
SHORING UP THE FUTURE

for the Texas Gulf Coast

Texas General Land Office
George P. Bush, Commissioner



TXGLO

"We are perfectly suited to the task of protecting our coast. The GLO has a unique platform that allows us to provide real solutions, real reform, and real hope to the people of Texas."

*George P. Bush,
Commissioner, Texas General Land Office*



TEXAS COASTAL MANAGEMENT: GLO LEADS THE WAY

This overview of a state at risk illustrates the Texas coast's economic and environmental significance and describes the primary challenges facing the coast today.

As Texans, our diverse coastal landscape is a vital part of our identity. Our 367-mile coast and 3,300 miles of bay front are essential to key aspects of our daily lives. The Texas coast's contributions to the state and the nation are many, ranging from energy and agricultural industries, the port system and military transportation, to commercial fisheries, tourism and recreation. But the coast is at risk from eroding shorelines, powerful storms, lost habitat, impaired water quality and increasing land use and development, thereby exposing inland communities and putting our state's key industries at risk.

As these diverse uses of coastal areas expand, they extend into recreation and conservation activities, at times causing conflicts among users over the coastal environment. In order to properly manage these activities, interested parties must work together to ensure the protection of the Texas coast. The time has come for Texas to create a collaborative approach to plan for and balance human use of coastal resources with protection.

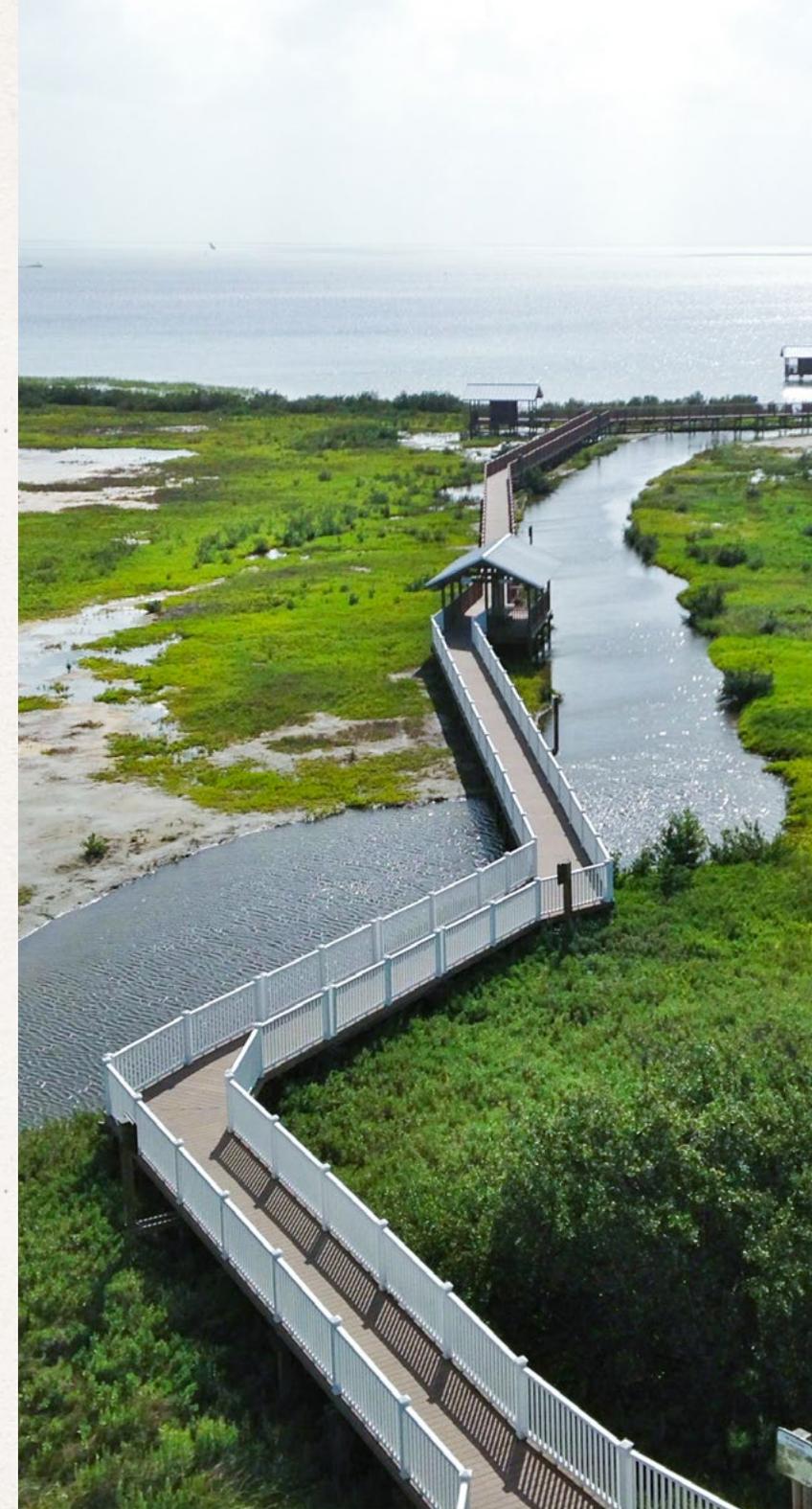
As a steward of the Texas coast, the GLO is developing a long-term coastwide planning initiative that will provide a framework for community, socio-economic,



