are much the same in terms of threats, diversity, and structure. They support distinct assemblages of plants and animals associated with particular landforms, hydric soils, and hydrologic regimes and are generally higher, intermittently-flooded strips of land immediately adjacent to the riverine ridge and to meander lakes (oxbows) are often forested by mature bottomland hardwood forest. The largest tracts are at the extreme upper end of the study area, just south of the Neches River saltwater barrier and along the Sabine River north of I-10, within Sabine Wildlife Management Area. Agriculture and silviculture are the major continuing threats on these forested wetlands leading to deforestation and altered hydrology. Restoration efforts are ongoing across Texas and Louisiana in an attempt to reconnect fragmented forest blocks and restore wetland forest functions.

#### *Recommendations*

Due to the rarity and ecological significance of the coastal bottomland forests and forested wetlands in general, the Service deemed this habitat a "focus area" for preservation, restoration, and research. We recommend the acquisition of lands adjacent to previously purchased and protected lands that increase the conservation footprint for bottomland hardwoods along the Texas coast. Once the properties have been acquired and placed in perpetual conservation easements, we recommend the Corps develop long-term funding mechanisms to ensure ecosystem benefits for fish and wildlife into the future. Finally, we recommend the Corps develop comprehensive restoration and management plans for the property identifying opportunities for invasive species removal, burning, woody and shrub species propagation, comprehensive species list, and identification of additional tracts of land to compliment acquisition efforts by the Service and other partners for the benefit of resident and migratory birds and wildlife. The Service looks forward to working with the Corps and other partners to identify suitable coastal prairie tracts for restoration and purchase.

#### **Gulf Intracoastal Water Way Shoreline Protection and Sediment Transport**

Texas navigable waterways once designed to support only local vessel traffic are now exploited for national and international commerce utilizing increasingly larger vessels. Increases in vessel size and frequency create greater tidal surges resulting in shoreline creep, widening canals, saltwater intrusion into freshwater marsh, and erosion of public and private lands bordering the waterways. The Texas portion of the Gulf Intracoastal Water Way (GIWW) is over 50 years old and 423 miles long, is an essential component of the state's and nation's transportation network, and continues to operate with the goal to provide safe, efficient and effective means for the movement of people and goods throughout the state. The Texas portion of the GIWW supports five of the top 33 leading ports in 2016 with combined domestic and foreign tonnage of 524.5 million. In 2016, Texas ranked second in the nation in total waterborne tonnage transported with 496.67 million tons of the total maritime freight volume on both deep and shallow draft waterways (USACE, 2016). However the total tonnage for the entire GIWW was 111.7 million tons in 2016, down 6.1 percent from 188.9 million tons in 2015. While these shipping volumes are impressive and necessary to sustain a growing national economy, many within the

environmental community have concerns over the degradation of the GIWW shoreline and adjacent lands and that current waterway conditions warrant additional shoreline protection. Authorized at 125 feet wide and 12 feet deep, some stretches of the GIWW are now over 600 feet wide.

Despite the economic gains to many local communities, the GIWW, serves as a conduit for transporting sediments, is a barrier to freshwater inflows from north to south, and continues to degrade the hydrological regimes of adjacent wetlands by eroding existing shorelines. Historic hydrologic sheet flows across the landscape are compromised often resulting in trapping or ponding of freshwater north and increased salinities in wetlands south of the GIWW. The Service continues to advocate for shoreline protection along the entire GIWW protecting state, private, and federal lands.

The Beneficial Use (BU) of dredged material, whether used as thin layer placement on wetlands, marsh creation, seagrass bed enhancement, or bird island creation, is critically important to coastal aquatic ecosystems. Most sediment located within the GIWW is composed of fine silts and does not lend itself well to stacking. However, this material is suitable for thin layer placement on adjacent private, state, and federal lands where wetland conversion, degradation, and subsidence are common. Stiffer clays stack better and are consistent with levee and island building. The Corps typically beneficially uses between 15-20 percent of the dredged material for the entire state and the Service strongly recommends the Corps adopt a stronger BU policy where at least 50 percent of dredged material is beneficially used. The Service can provide technical support for BU marsh and island creation throughout the coastal bay systems.

