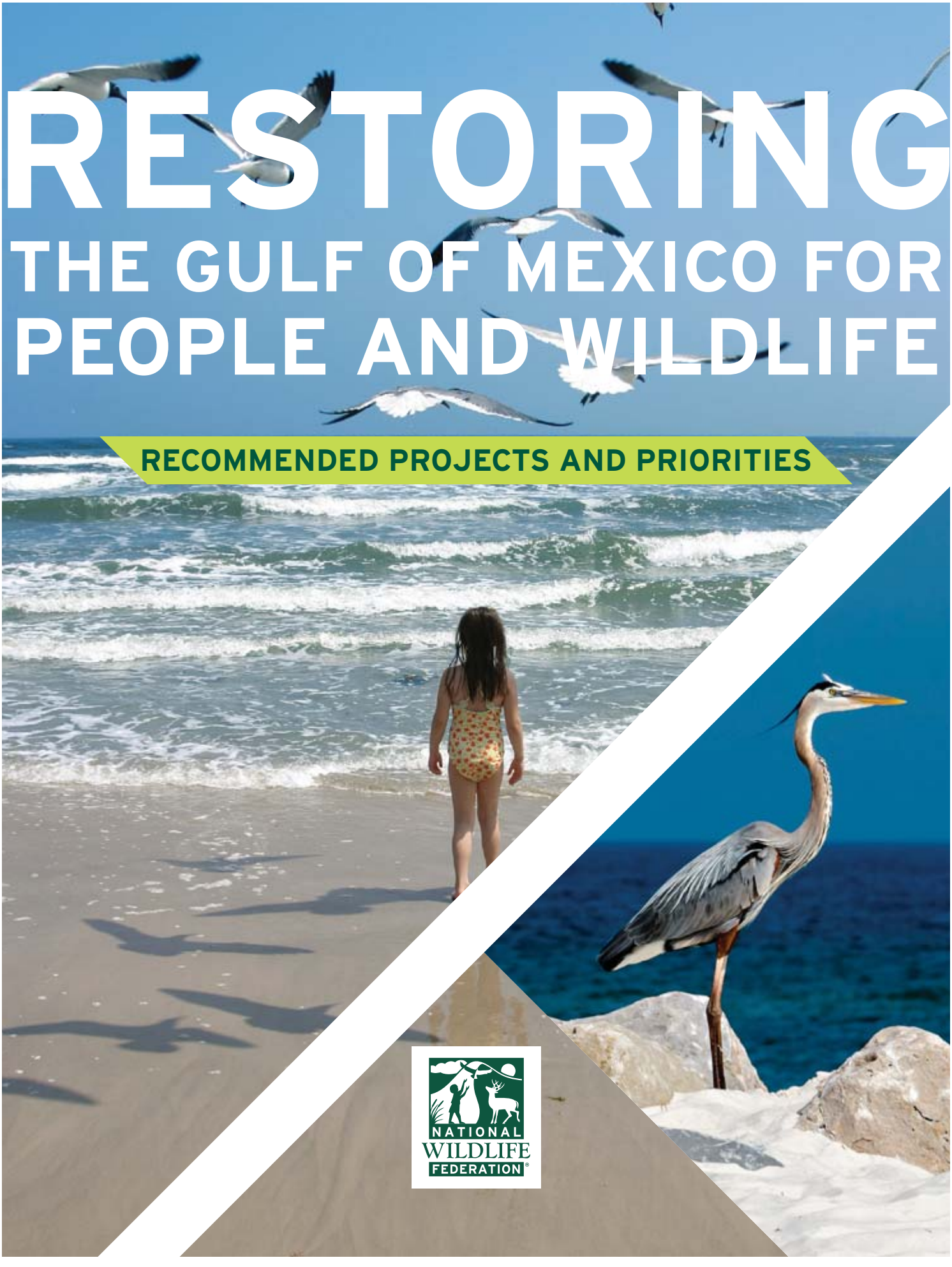
RESTORING THE GULF OF MEXICO FOR PEOPLE AND WILDLIFE

RECOMMENDED PROJECTS AND PRIORITIES



NATIONAL WILDLIFE FEDERATION®

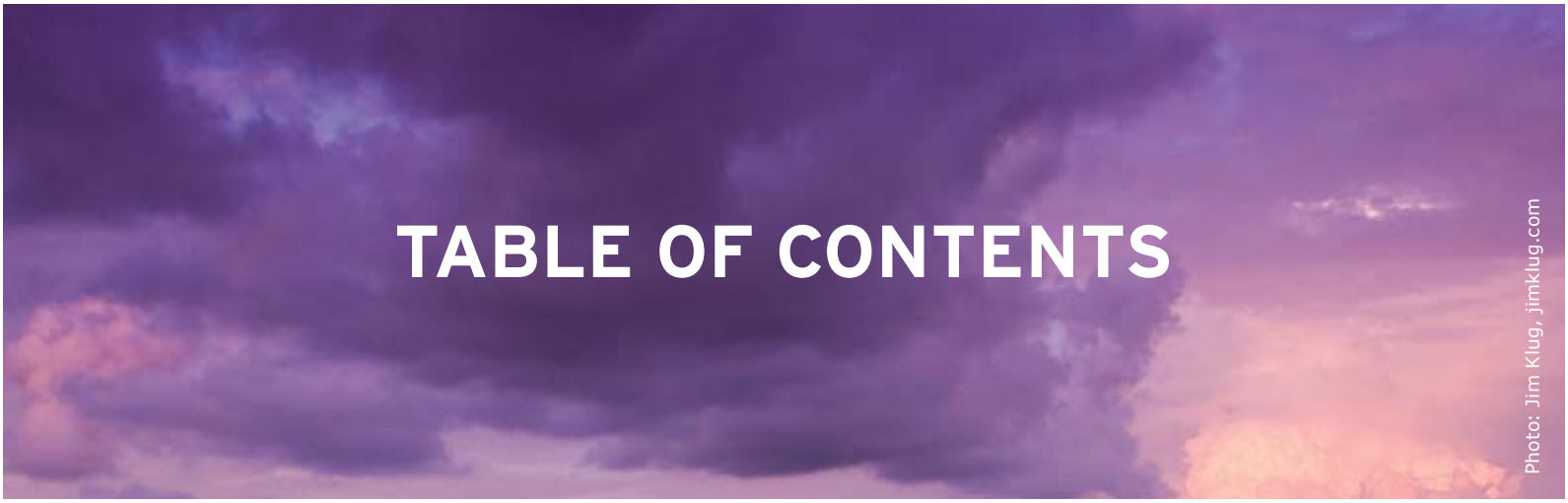


TABLE OF CONTENTS

Photo: Jim Klug, jimklug.com

Front cover photo credits:

Girl: iStock
Great Blue Heron: iStock

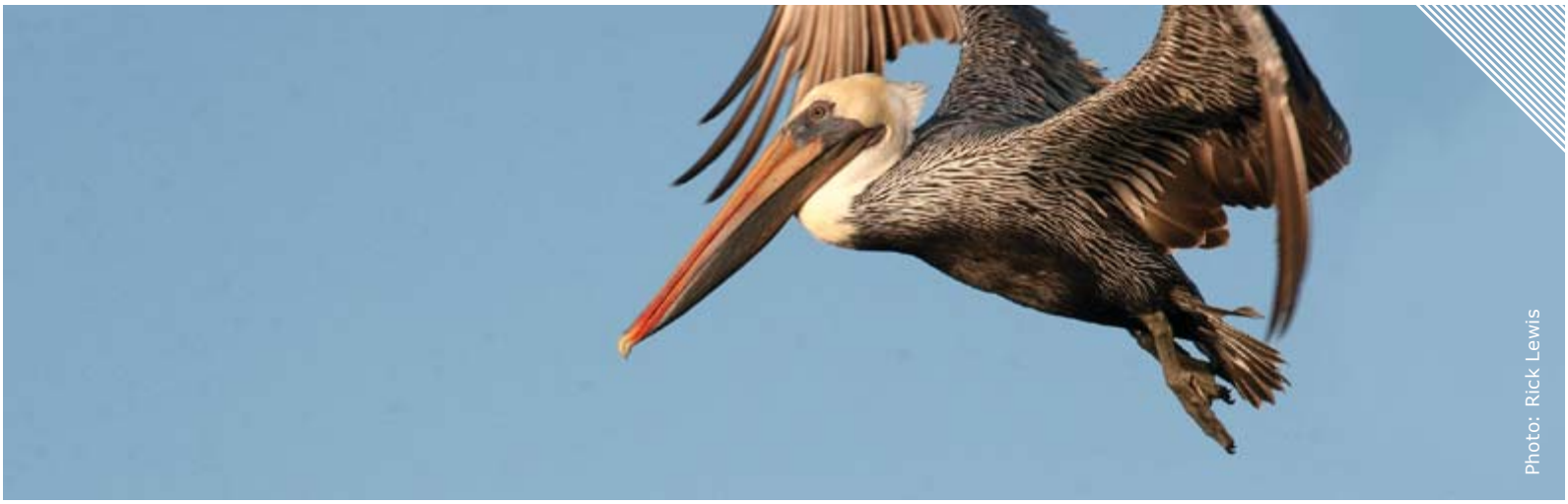


Photo: Rick Lewis

OUR APPROACH TO GULF RESTORATION

The National Wildlife Federation has a long history of advocacy in the Gulf of Mexico region. In 2000, our four million members and supporters were instrumental in securing Congressional support for the Comprehensive Everglades Restoration Plan. For more than a decade we have worked to ensure that Texas bays have the fresh water they need to support healthy fish and wildlife populations. And since well before Hurricane Katrina, we have championed the restoration of Louisiana's disappearing coastal wetlands.

The 2010 Deepwater Horizon oil spill focused the world's attention on the Gulf of Mexico, and in particular, on its natural resource value. In addition to causing the tragic deaths of 11 men, the 87-day disaster closed vast areas of the Gulf to fishing, killed and injured marine mammals, shorebirds, sea turtles, and other wildlife and damaged the Gulf's delicate web of life in ways that are still unfolding. The spill also drew attention to the longstanding conservation and restoration needs of a Gulf ecosystem that supports much of the region's economy but has been overworked and under-protected.