ecologic and infrastructure protection from coastal hazards (e.g., flooding, storm surge, erosion and habitat loss).

This planning effort will recognize that the state and the nation both benefit from a healthy coastal environment and economy. It also will embrace a partnership-based approach to achieve a resilient coast, use science to identify issues of concern and potential solutions and adapt to meet the needs and changing conditions of the Texas coast. This commitment to preserving our valued coastal resources, promoting a vibrant coastal economy and protecting our shared heritage will ensure the livelihood of Texans for generations to come.

DID YOU KNOW? FEMA ESTIMATES THAT EVERY \$1 SPENT ON MITIGATION TO PRESERVE WETLANDS AND OTHER NATURAL DEFENSES SAVES AN AVERAGE OF \$4 IN THE LONG RUN.



Protecting the State's Most Valuable Coastal Asset – Our People

Rapid development along the coast continues, signaling the need to protect the land that supports ecological health and economic progress, not just on the coast but across the state.

The people living and working in our coastal regions are, by far, the most valuable and vulnerable assets. Texas' 18 coastal counties make up less than 6 percent of the state's land area, but contain 24 percent of the state's population. The population living within the coastal counties of Texas is expected to increase from 6.1 million in 2010 to 7 million in 2020, and to over 9 million by 2050. This means that, in the years ahead, there will be millions more lives and livelihoods to protect from hurricanes and other storm hazards. The increased population and growing business community in coastal regions make it more challenging to evacuate as a hurricane approaches and more vulnerable to the negative impacts of flood and hurricane destruction. Securing the resiliency of

the communities along the Texas coast is the first step towards finding a balance between flood and storm damage reduction, economic growth and ecosystem restoration. This can occur by addressing the most pressing issues of concern along the coast:

- » Altered, Lost or Degraded Habitat
- » Gulf Beach Erosion & Dune Degradation
- » Bay Shoreline Erosion
- » Existing & Future Coastal Storm Surge Damage
- » Coastal Flood Damage
- » Impacts on Water Quality & Quantity
- » Impacts on Coastal Resources
- » Abandoned or Derelict Vessels, Structures & Debris

6.1
MILLION

Number of people living in the 18 Texas coastal counties in 2010, nearly one quarter of the state's population.

9.3
MILLION

Projected population of the Texas Coast by year 2050, an increase of 50 percent.



► To protect critical coastal natural and economic assets, we must move towards a balanced approach to manage coastal uses.



Defending the Texas Coast Protects the Nation

The state's ports, intracoastal waterways and energy production all contribute to a robust Texas and national economy.

Texas Ports: Critical to Our National Defense and Economy

Texas is one of the nation's top states for waterborne commerce, with Texas ports generating over \$82.8 billion in economic value to the state. More than 500 million tons of cargo pass through Texas ports annually, including machinery, grain, seafood, oil, cars, retail merchandise and military freight.

Texas ports help create well-paying jobs that translate to consumer spending and provide significant state and local tax revenues. Texas ports generate \$6.5 billion in tax revenues, support more than 1.4 million jobs and represent approximately 25 percent of the total state Gross Domestic Product. These vast economic benefits highlight that the shutdown of even a single Texas port can deliver a devastating blow to state and national economies as experienced in 2008 when Hurricane Ike came ashore near Houston and Galveston.