#### *Recommendations*

Shoreline stabilization and protection of lands adjacent to the GIWW continues to be of great concern for the Service. We recommend the Corps work with resource agencies, non-governmental organizations, and private landowners to develop a GIWW wide shoreline stabilization plan with dedicated funding to protect adjacent wetlands. The Service recommends the development of a comprehensive state wide sediment management plan to address sediment transport throughout the state's coastal rivers and bay systems. We expect this plan will address the GIWW as this waterway remains a major conduit for fluvial sediment transport during normal flows and severe flooding events. Preferred options for the placement of dredged material, emergency dredge disposal, beneficial use opportunities, understanding the fate of sediment-bound pollutants in our waterways, analysis of how channels change during flood events, hazard and debris removal, climate change/sea level rise, and the effect on sediment accumulation and transport also should be discussion topics in the plan. We also recommend the Corps analyzes landscape flows for a variety of flood events, identify restrictive barriers, and identify ways to provide safe alternatives for river flooding. The Service recommends the Corps develop a "tool box" with a variety of hard and non-structural technologies aimed at protecting the entire Texas GIWW shoreline. The Service can assist the Corps with identification of suitable protection measures and BU opportunities along the GIWW as some adjacent areas remain environmentally sensitive.

#### **Wetland Preservation**

All marsh habitats along the Texas coast serve as breeding, feeding, and nesting, habitat for a diverse range of fish and wildlife species. Many nationally important commercial and recreational fish and wildlife species spend portions of their life cycle within marsh habitats. As a result of agricultural practices, oil and gas exploration, and commercial development, marsh habitat has been drained or filled resulting in low quality and fragmented habitats. Recent efforts to protect, create, and restore marsh along the Texas coast have been successful; however, additional protection and preservation measures are needed. Wetland types found in coastal watersheds include saltwater marshes, bottomland hardwood swamps, freshwater wetlands, mangrove swamps, shrubby depressions, and prairie potholes. Much of the

Texas coast is dominated by intermediate, brackish, or saline wetlands while fresh water wetlands are either impounded and are usually found further inland. Coastal emergent wetlands provide important transitional habitat between the gulf waters and lands protecting against storm surge, act to slow wave velocity, combat sea level rise, and have a tremendous ecological and economic value.

Both freshwater swamp and freshwater marsh, often occurring in intermeshing context within large wetland tracts, occur in abundance within the northern upper Texas coast. Primary swamp type is cypress-tupelo swamp, which is characterized by common baldcypress *Taxodium distichum* and tupelo gum *Nyssa aquatica* overstory, and numerous aquatic understory species such as bulltongue *Sagittaria lancifolia*, swamp lily *Crinum americanum*, pickerel weed *Pontederia cordata*, smartweed *Polygonum sp.*, and blue iris *Iris sp.* Large tracts of cypress-tupelo swamp occur in permanently and semi-permanently flooded areas along the Neches River north of Interstate (I-) 10 and along the Sabine River north of I-10.

Swamp scrub and freshwater marsh are often intermixed within cypress-tupelo tracts, either in natural meander scars or in areas completely logged in the past which have not reforested. Primary plant species here are buttonbush *Cephalanthus occidentalis*, rattlebean *Sesbania drummondii*, box elder *Acer negundo*, swamp privet *Foresteria acuminata*, cattail *Typha latifolia*, and Virginia tea *Itea virginica*. Preserving and restoration of freshwater marsh/scrub shrub habitat, although cypress-tupelo swamp should be the long term goal along the upper Texas coast due to its high productivity and recreational value to wetland users, primarily waterfowl hunters, fishermen, and birdwatchers should be a principal concern for this study.