The National Wildlife Federation and our state affiliates, together representing millions of sportsmen and outdoor enthusiasts, actively supported the 2012 RESTORE Act, which sends 80 percent of the civil penalties arising from the 2010 oil spill back to the Gulf for restoration and recovery. With the passage of this groundbreaking legislation, Congress sent a message that the historic neglect of the Gulf Coast's natural systems must be remedied. Now, as the Gulf region recovers from the largest oil spill in U.S. history, state and federal leaders have an opportunity to invest in the long-term health and resiliency of its coastal lands and waters.

The National Wildlife Federation believes that the highest return on this investment will come from efforts to restore and protect Gulf estuaries. These coastal waters are among the most productive natural habitats in the world. Estuaries serve as spawning, nursery, and feeding grounds for nearly all of the Gulf's commercial and recreational fish species and provide essential habitat for hundreds of species of birds, waterfowl, and other wildlife.

Despite their ecological and economic importance, most of the Gulf's estuaries have been adversely affected over the years by human alterations to land and water upstream. This is true of the marshes of coastal Louisiana, Apalachicola Bay and adjacent sea grass beds, the Mobile Bay estuary, Charlotte Harbor and Florida Bay in southwest Florida, the Mississippi Sound and the estuaries along the Texas coast.

Under the RESTORE Act, a new federal entity, the Gulf Coast Ecosystem Restoration Council, is charged with developing and implementing a Comprehensive Plan for the restoration of the Gulf Coast region. In its August 2013 Initial Comprehensive Plan, the Council identified estuaries and related habitats as major restoration priorities.

The National Wildlife Federation has compiled the following recommended state-by-state list of projects to begin a robust investment by the Council in the health and productivity of Gulf estuaries. These waters are the lifeblood of communities and businesses across the Gulf. Their protection and restoration are key to both the near-term recovery and the long-term resiliency of the national treasure that is the Gulf of Mexico.

Photo: Panama City Beach Convention & Visitors Bureau

FLORIDA

Florida's barrier islands, estuaries, beaches, seagrass meadows, wetlands, and mangrove forests are world-renowned natural resources and attractions. The state's 770 miles of coast, 5,095 miles of tidal shoreline, and 7.4 million acres of tidally submerged lands stretch from temperate Pensacola in the Panhandle to tropical Key West. The region's habitats include rare coastal dune lakes, pine flatwoods and prairies, coastal hammocks, America's Everglades, and the coral reefs of the Florida Keys.

Rich and productive areas along Florida's coast are major ecological drivers for the entire Gulf region, from the famed Apalachicola River and lush seagrass meadows of the Big Bend, to the recovering estuaries of Tampa Bay, Sarasota Bay, and Charlotte Harbor and the nationally treasured Everglades and Florida Bay. These systems provide food, shelter, and important nurseries for a wide range of birds, fish, and other marine life. Similarly, the sandy beaches of Florida's Gulf Coast and the Florida Keys are ecologically important nesting habitat for endangered shorebirds, beach mice, and sea turtles.

Florida's vast natural resources also fuel the state's economy. Its white sandy beaches are consistently ranked among the best in the nation, and millions come to Florida's Gulf Coast each year to fish, dive, swim, and view wildlife. The state has nearly five million saltwater anglers and it leads all states in economic return for its marine recreational fisheries. Likewise, the commercial fishery is listed as the second-largest of all states and ranks third for jobs supported by the industry.

Restoration of Florida's coastal environment will help boost its economy. Although the state's coastline is extensive and diverse, common restoration themes across the coastal region include the need to restore estuaries, address stormwater and sedimentation, improve water quality and better manage water flows. These needs and others are addressed by the following projects.

C-43 West Basin Storage Reservoir Project

The Comprehensive Everglades Restoration Plan, approved by Congress in 2000, calls for the construction of the C-43 Reservoir adjacent to the Caloosahatchee River in Hendry County. This project is critical to restoring the estuaries of southwest Florida, including Charlotte Harbor National Estuary, an important contributor to the sustainability of Gulf of Mexico fisheries. Under current practice, in times of drought, the Caloosahatchee estuary suffers as fresh water is held back to meet water-supply needs.

During the wet season, if Lake Okeechobee rises to a level that threatens the integrity of the Herbert Hoover Dike, large pulses of nutrient-laden water are discharged, triggering algal blooms and seagrass loss, and disrupting the salinity balance of the estuary. More gradual and strategically planned releases of fresh water are needed to ensure the continued health and productivity of the estuary.

This project involves an above-ground 170,000 acre-foot reservoir located south of the Corkscrew Regional Ecosystem Watershed, and will comprise a significant portion of total water-storage requirement for the C-43 Basin. The reservoir will capture stormwater runoff and water released from Lake Okeechobee during the wet season and release the water as needed during the dry season to maintain a healthy salinity balance in the estuary.

By closely mimicking the natural cycle, the project will create a more productive nursery for Gulf fisheries and will benefit habitat for nearly 40 percent of Florida's rare, threatened, and endangered species. The project has tremendous value for the people who depend on the ecological health of this unique wetland system for their livelihood and property values, and it is part of the National Estuary Program's Southwest Florida Regional Restoration Plan.

Robinson Preserve Restoration Phase II, Manatee County

Robinson Preserve is a 637-acre conservation area positioned at the junction of two estuaries of national significance: Tampa Bay and Sarasota Bay. The site currently contains areas of valuable habitat such as mangrove forest, salt marsh, and salt barren habitats, with smaller amounts of coastal upland habitats such as pine flatwoods, coastal strand hammock and maritime hammock. Robinson Preserve is highly utilized by wildlife, including threatened and endangered species.

In recent years, some 487 acres have been transformed from disturbed farmland to high-quality coastal habitats. The recommended Phase II project would add 150 acres of land to the preserve, restore that land to a more natural state, and open it to the public for passive recreation and education. The 150 acres of primarily upland habitat will provide an ecological connection to existing features of the Preserve.

By re-contouring the land, planting native vegetation, and conducting intensive maintenance, 61 acres of pine flatwoods, 35 acres of coastal hammock, 34 acres of open water, 11 acres of freshwater emergent marsh, and 13 acres of intertidal habitats including salt marsh, mangrove swamp, and oyster bars will be restored, created, or enhanced. These habitats will benefit water quality, biological diversity, and fisheries. This project is also part of the National Estuary Program's Southwest Florida Regional Restoration Plan.

Apalachicola River and Bay Restoration Plan

The Apalachicola River and Bay system in the Florida Panhandle is an area of exceptional ecological importance. It constitutes one of the least polluted, least developed, resource-rich systems left in the United States. Designated as an International Biosphere Reserve, a National Estuarine Research Reserve, and an Outstanding Florida Water, the river supports the most diverse assemblage of freshwater fish in Florida and the largest number of endemic species in western Florida. Apalachicola Bay is one of the most productive estuaries in the northern hemisphere, supporting a wide variety of recreationally and commercially important fish species, and providing habitat for migratory birds and other wildlife. Apalachicola River and Bay are closely linked: the river and its inundated floodplain are the biological factory that fuels the estuary's productivity. Apalachicola Bay also supports one of the nation's great oyster fisheries, representing 90 percent of the Florida's total oyster fishery and roughly ten percent of the oyster harvest nationwide.

Despite its enormous ecological value, the Apalachicola River ecosystem has been severely degraded over time, thanks to impoundment of water by upstream reservoirs, consumptive use of water by farms and cities, and navigational dredging and channel alterations. The combined effect of these human activities has been to alter the river's flow regime and channel form, reduce the river's hydraulic complexity and habitat diversity, and smother and displace habitat in the river's rich sloughs, floodplains, and channel margins. Effective restoration of the Apalachicola River and Bay will require a system-wide strategy and a scientifically sound basis for prioritizing restoration techniques and projects. The Apalachicola River and Bay Restoration Plan will include a scientific assessment of the significant human-induced changes in the system's geomorphology, hydrology, and ecological processes to ensure that restoration planning is based on an accurate understanding of the linkages between water flow, sediment, nutrients, and biota throughout the river and bay system. Conducted for the Florida Fish and Wildlife Conservation Commission, the restoration plan will be carried out by a nationally recognized expert in river geomorphology in cooperation with the National Wildlife Federation, Florida Wildlife Federation and Apalachicola Riverkeeper, and will result in pilot restoration project recommendations in the Apalachicola River floodplain.

Pensacola Bay Living Shorelines and Oyster Reef Restoration

Living shoreline projects apply natural principles and construction elements that create habitat and provide other services important for estuarine function, includ-

ing structural and foraging habitat for economically important estuarine fishes, vertebrates and invertebrates, increased light penetration for seagrass, and decreased wave energy and shoreline erosion. Living shorelines are being created throughout the Gulf of Mexico and often include the restoration or establishment of oyster reefs.

The Florida Department of Environmental Protection's Pensacola Bay Living Shorelines Project will create up to eight miles of living shorelines in the East Bay area of Pensacola Bay. The project will include installation of materials to provide structure suitable for development of oyster reef habitat and will serve as a natural approach to controlling shoreline erosion. The project will apply the most appropriate substrate for oyster larvae to settle and colonize, ultimately providing nursery habitat for commercially and recreationally important finfish and shellfish and forage and nesting areas for birds. The deployment of oyster habitat (which serves as a breakwater) and the planting of salt marsh vegetation will protect the shoreline by dampening wave energy (which erodes the shoreline) and stabilizing sediments (which cause turbidity). These improvements will promote the growth of seagrass and increase colonization by oysters.

This project will address components of Florida's Wildlife Action Plan and will provide a comprehensive, science-based approach to restoration that includes pre-restoration monitoring, project design and permitting, as well as implementation and monitoring of restoration activities.

St. Marks National Wildlife Refuge

The St. Marks National Wildlife Refuge spans more than 43 miles of coastline and supports 52 species of mammals, including the Florida black bear and bobcat, 40 species of amphibians, including the endangered flatwoods salamander, 65 species of reptiles, and numerous fish species, including Gulf sturgeon and Gulf striped bass. This project, located in Wakulla, Jefferson, Taylor, and Franklin Counties, provides additional habitat conservation through land acquisition and permanent conservation easements with willing landowners. The project will also provide tremendous benefit to migratory bird species.