Delivering Goods to the Nation

The state's maritime system is a critical gateway to international trade and provides Texas with a multitude of economic opportunities through the movement of waterborne commerce. Texas is one of the nation's leading states in the maritime industry, handling 15.8 percent of total U.S. cargo between 2007 and 2011. Texas ports managed 20.1 percent of the nation's total export tonnage during this period, making it the nation's leading export state. Texas ports also received 26 percent of the total foreign tonnage handled in the U.S.

Texas ports offer critical links to other modes of transportation throughout the U.S., such as major railroad lines and trucking routes. In 2010, 7.4 million tons of intermodal rail freight were shipped from Texas, the nation's third-highest total.



Cost of the 5-day closure of the Port of Houston due to Hurricane Ike. That's about \$322 million per day.

Texas Ports: Supporting Our Nation's Defense

Three Texas ports are designated by the Department of Defense as "strategic military ports," providing surface deployment and distribution for strategic military cargo worldwide. The Port of Beaumont, Port of Port Arthur and the Port of Corpus Christi all serve in the U.S. Maritime Administration's National Port Readiness Network, supporting deployment of United States military forces during defense emergencies. For example, the Port of Beaumont handles more military cargo than any other port in the United States.

In addition to military cargo, the Texas coast literally fuels the nation's military, as well. The Texas coast delivers a larger volume of energy products, such as jet and diesel fuel, to the U.S. military than any other state. Furthermore, the majority of the nation's strategic petroleum reserves are located near Houston.



► The Port of Port Arthur supports the deployment of United States military forces during defense emergencies as part of the U.S. Maritime Administration's National Port Readiness Network.

TEXAS PORTS = JOBS FOR TEXANS

1.4 MILLION JOBS IN TEXAS SUPPORTED BY PORT ACTIVITY

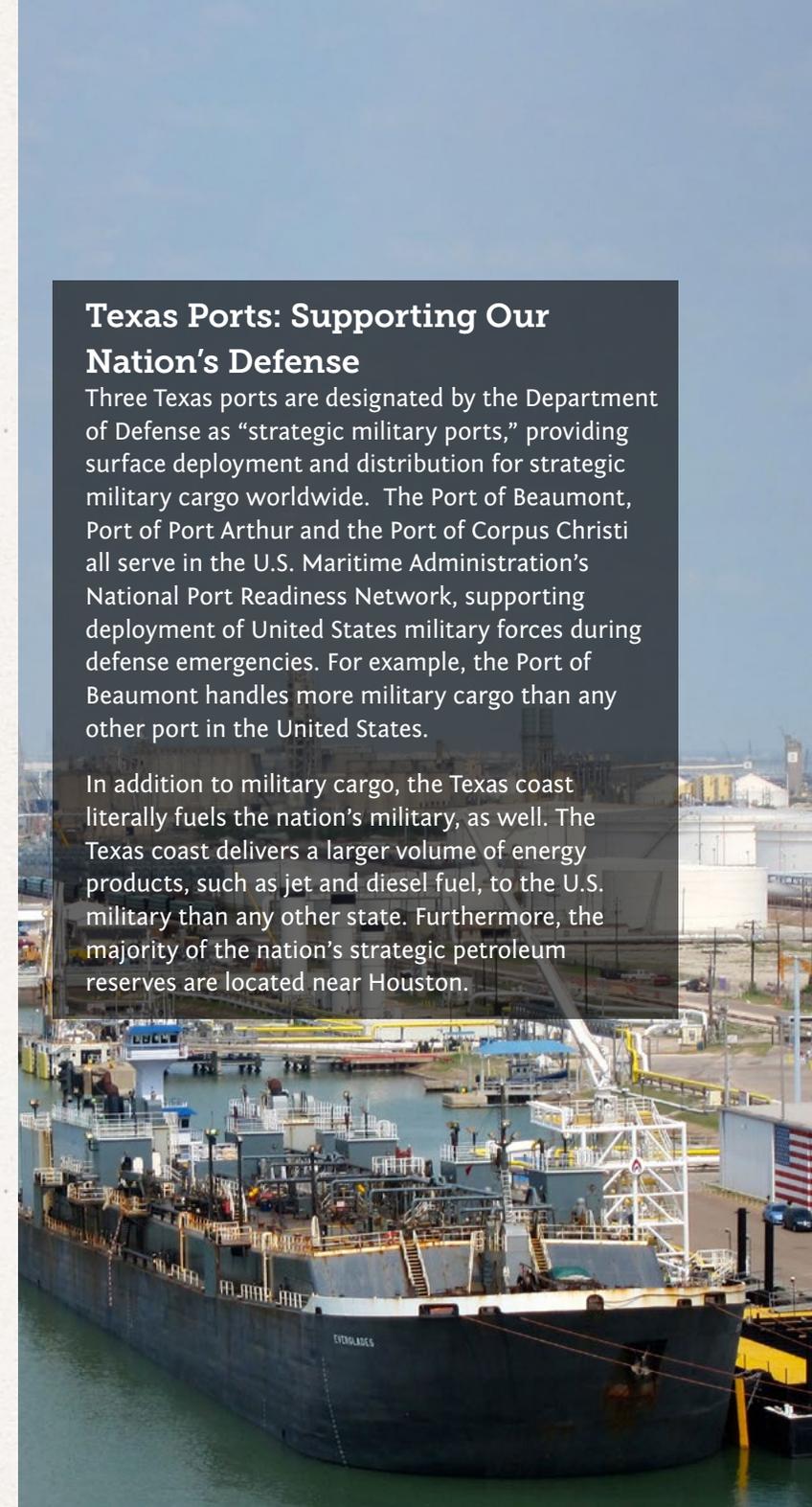
- » Direct jobs: 112,100
- » Induced jobs: 159,683
- » Indirect jobs: 109,193
- » Port client jobs: 1,059,969