Intermediate marsh covers much of the study area and is characterized as marsh type is located between brackish and fresh marsh with salinity averages about 3.3 ppt. Intermediate marsh has an irregular tidal regime, is oligohaline, and is dominated by narrow-leaved, persistent species such as marshhay cordgrass (*Spartina patens*). Plant diversity and soil organic matter content is higher than in brackish or saline marshes. This marsh is characterized by a diversity of species, many of which are also found in freshwater and brackish marshes. Characteristic species include roseau cane *Phragmites australis*, bulltongue *Sagittaria lancifolia*, coastal water hyssop *Bacopa monnieri*, spikesedge *Eleocharis spp.*, Olney's bulrush *Schoenoplectus americanus*, California bulrush *Schoenoplectus californicus*, American bulrush *Schoenoplectus pungens*, saltmarsh bulrush *Bulboschoenus robustus*, deer pea *Vigna luteola*, seashore paspalum *Paspalum vaginatum*, switch grass *Panicum virgatum*, bearded sprangletop *Leptochloa fascicularis*, camphor-weed *Pluchea camphorata*, Walter's millet *Echinochloa walteri*, fragrant flatsedge *Cyperus odoratus*, alligator weed *Alternanthera philoxeroides*, southern naiad *Najas guadalupensis*, big cordgrass *Spartina cynosuroides*, and gulf cordgrass *S. spartinae*. Two other major autotrophic groups in intermediate marsh are epiphytic and benthic algae. Intermediate marsh occupies the least acreage of any of the four marsh types. This marsh type is very productive of many species of wildlife and is important to larval and postlarval marine organisms such as shrimp sp., crabs *Callinectes sp.*, Gulf menhaden *Brevoortia patronus*, etc. Hydrological changes to this marsh community may shift to either fresh or brackish marsh if salinities rise or fall due to weather events such as droughts, excessive rainfall, or influxes of sea water.

Brackish marsh occurs in areas located between the high-salinity saline marshes near the Gulf of Mexico and the intermediate areas further removed from the Gulf. Brackish marsh is generally considered "slightly salty"; with salinity levels varying over a wide range from location to location. In coastal Texas, the typical brackish marsh vegetation pattern occurs in areas within approximately the 4 to 15 ppt normal salinity range. Common, usually dominant, vegetation in these areas is saltmarsh bulrush *Bulboschoenus robustus*, seashore saltgrass *Distichlis spicata*, marshhay cordgrass *Spartina patens*, dwarf spikerush

*Eleocharis parvula*, waterhemp *Amaranthus australis*, and marsh pea *Vigna luteola*. Brackish marsh areas have cyclically high waterfowl populations, especially in years following high-salinity events when freshwater levels return to normal and periodic “blooms” of prime food plants such as widgeongrass *Ruppia maritima* and *Paspalum* sp. occur. Furbearers such as muskrat *Ondatra zibethicus*, formerly an important commercially-harvested animal in portions of the study area, also occur in cyclically high numbers. Brackish marshes have suffered some of the highest rates of marsh loss due to subsidence and loss of organic materials as formerly fresh areas are subjected to salinity intrusion, resulting in plant loss.

Salt marsh is formed when salt-tolerant plants take root on mud flats around edges of bays, usually slowing the flow of water during high tides, allow sediment to settle out, and raises elevation for plant life to continue. Plants in the salt marsh are usually dominated by smooth cordgrass *Spartina alterniflora*, seashore saltgrass, blackrush *Juncus roemerianus*, saltmarsh aster *Aster tenuifolius*, and glasswort *Salicornia* sp. Gulf coastal salt marshes are often almost exclusively smooth cordgrass-dominated and comprise important marine nursery habitat, probably due to its ready access to estuaries, though wildlife populations are less diverse than in nearby intermediate and freshwater marshes. However Gulf coast coastal marsh habitat southward from the Coastal Bend area comprises mainly black mangrove *Avicennia germinans* interspersed with smooth cordgrass.

Texas NWRs many established to conserving wetland habitats specifically for the benefit of migratory waterfowl contain coastal marshes that provide wintering habitat for hundreds of thousands of geese and ducks and provide critical landfall sites in the spring for neotropical migratory birds. Wetland hydrologic connectivity remains a challenge across the coastal landscape as much of the region was transformed as a result of agricultural practices, navigation, development, and industry. Reestablishing hydrologic connectivity among wetlands remains a focus for the Service.

#### *Recommendations*

The Service supports the creation, preservation, and restoration of wetlands along the Texas coast to include coastal and inland marsh habitats. Much of the coastal landscape is altered in large part due to commercial, industrial, and residential development. Restoring hydrological flows by removing barriers specific to tidal exchange, impoundments, and levees will improve aquatic function, promote fish and wildlife dispersal, and aid in providing improved sediment and water quality on the larger landscape. Large tracts of coastal and inland marsh benefit the endangered whooping crane and other aquatic and terrestrial wildlife species; while providing improved water quality and protection from storm surge events. The Service, in conjunction with the other federal, state, and local natural resource agencies, can assist with priority wetland tract identification that benefits migratory fish and wildlife.