Project effects include habitat conservation, enhanced water quality, enhanced community resilience, and protection of coastal marine resources. Tracts within the approved expansion boundary of this project protect wetlands that directly benefit Apalachee Bay, St. Marks River, and the Gulf of Mexico. Two tracts north of the existing refuge, the Sam Shine tract (8,117 acres) and The Nature Conservancy Tract (7,699 acres) are ready to be acquired and will protect and conserve land south of US 98. The addition of the 2,228-acre Lower Ochlockonee River Tract would protect the local estuary. Two other easement parcels (JLT and Five Smooth Stones, both in Wakulla County), together totaling approximately 2,100 acres, would complete protection of the Refuge, and greatly aid the St. Marks River.

WHY ESTUARIES MATTER

Estuaries are coastal bodies of water formed where fresh water from rivers mixes with salt water from the ocean. Gathering nutrients and sediment from the land and ocean, Gulf estuaries are extremely important to both wildlife and human communities.

The overwhelming majority of economically important fish and seafood species—including shrimp, blue crabs, oysters, redfish, snook and spotted seatrout—require estuaries at some point in their lifecycles. Estuarine habitats vary widely and include oyster reefs, seagrass beds, salt and fresh marshes, mangroves, forested wetlands, beaches, river deltas, and rocky shores.

The economic value of the Gulf's estuaries is significant. Recreational saltwater anglers generate an estimated $12 billion in sales annually in the Gulf region, supporting more than 113,000 jobs. Furthermore, the Gulf accounts for more than 40 percent of the seafood caught in the United States.

Estuaries are ecologically and economically vital, affecting community health and resilience. Severe land loss due to erosion and development, and the decreased health of the Gulf's estuaries, pose an ongoing threat to wildlife, habitats, and the tourism activities that depend on them.

St. Andrew Bay – West Bay Preservation Area

St. Andrew Bay is one of the most diverse estuarine ecosystems in North America, supporting more than 3,600 species in its watershed. It includes federally designated critical habitat for the Gulf sturgeon. This project offers the opportunity to protect a relatively pristine portion of

the estuary known as West Bay. The 40,000-acre West Bay Preservation Area, with its lush seagrass and oyster beds, marshes and undeveloped uplands, was identified by a 2003 study of the West Bay watershed as encompassing the most sensitive lands in the St. Andrew Bay complex. About 14,500 acres in the area are already protected through mitigation agreements. This project would secure and restore an additional 4,494 acres, with direct benefits for water quality and quantity for West Bay and would help protect the bay's estuarine habitats. Alone or combined with other watershed protection projects (such as Seven Runs Creek, South Walton Ecosystem, and others), the West Bay Preservation Area project would greatly contribute to long-term health and resiliency of the area's diverse fish and wildlife habitats, including marine, estuarine and freshwater systems. The project will address components of the Bay County Optional Sector Plan.

Suwannee River/Caber Coastal Connector

Florida has the longest protected natural coastline in the continental United States, from Apalachicola Bay eastward to north of Tampa. A critical missing link in this conservation network is the 7,804-acre Caber tract, which connects the Lower Suwannee River National Wildlife Refuge and the Cedar Key Scrub conservation lands. Permanent conservation of this area has been a high priority for years, due to the high-value seagrass beds and estuarine resources that lie off the Caber tract. Lying directly on the Gulf of Mexico, the tract protects high quality fish habitat and enhances Waccasassa Bay. Conservation of the Caber Coastal Connector will establish an almost unbroken chain of coastal conservation lands from Gulf County to Hernando County. It will help maintain the quality and quantity of water flowing to contiguous estuaries, which will benefit all marine species and the saltwater fishery. Acquisition will greatly complement the 53,000-acre Lower Suwannee National Wildlife Refuge, which was established in 1979 to protect one of the largest undeveloped river-delta estuarine systems in the United States.

For more information about NWF efforts in Florida, contact:

Jessica Koelsch
Florida Gulf Restoration Policy Specialist
KoelschJ@nwf.org

Photo: VISIT FLORIDA

Photo: iStock

ALABAMA

Coastal Alabama is a dynamic, complex system of white-sand beaches, dunes, marshes, bays, rivers, streams, oyster reefs, and barrier islands. The Mobile Bay watershed is the nation's fourth-largest in terms of water volume and the sixth-largest river system in area. It serves as the terminus of the Mobile-Tensaw Delta Complex, which is the second largest river delta in the United States.

The Mobile Bay estuary is one of North America's largest, most productive and most diverse estuarine systems. The region is home to a stunning array of wildlife and marine life, including over 350 species of birds and more than 335 species of freshwater and saltwater fish. Wildlife tourism—hunting, fishing and bird watching—on the Alabama coast generates more than $2 billion in spending every year.

Mobile Bay also provides critical nursery grounds for a multitude of fish and shellfish species. Recreational and commercial fishing together generate $1 billion in economic activity and the region's thriving seafood market supports more than 10,000 jobs.

Nonetheless, coastal Alabama is confronted with a myriad of challenges, as urbanization, hydrologic modifications, erosion, and invasive species have diminished water quality, altered salinities and sediment loads, and reduced habitat and biodiversity. Restoration efforts focused on revitalizing critical shorelines and wetlands, restoring hydrological connections, reestablishing oyster reefs and seagrass beds, protecting valuable coastal habitats, and improving water quality will ensure a healthy legacy for Alabama's coastal lands and waters, ensuring that its seafood and tourism-based economy continues to flourish.

100-1000: Restore Coastal Alabama

Mobile Bay has experienced a significant loss of oyster reefs, coastal marsh and seagrass beds. Yet the Bay has enormous potential for comprehensive ecological restoration—including replacement and enhancement of these lost habitats—due to the size of the estuary, historical distribution of oysters in the bay, high natural oyster-recruitment potential and warm water for fast growth. The "100-1000: Restore Coastal Alabama" partnership proposes to build 100 miles of intertidal oyster reefs, which will in turn protect and promote the growth of more than 1,000 acres of coastal marsh and seagrass. The project will result in improved water quality and new habitat for many species of fish and other wildlife. Importantly, project planning incorporates feasibility considerations to ensure that restoration goals are achievable. These living shoreline projects will provide substrate for oyster larvae to settle and colonize, and in the process create structural and foraging habitat for economically important estuarine fishes, vertebrates and invertebrates. Because oysters filter water, the new reefs will increase light penetration for seagrasses. By absorbing wave energy, the reefs will also reduce shoreline erosion and support adjacent marsh habitat.

D'Olive Creek Watershed Restoration

The D'Olive Creek Watershed is located within the Mobile Bay National Estuary Program, in Baldwin County. Draining a total area of more than 7,700 acres, the watershed consists of three principal tributaries: D'Olive Creek, Tiawasee Creek, and Joe's Branch. The D'Olive Watershed is located in a rapidly developing, urbanized area along the eastern shore of Mobile Bay, and provides critical nursery habitat for fish and wildlife. Natural stream and

wetland functions in the watershed have been altered by development, resulting in reduced floodplain connectivity and diminished sheet-flow into adjacent wetlands. The impacts along streams in this watershed include altered aquatic habitat, stormwater sediment deposition, hydrologic modification, and impaired water quality. Of almost 23 miles of streams in this watershed, 12 miles are either substantially degraded or have significant potential to be degraded. Five D'Olive Watershed streams are listed on the Alabama Department of Emergency Management's 2010 303(d) impaired waters list for siltation, a primary stressor which limits needed light penetration through the water column.

Restoration of watershed hydrology through improved stormwater management measures would reduce the abnormally high sediment loads making their way into this productive ecosystem. This project involves stabilizing 20,000 linear feet of priority stream reaches to minimize further head-cutting, channel incision, and bank erosion processes. Restoration techniques, including grade control, flow deflection/concentration, and bank protection, will reduce sediment loads and restore aquatic habitats. Additional restoration activities include mechanical sediment removal, removal of invasive species, excavation to restore width to riparian areas, and planting of native vegetation. Notably, in November 2013 the National Fish and Wildlife Foundation (NFWF) selected key components of the D'Olive Creek Watershed Restoration for the first round of funding in Alabama through the Gulf Environmental Benefit Fund. NFWF's selection of this project demonstrates the ecological value of the D'Olive Creek Watershed, and the $6.8-million award will help catalyze the much larger multi-phased restoration work needed in the watershed. The project will address components of D'Olive Watershed Management Plan and the Mobile Bay National Estuary Program's Comprehensive Conservation Management Plan.

Grand Bay National Wildlife Refuge Land Acquisition

The Grand Bay National Wildlife Refuge, which lies along the Mississippi/Alabama border, was established to protect one of the largest expanses of undisturbed pine savanna habitat in the Gulf Coastal Plain region. Pine savanna makes up the largest portion of the refuge, interspersed with poorly drained evergreen bays and pond cypress stands graduating to estuarine salt marshes to the south. The marshes on the southern portion of the refuge provide wintering habitat to about 16 percent of neighboring coastal Mississippi's total waterfowl population, including lesser scaup, redhead, ring-necked duck, mallard, and American widgeon. A number of migratory species utilize the habitats provided on this acreage for portions of their life cycle, including ibis, martins and swallows, rails, plovers, sandpipers and phalaropes, and gulls and terns, along with many different neo-tropical species.

In addition to birds, the marshes are extremely important to many recreational and commercial fish species, including speckled trout, red drum, and flounder.

The goals of the refuge include conserving valuable riverine habitat, protecting threatened and endangered species, restoring and protecting key coastal habitats, and managing populations of migratory birds and other trust species. This project would add approximately 2,250 acres to the nearly 18,000 acres currently owned by the U.S. Fish and Wildlife Service and the Grand Bay National Estuarine Research Reserve, managed by the State of Mississippi. It will add critical coastal frontage to the refuge for permanent protection and improved management of coastal wetlands and adjacent upland areas.

Bon Secour National Wildlife Refuge Land Acquisition

Bon Secour National Wildlife Refuge was established by Congress in 1980 to provide habitat for migrating birds. The refuge is also home to the endangered Alabama beach mouse, which relies on sand dunes and sea oats. Green, loggerhead, and Kemp's ridley sea turtles nest on refuge beaches. The refuge's varied habitats include sand dunes, scrub forest, fresh and saltwater marshes, freshwater swamps, and uplands.

This project will permanently protect sensitive lands identified by the U.S. Fish and Wildlife Service as critical for the long-term management of the refuge through land acquisition, permanent conservation easements, and agreements with willing landowners. It will add two tracts totaling 488 acres, currently under agreement for purchase by The Conservation Fund, to the refuge's Little Point Clear Unit. These properties include significant frontage along Saint Andrews Bay, Bon Secour Bay and more than 200 acres of salt and freshwater wetlands, as well as numerous tidal sloughs and adjacent upland areas.