\$82.8 BILLION PERSONAL INCOME AND LOCAL CONSUMPTION

- » \$6.7 billion direct wage and salary income
- » \$19.4 billion re-spending and local consumption
- » \$4.9 billion indirect income
- » \$51.8 billion of user personal income

\$6.5 BILLION OF STATE AND LOCAL TAXES

- » \$2.5 billion direct, induced, and indirect
- » \$4 billion industry taxes



Fueling the Nation

Texas plays a key role in the economic and domestic energy security of the nation. Much of this activity takes place around Houston, known as the Texas Gulf Coast Refining District, home to 5,000 energy-related companies and 15 of the 20 largest oil pipeline companies in the nation. Overall, the 27 Texas refineries represent 29 percent of the nation's total refining capacity.

The Texas Gulf Coast Refining District has a distillation capacity of more than 5.1 million barrels of crude oil daily. Texas exported more than \$59.1 billion of petroleum and coal products in 2014, supporting more than 1.1 million jobs through exports. This is by far the largest segment of the state's export market, making it one of the top commodities shipped through Texas ports.

With respect to imports, 63 percent of the value of waterborne imports in Texas in 2014 were petroleum and petroleum products. Texas is also poised to become a leader in exporting liquefied natural gas, a cutting-edge industry that will be part of the world's energy future.

This infrastructure is critical to our national economy, and it is imperative that we provide improved coastal protection measures to ensure our state and nation's stability for years to come.

DID YOU KNOW? A LARGER VOLUME OF ENERGY PRODUCTS IS DELIVERED TO THE U.S. MILITARY THROUGH THE TEXAS PORT SYSTEMS THAN ANY OTHER STATE.



► Petroleum and coal products are one of the top commodities shipped through Texas waterways.



Safeguarding Critical Waterways

Protecting our shoreline is vital to preserving waterways, fisheries and recreational opportunities for all Texans to enjoy.

Eroding Inland Waterways

Barge transportation is fuel-efficient and reduces both highway congestion and emissions compared to truck or rail. The wave action of barges, however, is taking its toll on the Gulf Intracoastal Waterway (GIWW), causing shoreline erosion and wetland loss. These issues are compounded by population growth and the density of development along the coast and adjacent to the GIWW. New housing, marinas, docks, piers and other modifications are restricting and crowding channels, creating additional navigation risks to commercial and recreational users.

Given the significance of the Texas ports, the energy industry and the intracoastal waterways, it is extremely important to protect these vital economic resources from erosion, wetland degradation and hurricane and storm damage.