#### **Seagrass Beds**

One of the most biologically productive, recreationally and economically valuable habitats, seagrass beds provide feeding and nursery habitat for waterfowl, fish, shrimp, crabs and other economically important estuarine species (U.S. Fish and Wildlife Service) as well as sea turtles, manatees, and countless invertebrates that are produced within, or migrate to seagrasses. Seagrass helps to dampen the effects of strong currents, prevent erosion, enhance water clarity, provide protection to fish and invertebrates, and prevent scouring of bay bottom areas. Sea grasses are usually found in calm, shallow gulf waters where higher salinities, light, and nutrients are plentiful. Excessive freshwater inflows into a bay system can decrease salinities to near brackish conditions, and depending on the duration of the fresh conditions, some seagrass species are not physiologically capable of tolerating these extreme conditions and may die and areas recolonized with less favored species.

The majority of Texas seagrass meadows occur along the middle and lower Texas coast where waters are warm, clear, and have higher salinities. Almost 80 percent of the remaining seagrass habitat in Texas is located in the Laguna Madre System and however abundant, this resource remains threatened. The Laguna Madre is the only hyper-saline coastal lagoon in North America, one of only five in the world. These seagrass beds are the winter home to 80 percent (as many as 700,000 individuals) of the continental population of redhead ducks and are now confined to wintering areas on the Gulf of Mexico due to declining abundance of seagrasses along the Atlantic Coast. Ducks Unlimited, (2017) estimates the decline of shoalgrass, the preferred forage of redheads, is more than 40 percent in the Laguna Madre since 1965 and can be linked to decreasing salinities and navigation projects. 1950's aerial photographs indicate seagrasses once present in the Galveston Bay system, ranged from 2,500 to 5,000 acres, and were completely eliminated by 1989. Restoration efforts by transplanting and seed broadcasting in portions of West Galveston Bay have been successful and seagrasses are slowly spreading on the upper Texas coast. Biotic and abiotic threats to seagrasses such as storms, excessive grazing by herbivores, disease, and anthropogenic threats due to point and non-point sources of pollution, decreasing water clarity, excessive nutrient runoff, sedimentation, sea level rise, and prop scarring negatively affect these diverse communities coast wide.

Conservation and protection of sea grass is the best and first approach for this vital resource, however restoration efforts to benefit seagrasses have had some success along the Texas coast. The Service along with other federal, state, and local partners work cooperatively to restore seagrass meadows along the coast utilizing a combination of hand planting and specially designed boats which rapidly injects nutrients, plant growth hormones and sprigs of seagrass in the bottom substrate, and by hand-planting seagrasses. Although restoration efforts are underway, continued damage from prop scarring, anchors, and ill-timed dredge material deposition threaten coastal seagrass beds all along the coast.

#### *Recommendations*

The Service recommends the Corps work in coordination with the federal, state, and local resource agencies to develop an interagency team focused on small and large scale seagrass monitoring and restoration along the entire Texas coast as well as dedicating funding for seagrass research. The Service recognizes the Corps' need to dispose of dredge maintenance material and remains committed to working with the Corps to monitor and address seagrass issues related to on-going maintenance dredging work. We expect any future Corps dredging actions including but not limited to, beneficial use of dredge material and open water placement will fully consider effects to seagrasses and will include coordination with the aforementioned interagency team. Finally, the Service continues to recommend a combined approach of outreach, education, and improved signage within channels and marinas aimed to avoid and reduce impacts to seagrass beds. As part of the outreach effort, the Service recommends the Corps develop and permanently fund a website dedicated to the status, monitoring, and research of seagrasses along the Texas coast.