Dauphin Island Parkway Salt Marsh, Finfish and Shellfish Habitat Restoration

Dauphin Island Parkway is the connecting link between Dauphin Island and mainland Alabama. Located in southern Mobile County along the western shoreline of Mobile Bay, the project site is exposed to heavy wave action from the long fetch across Mobile Bay and other erosive forces such as ship wakes. Studies indicate that the current shoreline, historically protected by a salt marsh, has now eroded more than 400 feet landward and the area has lost intertidal emergent habitat, salt marsh habitat, oyster reefs and areas of submerged aquatic vegetation. Structural shoreline protection has caused further erosion, a decline in water quality, and additional loss of aquatic habitat.

The project involves installing 18,000 feet of segmented breakwater that would extend from the Dauphin Island Bridge to north of Bayfront Park in order to reduce erosion and stabilize the shoreline. Additional project components include 115 acres of salt marsh restoration, achieved through the beneficial re-use of 550,000 cubic yards of dredged materials, as well as 30 acres of oyster reef habitat restoration. This project would further enhance protection for the Dauphin Island Parkway, the only evacuation route for the Town of Dauphin Island, while helping to stabilize the shoreline at Bayfront Park. The project specifically contributes to habitat restoration, shoreline protection, and improved water quality.

33 RIVERS FEEDING THE GULF

The area of land where streams, snow, and rainfall collect and enter a common water outlet, like a bay, a river, an ocean, or a lake is called a watershed. There are 2,110 different watersheds in the continental United States.

Think of a storm drain. Leaves and sticks that fall on roofs enter gutter systems. That water runs across lawns, picking up soil and fertilizer along the way. Much of what enters the water is likely to gather in the storm drain. A watershed acts in the same manner. If pristine water enters the system, it will improve the water quality in the receiving water. On the other hand, any pollutants that enter a watershed can harm downstream lakes, rivers, and bays.

Thirty-three major rivers drain into the Gulf of Mexico. The Mississippi and Atchafalaya Rivers provide 80-90% of the fresh water and 95% of all sediment entering the northern Gulf from rivers. An enormous swath of land encompassing thirty-one states and more than half of the land mass of the continental United States makes up the Gulf watershed.

Preserving the function, quality, and habitat of waters and wetlands along these rivers will in turn benefit the ecological health of the Gulf itself.

For more information about NWF efforts in Alabama, contact:

Jill Mastrototaro
Alabama/Mississippi Gulf Restoration Policy Specialist
MastrototaroJ@nwf.org

Photo: Bon Secour


Photo: Shutterstock

MISSISSIPPI

The Mississippi Coast boasts a diverse ecosystem that spans barrier islands and seagrass beds, meandering waterways and maritime forests. The 86-mile-long Mississippi Coast has as its centerpiece the Mississippi Sound, an ecosystem that includes fresh and saltwater environments. Several major river systems feed into estuarine bays that connect to the Sound. This intricate system provides habitat for many wildlife species and supports the state's $700 million per year commercial and recreational fishing industry.

The Mississippi Coast's barrier islands are integral to maintaining the ecological balance of the Sound. The barrier islands also help defend local communities against tropical storms and hurricanes. Four of these islands are preserved under the Gulf Islands National Seashore; another two make up the state's sole federally-designated wilderness areas. The Mississippi Coast serves as the cornerstone of the state's natural resource-based economy, and wildlife tourism alone generates nearly $2 billion each year for the coast's three counties.

Yet the health of Mississippi's fragile coast is jeopardized by coastal erosion, water quality problems, and development pressures. With an annual erosion rate of 200 acres a year decimating its compact coastline and disappearing barrier islands, important coastal habitats and crucial storm protection for communities are rapidly being lost. Coastal development pressures have altered waterways and shorelines and paved over habitat, resulting in fragmented ecosystems and poor water quality. Oyster reefs are at an historic low. The six environmental restoration projects identified below restore, protect, and promote the ecologic and economic health of the Mississippi Coast.

Gulf Islands National Seashore Acquisition

Gulf Islands National Seashore spans two barrier island chains off the Mississippi Coast and the Florida Panhandle. Spreading 160 miles from Cat Island in Mississippi to the eastern tip of Santa Rosa Island in Florida, the Seashore includes Horn and Petit Bois Islands, both federally-designated wilderness areas. A unit of the National Park System, the Seashore's submerged territories support productive fisheries. Terrestrial habitats within the park include beaches, dunes, salt marsh, and dense maritime forest. These islands and adjacent coastal systems provide essential habitats for threatened and endangered species, such as piping plover, sea turtles, and Gulf sturgeon.

The barrier islands are experiencing accelerated erosion and degradation, especially in the wake of recent hurricanes. Without action, continued erosion of the barrier islands will increase the salinity of Mississippi Sound, compromising the integrity of the ecosystem. This project will provide additional protection of these barrier islands through the acquisition of land and conservation easements from willing sellers.

Additional valuable habitat will be protected through a second acquisition of Marsh Point, a 511-acre peninsula of wetlands immediately south of the Davis Bayou Area. This project will protect the integrity of the Mississippi Sound, support the local economy through tourism, and enhance community resilience against storms and sea level rise.

Bay St. Louis and Biloxi Bay Oyster Reef Restoration

Bays and estuaries along the Mississippi Coast once supported a thriving oyster industry, but overfishing, habitat alteration and declining water quality have reduced natural oyster reef habitats by more than 90 percent in some areas. Historically oyster reefs have played an important role in maintaining the ecological integrity of near-shore waters. They improve water quality through filtration, provide important habitat for fish and other aquatic species, and support marsh creation by trapping sediment. Oyster reefs also serve to dampen wave action, which reduces coastal erosion and helps to protect coastal communities from tropical storms.

The proposed project will construct up to 600 acres of sub-tidal oyster reef habitat using cultch (i.e. natural oyster shell, crushed limestone) in Bay St. Louis and Biloxi Bay. Both bays have historically supported oyster reefs, and previous local oyster reef restoration efforts have resulted in fully functional reefs that are contributing to productivity and biodiversity, as demonstrated through post-project monitoring. The project will first identify suitable deployment locations and these sites would be closed to commercial harvest to promote greater biomass.

This project would help restore the productivity and biodiversity of Bay St. Louis and Biloxi Bay by providing increased water filtration, nursery habitat for commercially and recreationally important fishes (e.g., spotted sea trout, black drum, southern kingfish, and Gulf sturgeon) and invertebrate species, enhanced food sources for wildlife such as shorebirds, and additional protection for shorelines and marshlands. The project is consistent with state and federal restoration plans for Mississippi's sub-tidal oyster reefs. In addition, the proposal will support the economy of the local and regional recreational and commercial seafood industry.

Pascagoula River Marsh Restoration

The Pascagoula River system is one of the last unimpeded major river systems in the lower 48 states. This watershed supplies a large portion of the fresh water entering the Mississippi Sound, supporting the health and diversity of low-lying flatlands, forested wetlands, and highly productive marshlands. The Pascagoula River transports nutrients that play a critical role in maintaining the productivity of these coastal waters, as well as providing sediment necessary to maintain extensive salt marsh habitat, which in turn regulates the discharge of nutrients into coastal waters. These marshes are threatened by a rapid expansion of invasive species, primarily caused by disturbances in river hydrology, which have led to loss of native trees and marsh plants. Two species of invasive plants, giant salvinia and Chinese tallow, are the greatest threat to native species. Because the marshes are important for sustaining the coastal ecosystem, changes in marsh area, plant species, and bio-geological habitats adversely affect water bodies that they help buffer.

This project would aim to restore approximately 11,150 acres of marsh habitat near the mouth of the Pascagoula River through hydrologic restoration, coupled with invasive species control and replanting of native marsh vegetation. The area would be treated with herbicidal and biological controls to reduce invasive species, as well as mechanical removal of Chinese tallow trees. In addition, hydrological restoration and replanting would occur along the Turner tract, a 42-acre estuarine fringe swamp forest, achieved by improving water flow through the wetland and replanting with native vegetation.

Grand Bay Acquisition/Restoration

The Grand Bay National Wildlife Refuge, in Mississippi and Alabama, was established to protect one of the largest expanses of undisturbed pine savanna habitat in the Gulf Coastal Plain region. Pine savanna makes up the largest portion of the refuge, interspersed with poorly drained evergreen bays and pond cypress stands graduating to estuarine salt marshes to the south. The marshes on the southern portion of the refuge provide wintering habitat to about 16 percent of coastal Mississippi's total waterfowl population, including lesser scaup, redhead, ring-necked duck, mallard, and American widgeon. In addition to birds, the marshes are extremely important to many recreational and commercial fish species, including speckled trout, red drum, and flounder. Goals of the refuge include conserving valuable riverine habitat, protecting threatened and endangered species, restoring and protecting key coastal habitats, and managing populations of migratory birds and other trust species. This project consists of property acquisition and restoration with strong emphasis on assessing a suite of potential restoration options to ensure acquisitions are highly strategic.

OYSTER REEFS: HIDDEN GEMS OF THE GULF

Oysters are not just a treat for seafood lovers, they play an essential role in the ecology of the Gulf. An adult oyster can filter as much as 50 gallons of water per day, and oyster reefs provide important habitat for many economically important species of fish. Oysters live in estuaries—water bodies formed where fresh water from rivers mixes with saltier water from the Gulf. Oysters need this brackish water and are vulnerable when water in an estuary remains either too salty or too fresh for an extended period.

Oyster reefs have declined dramatically across the Gulf's estuaries for a multitude of reasons, including overharvesting, dredging, and changes in the quality, quantity and timing of fresh water reaching the estuary. For example, Mississippi Sound and Pensacola Bay are estimated to have each lost more than 90% of their historical oyster reefs. And oyster loss is an ongoing problem—nearly 60 percent of the reefs in Galveston Bay were destroyed by Hurricane Ike. Despite this decades-long decline, the Gulf Coast still produces two-thirds of the nation's oysters. In many places, conditions are right for restoring lost reefs and recreating the services oyster reefs provide. Oyster reefs provide the following benefits:

- Improve water quality: Oysters filter water, consuming algae and other plankton, in turn reducing sediment and nitrogen pollution. Increasing water clarity and water quality makes the area more attractive for fishing, swimming or boating and also encourages the growth of seagrass and marsh grasses.