Healthy wetlands are the least costly method of shoreline stabilization. Developing erosion control measures for the GIWW, including wetland restoration, will protect coastal resources, improve navigation and reduce the frequency and expense of maintenance dredging. This will not only benefit the Texas Gulf Coast region, but the entire state and the nation.

DID YOU KNOW? THE GULF INTRACOASTAL WATERWAY IS THE NATION'S THIRD BUSIEST INLAND WATERWAY, WITH THE TEXAS PORTION HANDLING OVER 63 PERCENT OF ITS TRAFFIC.

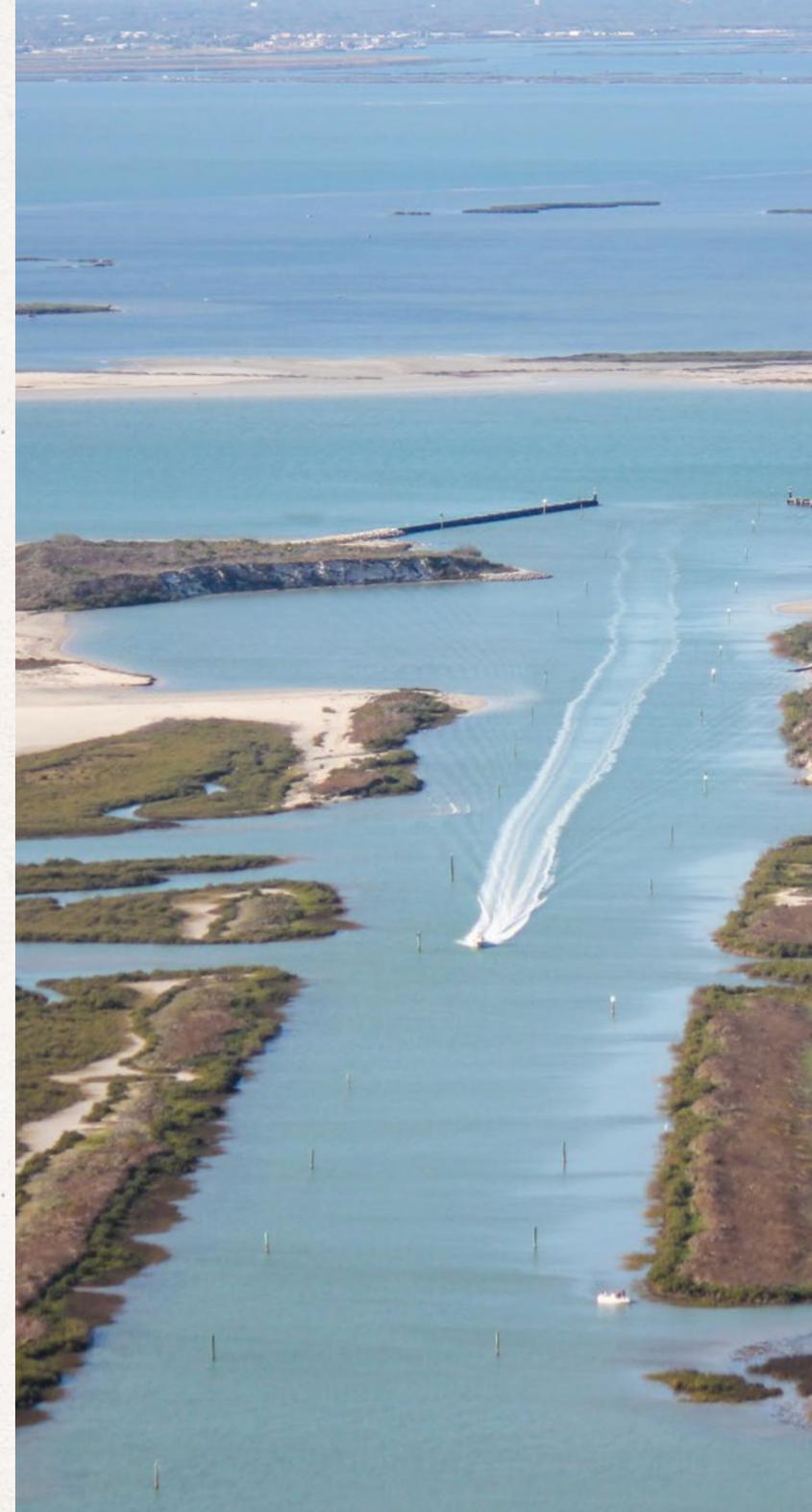


► The Gulf Intracoastal Waterway (GIWW) is one of the nation's most important commercial byways.