#### **Tamaulipan Thornscrub Habitat**

Tamaulipan thornscrub has a unique richness of flora and fauna not found in other ecosystems and is attributed to improved hunting experiences in South Texas (Erwing & Best, 2004). The presence of rare communities combined with the area's rich diversity of bird and butterfly species make South Texas one of the state's most popular nature tourism destinations. Private wildlife sanctuaries (such as those purchased and managed by The Nature Conservancy and others) provide protection for wildlife and help create much needed migratory corridors aimed at connecting tamaulipan thornscrub habitats. Land clearing for ranching, agriculture and urbanization resulted in the loss of more than 95 percent of the wildlife habitat in the Lower Rio Grande Valley of Texas. While ranching and agriculture traditionally have been the dominant industries in the Lower Rio Grande Valley area, landowners increasingly turn to

alternative land uses; and as a result, landowners are more interested in developing wildlife based habitats and activities. The diverse habitat of the lower Rio Grande Valley combined with the Valley's location within the Central Flyway, more than 500 bird species have been recorded in the area. A diverse avifauna presence on the LRGNWR makes it a key birding destination where over 354 bird species can be seen. The dense scrub habitat

The Service established the Lower Rio Grande Valley National Wildlife Refuge (LRGNWR) to specifically acquire, manage, and restore tamaulipan thornscrub habitat creating a wildlife corridor stretching from Falcon Dam on the Rio Grande to the Gulf of Mexico (approximately 140 miles) (Erwing & Best, 2004). This wildlife corridor aims to benefit wildlife species including the ocelot *Leopardus pardalis*, jaguarundi *Puma yagouaroundi*, Texas tortoise *Gopherus berlandieri*, northern aplomado falcon *Falco femoralis septentrionalis*, Brownsville common yellowthroat *Geothlypis trichas insperata*, Lomita Carolina wren *Thryothorus ludovicianus*, southern yellow bat *Lasiurus ega*, speckled racer *Drymobius margaritiferus*, black-spotted newt *Notophthalmus meridionalis*, Mexican white-lipped frog *Leptodactylus fragilis*, and the Rio Grande lesser siren *Siren intermedia*.

Current population estimates for the ocelots in South Texas is fewer than 60 individuals with a total of 100 remaining in the United States where the gene pool exchange remains limited. Habitat loss, fragmentation, and vehicular collisions are common and contribute to overall population decreases. The Service continues to work with private landowners and other federal, state, and local agencies to acquire, secure easements, and provide technical assistance to restore tamaulipan thornscrub habitat in this area.

While the endangered jaguarundi have historically occurred in southeast Arizona, South Texas, Mexico and Central and South America as far south as northern Argentina, biologists today believe the cat still occurs throughout most of the range except in Arizona; however, the population status is unknown and presumably smaller than the ocelot because confirmed sightings are rare. In South Texas, jaguarundi are known to occur (last verified sighting in mid-1990s) in only Cameron and Willacy counties where they prefer dense mixed brush with dry washes, arroyos, resacas, and the floodplains of the Rio Grande. Unfortunately, loss of habitat to agriculture production remains the main threat to the jaguarundi. The Service supports the acquisition of property aimed at preserving thornscrub habitat which furthers the Service's Recovery Plan's (U.S. Fish and Wildlife Service, 2013) effort to create a wildlife corridor for terrestrial species negatively impacted by thornscrub clearing.

#### *Recommendations*

Tamaulipan thornscrub is not a recognized habitat within the Texas Coastal Study. The Service considers this a rare habitat unlike any other region of the United States due to the combination of climate, vegetation, and associated wildlife. We remain committed to the preservation of thornscrub habitat and recommend the Corps coordinate with other federal, state, and local natural resource agencies to identify suitable tracts of land for acquisition or placement into conservation status. This action will promote the status of key wildlife species; improve wildlife corridors and the overall health of tamaulipan thornscrub ecosystems in south Texas.

#### **Research and Monitoring Needs**

To ensure a bright future for fish and wildlife in the face of widespread threats such as drought, climate change and large-scale habitat fragmentation, we can no longer base our actions solely on past experiences and success. Conserving these large landscapes which are subject to multiple changing pressures and uncertainties will require application of the best available science at every step. Because management of natural systems is not always predictable, having specific and measurable biological

objectives that summarize the existing scientific knowledge and present testable hypotheses is essential for effective restoration planning.

The Service relies on informed decision making where gathering and improving knowledge is a reiterative process and necessary in understanding the stressors on coastal habitats and living marine resources of Texas and the larger ecosystems of the Gulf of Mexico. Stressors such as continued energy exploration, the procession of climate change, coastal developments, alterations in hydrology, industrial activities, fishing pressures, and many others continue to impact the system and can hinder its ability adapt and function at healthy levels.