- Protect shorelines from erosion: Oyster reefs mitigate shoreline erosion, a problem in many estuaries. By dampening wave energy, reefs allow marsh grasses to grow; the roots of these grasses help hold the shores together. Oyster reefs can play a significant role in reducing storm surge.

- Provide wildlife habitat: Oyster reefs provide valuable habitat for economically important species of fish, shrimp and crabs. More than 170 marine species have been documented at oyster reefs in the northern Gulf.

- Grow the economy: For the reasons above, oyster reef restoration efforts have significant economic benefits. Reefs help avoid costs associated with coastal erosion and storm damage while creating measurable benefits for water quality and local fish populations. Therefore investing in oyster reef restoration will create tourism and fishing jobs and boost quality of life.

Turkey Creek Ecosystem Restoration

The Turkey Creek Watershed spans approximately 11,000 acres of forests, wetlands, agricultural areas and urban development. Turkey Creek flows approximately 13 miles from its headwaters to its confluence with Bernard Bayou, an important estuary within Biloxi Bay. Turkey Creek has been identified by the Mississippi Department of Environmental Quality (MDEQ) as an impaired water body, impacted by encroachment, changing land-use patterns, and channel modifications, which together have resulted in loss of habitat, flooding, and degradation of a once-natural waterway.

The Turkey Creek Ecosystem Restoration project site comprises 689 acres of an undeveloped area of degraded wet pine savanna habitat, south of an existing railway located atop an elevated berm. A smaller, 190-acre degraded pine savanna wetland is located north of the railway, which fragments the wetland habitat and substantially alters the hydrology of the northern sector. In addition, several miles of ditches have been dug throughout the site for past agricultural use. These wetland habitats have been identified by the U.S. Fish and Wildlife Service as of high value for native species and as relatively scarce or becoming scarce on a national or eco-region basis. Measures required to restore hydrology and natural vegetation on the site include the filling of drainage ditches, road removal, and controlled burning to allow the wet pine savannah environment to continue naturally as a functional system. One of three initial projects funded through the National Fish and Wildlife Foundation's Gulf Environmental Benefit Fund includes watershed planning for Turkey Creek, which demonstrates the watershed's ecological value and restoration significance.

Living Shorelines Wetlands Restoration Projects, Mississippi Gulf Coast

Loss of historic coastal marsh due to shoreline erosion continues to be a major problem across the entire Gulf Coast, and in Mississippi, estuarine marshes are considered to be imperiled. Continued loss of the intertidal zone to shoreline hardening has severed the hydrological connection between the Gulf and coastal wetlands, sometimes eliminating the wetlands altogether. These losses have negatively affected large numbers of marine species dependent on estuarine nursery grounds. Intertidal zones provide essential habitat and nutrition for many life stages of aquatic species as well as refuge from predation, and are ultimately required for the survival and recovery of viable fisheries.

Three areas of rapidly eroding wetland shorelines, totaling 2.25 miles, were selected for this project, based on either public ownership of lands or willing private landowners. In each area, documented shoreline erosion has sometimes exceeded 250 linear feet over 50 years. The Mississippi Department of Marine Resources will encourage various methods of habitat-friendly erosion barriers to minimize impacts to critical habitat for recreationally and commercially important species. Methods include placement of oyster-based living shoreline structures along selected wetlands. These structures will prevent further erosion and are designed to accrete sediments, leading to re-creation of lost marsh habitat. Over the long term, establishment of an oyster reef and a wetlands corridor will enhance habitat and sustain species of finfish and shellfish, including commercially fished species like shrimp, crab, spotted sea trout, red drum and bull minnows. Living shoreline projects like this one create and protect habitat for a variety of species while supporting the seafood and recreational fishing industry.

For more information about NWF efforts in Mississippi, contact:

Jill Mastrototaro
Alabama/Mississippi Gulf Restoration Policy Specialist
MastrototaroJ@nwf.org

Photo: iStock

Photo: Steve Bender

LOUISIANA

Louisiana's estuaries, barrier islands, and vast coastal wetlands are critical for the ecological and economic productivity of the northern Gulf of Mexico. Over the last 7,000 years, the changing course of the nation's largest river—the Mississippi—built the 6.2 million acres of swamps, barrier islands, and coastal wetlands that we now know as the Mississippi River Delta. But, short-sighted management of the river for navigation and flood control, combined with decades of marsh-destroying oil and gas development, has caused 1.2 million acres of coastal land to disappear since the 1930s. And the devastation continues: on average, Louisiana loses an area of land the size of a football field every hour.

Even in its current state, the Mississippi River Delta remains one of America's great landscapes. An estimated 100 million birds can be found in the state annually. Louisiana's vast coastal area generates more than $19 billion annually in revenues from hunting, fishing and wildlife watching. The state's commercial fisheries—valued at $2.85 billion per year, provide seafood for markets across the U.S. The entire nation is enriched by the Mississippi River Delta's bounty and will benefit from its revitalization.

The 19 projects below are major components of the Louisiana Coastal Master Plan, which was developed after months of comprehensive scientific research, modeling and stakeholder input and approved by the state legislature in 2012. Grouped within five distinct estuarine basins across the Louisiana coast, the projects on this list were identified as the most urgent and most compliant with applicable funding criteria. Projects selected emphasize long-term sustainability through re-establishment of natural processes, ecological benefits, net wetland acreage restored or benefited (compared with a "future without project" baseline), cost effectiveness and conservation of important estuarine habitat and wildlife resources.

Pontchartrain-Maurepas Basin Projects

The Pontchartrain-Maurepas Basin is dominated by three large estuarine lakes that are connected by tidal passes. Habitats in the basin include bottomland hardwood forest, freshwater swamps and marshes, and brackish and saltwater marshes. In the upper basin, swamps are cut off from the nourishing fresh water, nutrients and sediment of Mississippi River by levees installed for flood protection and navigation. As a result, these swamps are sinking and converting to marsh and open water. Marshes in the lower part of the basin are suffering from similar problems; exacerbated by navigation canal and levee construction, they are rapidly becoming open water. The freshwater swamps once found in the lower basin have almost completely disappeared.

The priority projects chosen for this basin restore freshwater flows from the Mississippi River into the upper basin swamps (West Maurepas) and lower basin marshes (Central Wetlands Diversion). They also restore or sustain two marsh or swamp landbridges: one between lakes Maurepas and Pontchartrain, and one between Pontchartrain and Borgne. These projects help to prevent these three lakes from becoming a single arm of the Gulf. The built or sustained marshes will provide not only important habitat to birds, fish and wildlife, but they will also help buffer the new surge barrier on the east side of Lake Borgne (Golden Triangle) which greatly enhances

storm surge protection for Greater New Orleans. The first two diversions are necessary for the long-term success of the latter two projects.

West Maurepas Freshwater Diversion

This Mississippi River diversion project is located in the vicinity of Convent/Blind River between New Orleans and Baton Rouge and would benefit the western Maurepas Swamp and landbridge. Dominated by bald cypress, this swamp is one of the largest forested wetlands in the nation and is home to one of the highest concentrations of breeding prothonotary warblers in the world, among other wildlife. However, levees along the Mississippi River and the closure of Bayou Manchac have isolated the area from spring floods and the vital fresh water, nutrients, and the sediments they bring. This isolation, coupled with rising salinities throughout the Pontchartrain Basin, has left the swamp in a state of rapid decline. The West Maurepas Diversion will benefit the swamp by reconnecting it with the river, preventing further loss and conversion to open water, as well as helping to temper rising salinities throughout the entire Pontchartrain Basin.

Central Wetlands Diversion and Wetland Restoration

This diversion project would benefit the Central Wetlands in eastern Orleans and St. Bernard parishes, including the Bayou Bienvenue Triangle. The area was once primarily a freshwater system, dominated by bald cypress swamp and freshwater marsh. Today deteriorating brackish marsh is the predominant habitat type and much of what was swamp is now open water. The destruction of swamp habitat was caused by saltwater intrusion into this system through the Mississippi River Gulf Outlet navigation channel. This project will help sustain remaining marsh and swamp in the Central Wetlands and will facilitate restoration of marsh and swamp in areas that are now open water by utilizing dredged river sediment through a sediment-conveyance pipeline. Additionally, fresh water from this project could help maintain optimum salinities for oysters and other estuarine organisms in the nearby Lake Borgne and Biloxi marshes.

Golden Triangle Marsh Creation

This marsh creation project is located near the confluence of the closed Mississippi River Gulf Outlet shipping channel and the Gulf Intracoastal Waterway. Dominated by brackish marsh, this area was badly damaged by saltwater intrusion and erosion following the dredging of the Mississippi River Gulf Outlet. It was the principal conduit for storm surge into the city during Hurricane Katrina. This project will use a sediment-conveyance pipeline from the Mississippi River to create and restore marsh in the area. This restored marsh will help buffer the newly constructed surge barrier and provide important habitat to birds, fish, and wildlife.

New Orleans East Landbridge Restoration

This marsh-creation project is located in east New Orleans on a narrow landbridge separating Lake Pontchartrain from Lake Borgne, where local subsidence and canals have raised salinities. This, combined with exposure to high wave energy, has resulted in rapid retreat of the shoreline and the expansion of ponds and lakes within the marsh. This project will create and restore marsh via a sediment-conveyance pipeline. Restoration of the project area is a critical landscape feature. It separates Lake Pontchartrain from the Gulf, providing not only estuarine habitat, but also is a crucial line of defense from storm surge for more than 1.5 million people in eight parishes that include the cities of New Orleans, Laplace, Madisonville, Mandeville, and Slidell.

Breton-Chandeleur Basin Projects

The Breton-Chandeleur Basin is a large open sound bordered on the east by remnants of a barrier island chain and on the west by the Mississippi River flood-protection levee system. Habitats in the basin range from freshwater to saltwater marshes. To the north is the Biloxi Marsh, which is among the most stable marsh platforms remaining in coastal Louisiana. But wave-induced erosion along the marsh edge has contributed to significant loss. Marshes in the mid-part of the basin have been starved of sediment for almost a century and have some of the highest recent marsh-loss rates along the coast. In contrast,

marshes in the lower basin periodically receive fresh water and sediment during high flow periods from the last stretch of un-leveed river and have much lower rates of loss.