\$25
BILLION

Value of cargo passing annually through the 406-mile section of the GIWW that runs along the Texas coast.



Supporting Gulf Seafood and Fisheries

Commercial fishing has long supported local and state economies. In 2014, Texas commercial fisheries brought in \$2.8 billion in sales impacts, \$826 million in income impacts, \$1.2 billion in value-added impacts and 33,880 jobs. Top commercial species include various shrimp, oysters, blue crab, red snapper and black drum. These marine resources are threatened by pollution, water flow modifications, invasive species and stock population declines. For instance, an outbreak of “Red Tide” in Galveston County resulted in a \$9.9 million loss due to fish kills, temporary closure of shellfish harvesting, lost tourism revenue and substantial clean-up costs.

Recreational fishing is also a large economic contributor to the state, generating \$1.8 billion in sales impacts, \$757 million in income impacts and \$1.2 billion in value-added impacts in 2014. Recreational saltwater anglers fish for red drum, spotted trout and flounder in Texas inshore waters, as well as red snapper, tuna, wahoo, marlin and other species in offshore waters. Restoring and expanding coastal and estuarine habitat leads to increases in fish populations, which has a positive impact on the communities and the industries that depend on thriving and sustainable fisheries.



► In 2014, commercial seafood landings in Texas totaled more than \$278 million.



\$396
MILLION

Expenditures on recreational fishing trips in 2014.



\$249
MILLION

Dollars spent on recreational fishing tackle.



16,496

Number of jobs created in 2014 by recreational saltwater fishing.



\$242
MILLION

Landings revenue for shrimp in 2014.





A Healthy Coast Supports Tourism

Outstanding fishing, birding and waterfowl hunting opportunities, as well as family outings to the beach, make the coast the second most popular tourist destination in Texas, keeping the economy strong and creating jobs for both coastal residents and inland workers. Tourists visiting the Texas coast in 2014 spent \$19.7 billion traveling in this region, over \$10.4 million at hotels and motels alone.

The cruise business has been growing at Texas ports, generating over \$1.3 billion for the Texas economy in 2014, a 5.6 percent increase since 2013. The Texas cruise industry also generated 22,689 jobs, with a total wage impact of \$1.42 billion. This is realized from the 1.06 million passenger and crew visits at the two cruise ports of Houston and Galveston.

Additionally, the Texas coast hosts hundreds of miles of nature tourism opportunities. Through conservation management and nature tourism, coastal communities gain economically while protecting their valued coastal resources. Nature tourism contributed more than 6,613 jobs in the Rio Grande Valley alone in 2011. An excellent example of nature tourism, or avitourism, is the Great Texas Coastal Birding Trail, the largest nature trail in the nation, with over 300 birding sites available along the Texas coast.



▶ Whooping Cranes are an iconic endangered species whose native habitat is on the Texas coast.

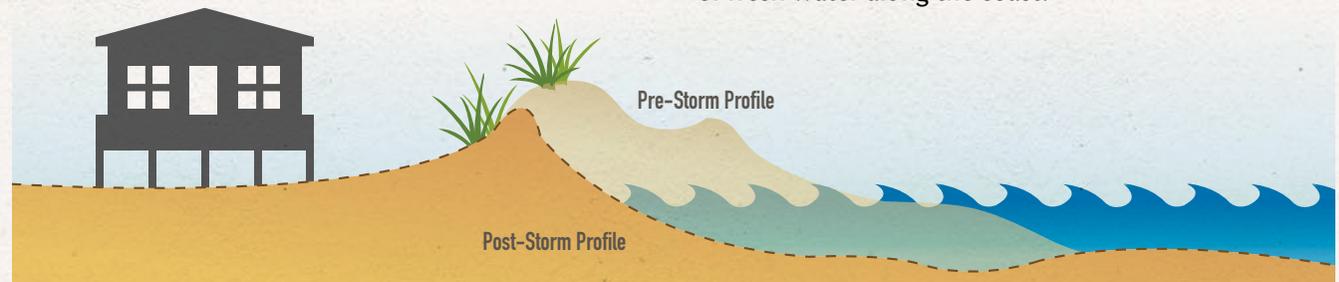
Preserving the State's Ecologic Health

Healthy bays, wetlands and estuaries provide the critical foundation for sustainable environments and thriving economies, both along the coast and throughout Texas. Yet these priceless coastal landscapes are stressed in many places to their breaking point, endangering the tremendous benefits they provide.