Losses of these coastal habitats and living marine resources directly translate into diminished future resources available for coastal residents. The Service supports the research priorities identified under the Texas One Gulf draft Strategic Research and Action Plan (2017) which aim to maintain or increase biodiversity, defining “baseline” conditions, identify stressors and pressures impacting the Gulf of Mexico, and understand connections between estuarine and coastal environments and the offshore and deeper Gulf of Mexico environments.

#### *Recommendations*

We encourage the Corps to consider recommending the study and analysis of specific coastal issues in the Study’s Comprehensive Plan to compliment restoration project identification. The Service in combination with the other state and federal natural resource agencies can work with the Corps to identify gaps in research specific to coastal habitats. This approach will assure the greatest chance for future restoration success. Additionally, monitoring of natural resources after project construction is also recommended where project success will be defined by specific criteria prior to construction. The Service appreciates the opportunity to review and comment on the success criteria developed for each restoration site.

#### **Service Priorities**

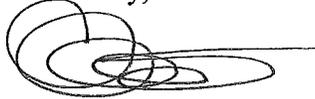
Through this PAL, the Service outlined key habitats and research opportunities within the four regions of the Coastal Texas Study’s boundaries. Specifically, the Service provided concerns and recommendations to conserve and protect these highlighted habitats: wetlands, oysters, bird islands, beach and dune habitat, coastal prairies, seagrasses, and tamaulipan thornscrub. Below is a list of high action coastal Texas priorities based on the Service’s visions:

- ❖ Restore and conserve agricultural and working ranchlands that complement and support the connectivity of land, invasive species control and water conservation efforts in the Rio Grande area.
- ❖ Enhance the existing network of conservation lands linking the Rio Grande River Valley and the South Texas coastal ecosystem to ensure that fish and wildlife resources are sustainable.
- ❖ Reconnect hydrology and watershed diversions, such as the Bahia Grande, and restore wetlands and aquatic habitat for fish and other aquatic and wetland dependent species.
- ❖ Create a conservation network of lands through conservation easements or acquisition of grassland savanna and prairies, woodlands, and riparian areas in the Texas coastal bend region.
- ❖ Manage non-native species, reintroduce native plants, restore natural drainage features and use frequent prescribed fire to restore grassland savannas and prairies on former farmland and working ranchlands to enhance habitat for native plant pollinators.

- ❖ Support water-sharing efforts to provide freshwater input to coastal ecosystems that account for the needs of people and natural resources, including commercially significant fisheries and culturally important species like the whooping crane in the Coastal Bend area.
- ❖ Conservation, restoration, and continued management of native grassland prairie habitats are necessary to meet the life requisites of federally listed species and species of concern and continue to be a focus for the Service.
- ❖ Protect critical bottomland habitat adjacent to the Trinity, San Bernard, and Brazos Rivers that represent significant stopover destinations and staging areas for millions of songbirds and landbirds during their migration across the Gulf.
- ❖ Protect and restore coastal prairie in its historic upland and wetland complex on former rice cultivation fields to support pollinators, grasslands and wetland dependent species like the mottled duck and the bobwhite quail, as well as wintering waterfowl, water birds, and shorebirds.
- ❖ Restore hydrologic processes including watersheds and diversions (e.g., Salt Bayou project) to restore and enhance wetlands and aquatic habitats to enhance fisheries and habitat for wetland dependent species.
- ❖ Restore landscapes and interrupted sedimentary processes by incorporating beneficial use of dredged material, direct, dredging and erosion protection with willing public and private land managers.
- ❖ The Chenier Plain is best served by conserving coastal prairie landscapes by recovering historic pothole and mound complexes and re-introducing native prairie species on former agricultural (rice) lands to support pollinators, grassland and wetland dependent species like the mottled duck and bobwhite quail, and wintering waterfowl, waterbirds, and shorebirds.
- ❖ Success criteria, monitoring, and adaptive management should be incorporated in to all projects to ensure project success.

We appreciate the opportunity to identify and highlight key coastal habitats and the fish and wildlife that occur there. We look forward to working with the Corps and our partners in the future to identify to develop a list of specific research and restoration opportunities. Please contact staff biologist, Donna Anderson or myself at 281-286-8282 with any questions.

Sincerely,



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Field Supervisor

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