The priority projects selected for this basin reintroduce sediment and freshwater flows from the Mississippi River to slow the rate of land loss, strengthen soils, and build new land in the mid-basin (Mid-Breton Sediment Diversion) and in the lower basin (Lower Breton Sediment Diversion). Two projects—the Bayou la Loutre Ridge restoration and the Biloxi Marsh Oyster Reef—will provide natural structural protection by reducing wave and tidal energy, thus prolonging the life of the marshes while providing habitat for neotropical migratory birds on the ridge and for fish on the reef.

Mid-Breton Sediment Diversion

To be located along the east bank of the river, perhaps in the vicinity of White Ditch (about 25 miles below New Orleans), this sediment diversion will convey fresh water and sediments from the Mississippi River into deteriorating marshes that drain into Breton Sound. The brackish marshes in the influence area have rapidly disappeared due to a combination of changes in the supply and distribution of fresh water, rapid subsidence, saltwater intrusion, sediment starvation and storm events. This project will reconnect the influence area with the river and divert sediment and fresh water during flood pulses, building new land and sustaining existing marsh.

Lower Breton Diversion

This Mississippi River sediment diversion project is planned for lower Breton Sound along the east bank of the river. The brackish and salt marshes in the influence area have low rates of loss relative to many other parts of the coast, which may be attributed to the sediment and fresh water it periodically receives when the river overtops the natural levee during high flows. This project will divert sediment and freshwater into the basin to build new land, maintain existing marshes and increase the resiliency of the influence area to sea level rise and storm events.

Bayou la Loutre Ridge Restoration

This project will restore the Bayou la Loutre Ridge, which stretches from the Mississippi River Gulf Outlet to the Biloxi Marsh. The Bayou la Loutre Ridge is actually two parallel natural levees flanking old Bayou la Loutre, which is part of the structural underpinning of the Biloxi marshes. Construction of the Mississippi River Gulf Outlet breached the ridges, dramatically altering the hydrology of the area and leading to saltwater intrusion and extensive wetland loss. Increasing salinity has led to decreasing plant diversity on the ridge, and even salt-tolerant live oaks are now dying. The purpose of this project is to re-establish the ridge by adding soil and elevation to improve basin hydrology, provide storm-surge protection, and decrease saltwater intrusion. It will also provide more diverse ridge habitat for wildlife, including important resting habitat for migratory birds before and after their spring and fall flights across the Gulf, and a higher-ground refuge for marsh species during tropical storms.

Biloxi Marsh Oyster Reef

This project will build an oyster barrier reef along the eastern shore of the Biloxi Marsh. The Biloxi Marsh platform is relatively stable geologically. However, erosion on the marsh edge by wave action has resulted in significant loss of this productive habitat. Re-establishment of once-common vertical oyster reefs in conjunction with the reintroduction of Mississippi River water via the West Maurepas and Central Wetlands diversions will help slow marsh deterioration. In addition to providing protection against waves and storm surge, oyster reefs also provide a broad range of other ecosystem and economic benefits. Once established, these reefs are naturally self-maintaining, and shells from dead oysters are re-worked by waves and currents to provide hard beaches for vulnerable Gulf shorelines as well as nesting habitat for birds, including gull-billed terns and American oystercatchers.

Barataria Basin Projects

The Barataria Basin is one of the nation's most productive estuaries. The basin is bounded on the north and east side by man-made Mississippi River levees, to the west by the high Bayou Lafourche and to the south by a barrier island chain. The Barataria Basin is a vital buffer to storm surge for communities on the West Bank of the Mississippi

River and in lower Plaquemines and Lafourche parishes. The basin hosts a variety of coastal habitats, including bottomland hardwood forests, cypress swamps, marshes ranging from fresh to saltwater, bays and barrier islands. The basin also contains the Barataria Preserve, which is the only natural area on the Louisiana coast that is part of the National Park System. Starved of sediment, habitats throughout the estuary system are collapsing. In the upper basin, bald cypress trees stand in stagnant waters, too deep for new trees to sprout, while freshwater marshes are converting to floating peat in the absence of a sediment source. The sediment-starved brackish marshes in the mid-basin have all but disintegrated. The barrier islands—with no supply of sand from the river—are rapidly eroding, offering little protection from salty Gulf waters that will eat away what remains of the upper estuary habitats.

The priority projects chosen for this basin, include two sediment diversions (Mid- and Lower Barataria), two large-scale barrier island restoration projects (Barataria Pass to Sandy Point and Belle Pass to Caminada Pass) and the rebuilding of a key marsh landbridge (Barataria Marsh Restoration). These projects can work in concert to protect the upper basin freshwater wetlands, re-establish a barrier to Gulf intrusion, enhance storm-surge protection and reintroduce annual infusions of freshwater, sediment and nutrients to build land and sustain existing wetlands.

Mid-Barataria Diversion

This Mississippi River sediment diversion project into the mid-Barataria Basin is located along the west bank of the river, near Myrtle Grove about 25 miles below New Orleans. The brackish and freshwater wetlands in the influence area are highly degraded due to a combination of saltwater intrusion, decreased freshwater supply, alterations to the natural hydrology of the area and a lack of sediment input. This project will reconnect the river to the influence area and divert sediment and fresh water to build new land, maintain existing marshes and increase habitat resiliency to sea level rise and storm events.

Lower Barataria Diversion

This is a Mississippi River sediment diversion into lower Barataria Bay in the vicinity of Empire. Marshes in the project's influence area have become nearly entirely open water due to high rates of subsidence and erosion, without the benefit of new sediment from the river. This project will reconnect the river to the influence area by diverting sediment and fresh water to build new land, provide a sediment source to the Barataria Basin barrier islands, restore historical salinities in the basin and help buffer communities in lower Plaquemines Parish from storm surge.

Large-Scale Barataria Marsh Creation

This marsh creation project is in mid-Barataria Bay in the vicinity of Lafitte. Historically, there was a limited hydrological connection between the fresher upper basin and the saltier lower basin. Canal networks, erosion and subsidence have eaten holes through natural barriers, exposing wetlands in the upper basin to saltwater intrusion and increased wave energy. Long-identified as a critical landscape feature, this project will build on other projects that are already in place or under construction to strengthen the Barataria Landbridge. Sandy sediment conveyed from the river through a pipeline will be used to build new marsh, nourish existing marsh in the area, help restore historic salinities in the upper basin, and help protect the nearby community of Lafitte from storm surge and tidal flooding.

Barataria Pass to Sandy Point Barrier Island Restoration

This barrier island restoration project is located on the southeast side of Barataria Bay and stretches from Barataria Pass to Sandy Point. Storm events, subsidence, wave action, and sea level rise have all contributed to the erosion of these barrier islands. This erosion has decreased barrier island habitat, exposed interior bay marshes to increases in salinity and wave action, and increased the vulnerability of the entire interior of the basin to storm impacts. This project will use sediment dredged from offshore to restore important migratory and shorebird habitat and improve the ecosystem function of the barrier island system, preventing the wholesale loss of the lower estuary.

Belle Pass to Caminada Pass Barrier Island and Headland Restoration

This barrier island restoration project is located on the southwestern side of Barataria Bay from west Belle Pass to Caminada Pass. Sea level rise, successive storm events, subsidence, and wave energy have caused erosion and retreat of the Caminada Headland and Elmer's Island. This sandy barrier system serves as important habitat, helps protect shipping and navigation infrastructure at Port Fourchon, and shelters interior marshes from salt water, waves and storm events. This project will use sediment dredged from offshore shoals to restore these barrier islands and provide protection to Caminada and Timbalier bays by diminishing wave and storm-surge energy.

Terrebonne-Atchafalaya Basin Projects

The Terrebonne and Atchafalaya Basins comprise the central coast of Louisiana. The area is bordered to the east by Bayou Lafourche, a former outlet of the Mississippi River, and to the west by the Chenier Plain. It includes the growing deltas of the Atchafalaya River—the largest remaining natural distributary of the Mississippi River. Habitats in the basin include bottomland hardwood forests, cypress swamps, barrier islands, and freshwater, brackish and saltwater marsh. While the Atchafalaya River and its Wax Lake Outlet on the western side of the basin are building new land, on the eastern side of the basin, wetlands are collapsing and becoming open water as the sediment-starved land sinks and salt water intrudes into freshwater wetlands.

The priority projects selected for this area focus on stabilizing the barrier island system (Isles Dernieres Barrier Island and Timbalier Islands Barrier Island Restoration) and re-establishing a balance of fresh and salt water as well as improved sediment and nutrient distribution. To accomplish that, two of the proposed projects will use the existing network of navigation canals. One project (Increase Atchafalaya River Flow into Terrebonne Marshes) will take advantage of the Atchafalaya River to the west and the existence of the Intracoastal Waterway to move fresh water and sediment eastward. To increase the effectiveness of the project, and the retention times of the fresh water within the basin, a gate (Houma Navigation Canal Hydrologic Modification) is needed to block salt water that currently penetrates deep into the estuary.

Increase Atchafalaya Flow into Terrebonne Marshes

This hydrologic diversion project stretches from the Atchafalaya River to the Houma Navigation Canal, which is part of the Gulf Intracoastal Waterway system. The marshes in the influence area are nearly equidistant between the Mississippi and Atchafalaya Rivers and are blocked from significant amounts of river water and sediment. As a result of saltwater intrusion and sediment starvation, these marshes have been rapidly converted to open water. Dredging and deepening the Gulf Intracoastal Waterway will increase the flow of fresh water from the Atchafalaya River eastward through the waterway to help sustain Terrebonne marshes, and provide sediment for strategic marsh creation.

Isles Dernieres Barrier Island Restoration

This project will restore the Isles Dernieres barrier islands located on the western end of the Terrebonne Basin barrier shoreline. Storm-induced breaching and erosion, sediment starvation, sea level rise, subsidence, and canal-induced hydrological changes have reduced the size of these islands. This loss directly impacts the fish and wildlife of the region and leaves the marshes and infrastructure in the interior of Terrebonne Bay vulnerable to saltwater intrusion, higher wave energies, and storm surge. This project will restore these barrier islands, providing dune, beach and back barrier marsh habitat, which will help reduce the impact of storm surge and waves in the Terrebonne Basin. These islands provide habitat for migratory, wintering, and nesting shorebirds.