Critical Natural Habitat

Coastal habitats help maintain native plant and animal populations, improve water quality, provide recreational and commercial fishing opportunities, enhance local tourism and maintain community resilience by reducing the impact of coastal hazards such as flooding and storm surge. Wetlands and barrier islands serve as nesting and foraging habitats for birds and wildlife, such as sea turtles, and as a nursery for fish, crabs and other shellfish. Unfortunately, these Texas coastal habitats are disappearing as they are encroached upon by development, and are eroded or inundated by rising seas.

► Dunes help prevent loss of life and property by absorbing the impact of storm surge and wave action. They also slow shoreline erosion and replenish eroded beaches after storms.



Deteriorating Lines of Defense

Texas has some of the highest erosion rates in the nation. Shores are retreating an average of 4 feet per year, with some areas experiencing losses greater than 30 feet per year, placing communities, business and infrastructure at risk.

Barrier islands, wetlands and natural sand dunes are the least expensive, most efficient forms of protection for coastal communities. However, to effectively do their jobs, these valuable and fragile landscapes must be maintained and enhanced.

Water Supply

In addition to providing habitat and stabilizing shores, wetlands and oyster reefs absorb and filter estuary waters to provide for safe and healthy swimming, fishing and, most importantly, drinking.

By acting like a giant sponge, wetlands absorb nutrients, sediments and pollutants that would otherwise degrade plant, animal and marine life, and spoil beaches and coastal waters. This sponge effect also helps reduce flood damage and recharge the state's groundwater supply, as water caught by wetlands seeps back into underground aquifers – the source of 60 percent of water used in Texas annually. As wetlands deteriorate, so will the state's reservoirs of fresh water along the coast.

TEXAS COASTAL ECOSYSTEM



Wetlands improve water quality, provide habitat for wildlife, control flooding and erosion, and recharge groundwater supplies.



The **flow of rivers** and streams transports water and sediment to support estuary health, control shoreline erosion and promote barrier island formation.



Estuary **water quality** can be impacted by upstream runoff from agricultural, residential and industrial activities within the watershed.



Oyster reefs act as water purification systems, helping keep waters clean and providing habitat for other aquatic life.



Coastal vegetation, such as seagrasses, mangroves, marshes, swamps and forests, reduce greenhouse gases by storing carbon.



Estuaries provide critical nursery habitat for the majority of Gulf commercial and recreational finfish and shellfish species.

Beaches, bays and barrier islands provide wildlife habitat and allow access to **recreational opportunities** for residents and tourists alike.

Barrier islands, beaches, dunes and wetlands provide the first line of defense against storm surges and inland flooding by protecting infrastructure, like ports and refineries.