Timbalier Islands Barrier Island Restoration

This project will restore the Timbalier Islands located on the eastern end of the Terrebonne Basin barrier shoreline. Sediment starvation, sea level rise, and storm events have driven migration of the islands to the northwest and severely reduced their length and width. This has diminished important barrier island habitat

in the area and increased the vulnerability of interior Terrebonne Bay marshes to high energy waves and storm surge. This project will restore dune and beach habitat and will reduce the impact of storm surge and waves in the Terrebonne Basin and lower Lafourche Parish. These remote islands are important refuges for migratory and wintering birds, and host huge nesting colonies of colonial waterbirds.

GULF WETLANDS IN CRISIS

The Gulf Coast is home to more than half of all saltwater wetlands in the country and the Gulf region also contains nearly 35% of the nation's freshwater wetlands. These wetlands are critical feeding, breeding, and resting habitats for a number of species. They serve critical roles in the ecosystem, filtering pollutants, cycling nutrients, stabilizing shorelines, and providing natural storm protection. Wetland habitats are also important economically, attracting tourists and supporting the seafood and recreational fishing industries.

The most recent federal assessment on the status and trends of wetlands in the conterminous U.S. shows a 25 percent increase in the rate of coastal wetland loss compared to the previous assessment. In the Gulf region alone losses were massive–257,150 acres of wetlands disappeared over a five-year period. However, few places in the world are losing wetlands faster than the Mississippi River Delta, the area where the Mississippi River meets the Gulf of Mexico. Over the past eighty years, this ecologically important region has lost an area of fresh and saltwater wetlands as large as the state of Delaware. Today, the delta loses an area the size of a football field every hour.

Many factors have led to the delta's collapse. The most significant is that the lower Mississippi River has been straitjacketed with levees. The delta's wetlands were once built and sustained over thousands of years by sediment delivered by the river, but levees erected in the past century for flood protection and navigation have blocked that natural land-building and sustaining process. Adding to that, a vast network of channels related to oil and gas extraction and navigation have allowed salt water penetration into freshwater wetlands, killing vegetation and leading to rapid compaction and erosion.

Hurricanes and damage from the BP oil disaster have further affected the wetlands in this, and other, areas around the Gulf. Many of the projects recommended in this document will rebuild coastal wetlands in Louisiana and elsewhere, protecting people while creating needed habitat for wildlife.

Houma Navigation Canal Lock Hydrologic Restoration

This project will construct a lock on the Houma Navigation Canal located in the central Terrebonne basin. The Houma Navigation Canal is a significant conduit for salt water into the rapidly disappearing marshes of the Terrebonne estuary. Construction of this project would help control salinities in the navigation canal and increase the effectiveness of the Increase Atchafalaya Flow into Terrebonne Marshes project by retaining and enhancing the distribution of fresh water in the wetlands north of the lock.

Chenier Plain

The Chenier Plain coast was built by sediment drifting westward over the last 7,000 years from the changing active arms of the Mississippi River, including the Atchafalaya. The sediment was built into beach ridges, or cheniers, running east-west between wide expanses of marsh. The historical sediment transport west along the coastline from the Atchafalaya River has been interrupted by coastal infrastructure. The interior Chenier Plain is characterized by fresh to brackish marshes and interior lakes that are fed by the Vermilion, Mermentau, Calcasieu and Sabine rivers. It is being overwhelmed by saltwater intrusion due to navigation features, such as the Calcasieu Ship Channel, Sabine Waterway, the Mermentau Navigation Channel and the Freshwater Bayou Canal. These channels allowed salt water from the Gulf to penetrate deeply into formerly fresher marshes, leading to widespread marsh loss, while the jetty systems interrupted the flow of sediment from east to west.

The priority projects chosen in this basin focus on increasing sustainability of the basin by reducing tidal movement into Calcasieu Lake (Calcasieu Ship Channel Hydrological Modification) to help reduce interior salinity. In addition, shoreline protection (Freshwater Bayou to Southwest Pass) will reduce shoreline retreat on the critical southeast corner of the Chenier Plain.

Calcasieu Ship Channel Salinity Control Measures

This project is located in the Calcasieu Ship Channel which leads from the Gulf to Calcasieu Lake through Calcasieu River. The Chenier Plain was once a stable wetland platform, but dredging of navigation canals changed the hydrology of the system dramatically. Saltwater intrusion led to the extensive loss of freshwater marshes and increased the threat of storm surge to communities in the lake's interior. This project will construct a structure that will limit saltwater intrusion through the Calcasieu Ship Channel and into adjacent marshes and could also provide minor storm surge protection in the ship channel.

Gulf Shoreline Protection: Freshwater Bayou to Southwest Pass

This project will be located on the eastern side of the Chenier Plain, near Vermilion Bay, extending from Freshwater Bayou to Southwest Pass. Chenier Plain beaches are a critical landscape feature and protect highly productive wetlands from erosion. The project will use shoreline parallel structures to reduce wave energy and trap sediments, slowing shoreline retreat and anchoring the critical southeast corner of the Chenier Plain.

For more information about NWF efforts in Lousiana, contact:

David Muth
Gulf of Mexico Program Director
MuthD@nwf.org

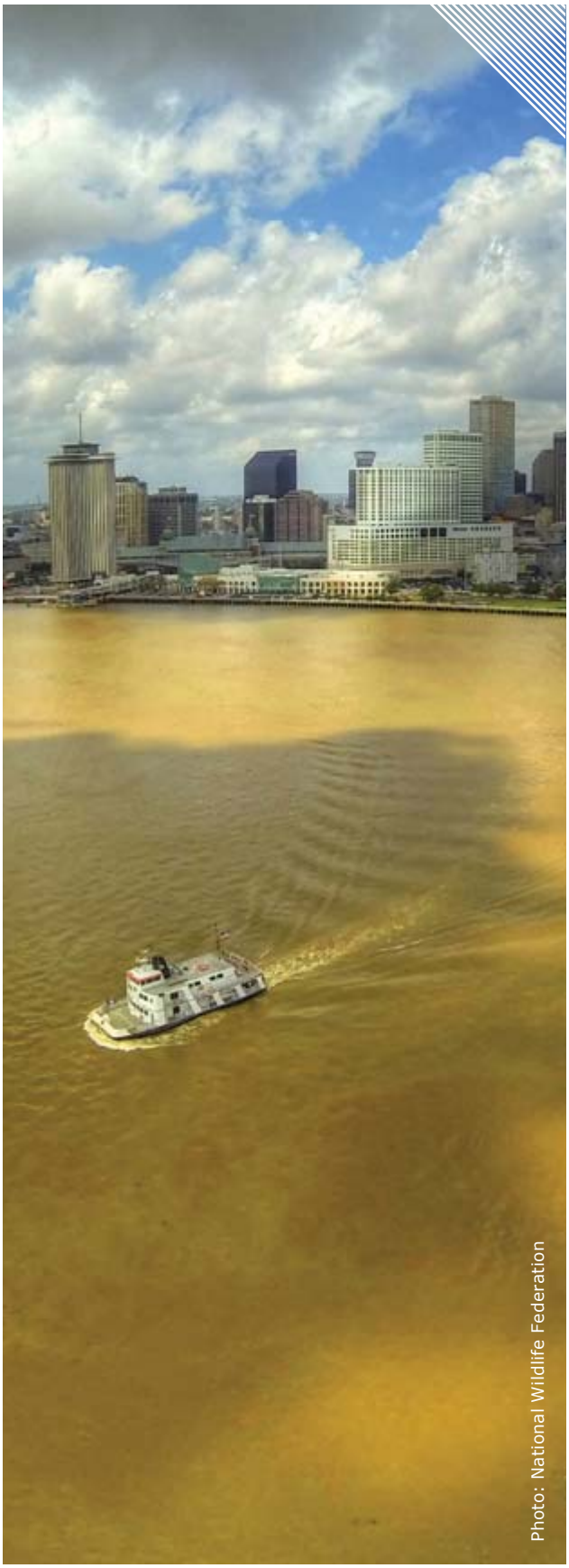


Photo: National Wildlife Federation

Photo: Texas Parks and Wildlife Department

TEXAS

Texas' 367 miles of coastline include seven major estuaries that range from the nearly fresh Sabine Lake on the Louisiana border to the hypersaline Laguna Madre in South Texas. With the exception of the Laguna Madre, which has historically received little fresh water, the continued productivity of these critically important estuaries depends on adequate freshwater inflows from the rivers that feed them.

This fresh water delivers essential nutrients and sediments as it mixes with the salt water from the Gulf and creates favorable conditions for young fish, crabs, shrimp, oysters, and other species. Healthy marsh vegetation, which also requires adequate freshwater inflows, not only provides important wildlife habitat, but also helps maintain the resiliency of the Texas coast by reducing erosion and providing much needed protection against storm surges.

Texas is a drought-prone state with a rapidly growing population and increasing water demands. Without proactive steps to maintain adequate inflows, particularly during dry periods, Texas estuaries are at serious risk. Because so much of the water that flows in Texas' rivers has already been permitted for withdrawal through perpetual water-use permits, affirmative measures are needed to ensure that some of that previously permitted water is set aside for estuary inflows.

The assurance of adequate freshwater inflows is arguably the most critical long-term restoration need on the Texas coast, which is home to robust commercial and recreational fishing industries that together support 23,000 jobs and generate more than $4 billion in revenue each year. Tourism along the Texas coast generates almost $18 billion of spending—over a quarter of all travel dollars spent in the state each year. These industries help drive the state's economy, making the guarantee of adequate freshwater inflows not only an important ecological restoration issue, but also an economic imperative for the overall long-term health of the Gulf coast and the communities and industries that rely on it.

With the exception of the Paso Corvinas Wetlands project, each of the Texas projects listed below will provide significant benefits to coastal habitats, fisheries, and wetlands by delivering additional freshwater flow to key locations. During drought periods, increased flows will help to maintain areas of moderate salinities that can serve as a refuge for salinity-sensitive estuarine organisms until more normal rainfall levels return. At times of more moderate rainfall, improved delivery of freshwater flows will support enhanced productivity. The Paso Corvinas Wetlands project in far South Texas would re-establish a connection between historical wetland habitats and coastal waters, helping to restore critical wetlands function. All of these projects are designed to help improve long-term resiliency of coastal habitats on an ecosystem scale.

Nueces Bay Productivity Enhancement through Wastewater Delivery

The Nueces Bay estuary system near Corpus Christi is a popular recreational fishing area that provides important fishery habitat and supports numerous species of birds and other wildlife. The Coastal Bend Bays and Estuaries system, which includes Nueces Bay, is part of the National Estuary Program. Scientists monitoring the ecology of Nueces Bay have determined that reduced freshwater and nutrient flows into the estuary, due to human alteration, are radically changing the system. As a result,

a panel of scientific experts recently deemed this bay "ecologically unsound" at current inflow conditions.

In this river basin, there is very limited potential for transactions to purchase water upstream to provide increased freshwater inflows to the estuary. Accordingly, this restoration project involves piping treated wastewater for delivery to the bay at an advantageous location. A demonstration project that ended in 2003, which had a 2 million gallons/day (MGD) (2,240 acre-feet/yr) discharge, has already illustrated the ecological benefits of this approach. Because Nueces Bay is in a water-short area of the Texas coast that historically received much less inflow than most other Texas bays, each acre-foot of inflow delivered in a key location provides a comparatively high per-unit benefit. This project, which would provide infrastructure to deliver treated wastewater from a somewhat distant wastewater treatment plant, will deliver between 5 and 8 MGD (5,600 - 9,000 acre-feet/yr) of freshwater inflows and beneficial nutrients to a key portion of the Nueces Bay delta each year.

San Antonio Bay Freshwater Inflows

The San Antonio Bay estuary system is located on the mid-Texas coast and depends heavily on freshwater inflows from the Guadalupe and San Antonio rivers. Bordered in part by the Aransas National Wildlife Refuge, which is the winter home for the only natural migratory flock of endangered whooping cranes, San Antonio Bay provides an abundance of important habitat for fish and wildlife as well as excellent recreational opportunities.

This project involves delivering water to the estuary by purchasing existing water-use permits from willing sellers or paying owners of water-use permits to enter into long-term commitments to not withdraw that water upstream. Downstream delivery points will be established to ensure the water reaches the estuary and, where feasible, storage facilities will be used to help deliver the purchased water to the estuary at times when it provides the greatest ecological benefit. The project will provide up to 40,000 acre-feet/year of reliable inflows to the San Antonio Bay system as compared to future conditions without the project.

Matagorda Bay Freshwater Inflows from the Colorado River

The Matagorda Bay estuary system is located on the central Texas coast and provides important habitat for a wide variety of fish and wildlife. In the Colorado River, which is the major source of estuary inflows, there are limited options for increasing drought-period inflows by paying those with existing water-use permits to not withdraw the water. Accordingly, this project involves purchasing an ongoing right to have water delivered to the estuary from new storage facilities that are planned for imminent development. Although purchasing the right to get water from a new storage facility will result in a relatively high per-unit cost for the water, the availability of storage will facilitate managing a limited quantity of water to maximize environmental benefit by allowing for water to be captured during periods of higher inflows and stored for release during periods of very low inflows. This project will procure up to 15,000 acre-feet/year of freshwater inflows that can be delivered when most needed.

Matagorda Bay Estuary System Freshwater Inflows from Tributary Streams

Because of the limited potential to greatly increase inflows to Matagorda Bay from the Colorado River, this project involves purchasing one or more existing water-use permits from willing sellers on other streams that flow directly into the estuary system. By limiting water withdrawals on one or more streams that reach the bay at a key location, this project will help moderate salinity levels during dry periods to provide a refuge area from which organisms can emerge to help revitalize the overall bay when wetter conditions return. Reduced withdrawals will also improve bay productivity during more normal rainfall conditions. The project will procure up to 10,000 acre-feet/year of water that would otherwise be withdrawn and establish downstream delivery points to protect the flows all the way to the estuary.

Galveston Bay Freshwater Inflows

Galveston Bay, which receives freshwater inflows from the Trinity and San Jacinto rivers, is the largest and most biologically productive estuary in Texas, and a valuable resource for the state and the nation. It provides abundant fish and wildlife habitats, important ecological services, diverse recreational opportunities for a population of about 4.5 million people in surrounding counties, and significant economic and aesthetic value. Galveston Bay is included in the National Estuary Program as one of twenty-eight estuaries of national significance.

This project involves delivering additional water to the estuary by purchasing water-use permits from willing sellers, or paying owners of water-use permits to enter into long-term commitments to not withdraw that water upstream, and then adding downstream delivery points to ensure that the water reaches the estuary. It will provide up to an additional 40,000 acre-feet/year of inflows to the Galveston Bay system during dry conditions as compared to future conditions without the project.

Salt Bayou Siphons

The Salt Bayou system, adjacent to Sabine Lake, comprises approximately 139,000 acres within the Chenier Plain and contains the largest contiguous estuarine marsh complex in Texas. Salt Bayou encompasses freshwater and estuarine marsh, coastal prairie, tidal flats, and freshwater creeks. This diversity of habitats is beneficial for economically important fish and shellfish species such as speckled trout, redfish, Southern flounder, shrimp, and blue crab, as well as wintering and migratory birds. Salt Bayou is therefore widely recognized for its fishing, hunting, and wildlife viewing opportunities.

However, the ecological functions of the Salt Bayou system have been significantly damaged by a long history of land development, including the construction of a rail line and the dredging of the Gulf Intracoastal Water Way. The rail line inhibits sheetflow and increases the duration of flooding in places, damaging marsh habitats. Additionally, the Intracoastal cut off nearly half of the watershed of Salt Bayou, and allowed salt water to intrude into and damage the freshwater portions of the system. Lastly, oil and gas extraction has resulted in land subsidence and a conversion of marsh to open water.

For this project, siphons will be placed at two locations in southern Jefferson County to help restore the hydrologic connection between the freshwater marshes on the north side of the Intracoastal and the degraded marshes on the south side. Hydrologic modeling indicates that a set of siphons in the J. D. Murphree Wildlife Management Area would benefit at least 4,300 acres of marsh, and that another set of siphons in McFaddin National Wildlife Refuge would benefit up to 22,500 acres of marsh. As many as 43,000 acres of marsh may receive some level of benefit if both sets of siphons are installed. These siphons and the diversion of fresh water are part of an integrated restoration plan that has been vetted and developed through the multi-agency Salt Bayou Working group.

Paso Corvinas Wetlands at the Bahia Grande

Historically, the Bahia Grande served as an important nursery for a wide variety of fish and shellfish and was important habitat for wildlife and wintering waterfowl. However, the natural tidal flow between Bahia Grande and the Laguna Madre was cut off by construction projects, and for nearly 70 years the degraded wetland was a source of blowing dust, a site of massive fish kills, and a complicated natural resource problem. In 2000, Laguna Atascosa National Wildlife Refuge acquired the 21,700-acre Bahia Grande Unit located between the towns of Laguna Vista and Brownsville, Texas. Almost half of the unit is wetlands, including the 6,500-acre Bahia Grande basin for which the tract of land was named.

In 2005, a pilot channel was constructed that connected the Bahia Grande to the Brownsville Ship Channel and the waters began flowing into the main basin and refilling the wetland. In 2007, two interior channels were cut that reconnected the larger basin to two smaller interior basins, enabling some tidal exchange.

The recommended next phase of the project focuses on the wetland area around the road called Paso Corvinas, which was historically a tidally influenced wetland. However, in recent decades a land barrier has formed between this area and the Bahia Grande. This new phase involves:

1. Conducting a hydrological study to determine dimensions of needed channels;

2. Construction of a channel through the elevated land barrier to connect the wetland around Paso Corvinas to Bahia Grande;

3. Construction of a second channel to connect the newly flooded wetland to another low-lying area; and

4. Installation of a water control structure under the road dividing the wetland of Paso Corvinas to control freshwater inflow. As wetland productivity is improved, the area will again provide habitat for a variety of wildlife, particularly shorebirds, wading birds, and waterfowl.

For more information about NWF efforts in Texas, contact:

Amanda Fuller
Texas Gulf Restoration Policy Specialist
FullerA@nwf.org

Photo: National Park Service

Photo: iStock

CONCLUSION

It will likely be many years, even decades, before scientists are able to systematically tally the impacts of Deepwater Horizon spill on the ecosystem of the Gulf of Mexico. Four years after the well was capped, there are signs that not all is well in the Gulf: Bottlenose dolphins are sick and dying, oyster reproduction remains low, and hundreds of dead sea turtles are found every year.

The Natural Resources Damage Assessment process is currently evaluating the ecological impacts from the Deepwater Horizon and will require the companies responsible for the disaster to pay full restitution. However large the fines, in many cases, it will simply not be possible to undo the damage done.

The Deepwater Horizon oil spill is the not the only ecological adversity facing the Gulf. Over the past several decades, we have dramatically changed how all of the major rivers flow into the Gulf's coastal waters—and not for the better. The rivers that nourish the Gulf of Mexico have been blocked behind dams, forced into artificial channels, polluted by urban and agricultural uses, and diverted for use in distant cities.

Restoring the health and functionality of the Gulf of Mexico's estuaries will benefit the health of the entire Gulf ecosystem, boost the regional economy and improve quality of life on the coast. The portfolio of projects outlined in this document is a snapshot of opportunities to create tangible benefits for people and wildlife; we anticipate providing information about similarly worthy investments in the future.

The National Wildlife Federation has long been committed to improving the health of the Gulf of Mexico. In the spirit of the Federation, the culture of the Gulf Coast, and the requirements of the RESTORE Act, it will take support across state lines and from a diverse group of constituents to realize comprehensive and meaningful restoration of the Gulf of Mexico. Please join us in our efforts. As the National Wildlife Federation's first president, cartoonist and conservationist J.N. "Ding" Darling once said, "It is hard to start a fire with one stick of wood."

For more information about the National Wildlife Federation's efforts to restore the Gulf of Mexico, contact:

David Muth
Gulf of Mexico Program Director
MuthD@nwf.org

Ryan Fikes
Gulf of Mexico Program Staff Scientist
FikesR@nwf.org


NATIONAL
WILDLIFE
FEDERATION
JOIN OTHERS IN RESTORING OUR GREAT GULF
Learn more at www.nwf.org/gulf
Inspiring Americans to protect wildlife for our children's future
This report made possible through the generosity of our donors.
www.nwf.org
Photo: Jim Klug, jimklug.com