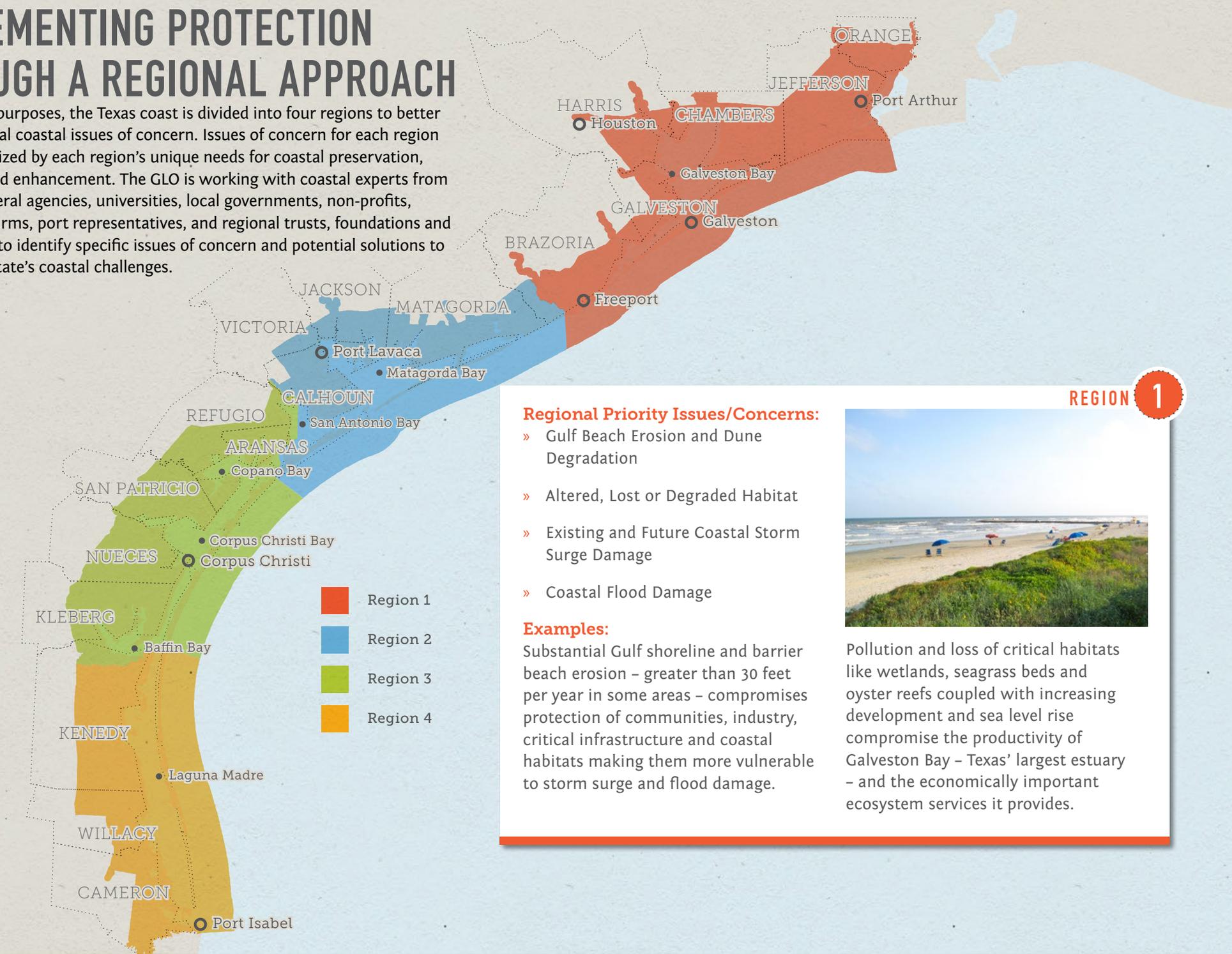
Sustainable fisheries support local economies and provide a bounty of seafood to the nation.

Offshore energy and supporting coastal infrastructure provide a substantial portion of the nation's domestic oil production and refining capacity.



IMPLEMENTING PROTECTION THROUGH A REGIONAL APPROACH

For planning purposes, the Texas coast is divided into four regions to better reflect regional coastal issues of concern. Issues of concern for each region are characterized by each region's unique needs for coastal preservation, protection and enhancement. The GLO is working with coastal experts from state and federal agencies, universities, local governments, non-profits, engineering firms, port representatives, and regional trusts, foundations and partnerships to identify specific issues of concern and potential solutions to address the state's coastal challenges.



REGION 1

Regional Priority Issues/Concerns:

- » Gulf Beach Erosion and Dune Degradation
- » Altered, Lost or Degraded Habitat
- » Existing and Future Coastal Storm Surge Damage
- » Coastal Flood Damage

Examples:

Substantial Gulf shoreline and barrier beach erosion – greater than 30 feet per year in some areas – compromises protection of communities, industry, critical infrastructure and coastal habitats making them more vulnerable to storm surge and flood damage.



Pollution and loss of critical habitats like wetlands, seagrass beds and oyster reefs coupled with increasing development and sea level rise compromise the productivity of Galveston Bay – Texas' largest estuary – and the economically important ecosystem services it provides.

REGION 2**Regional Priority Issues/Concerns:**

- » Altered, Lost or Degraded Habitat
- » Gulf Beach Erosion and Dune Degradation
- » Impacts on Coastal Resources
- » Impacts on Water Quality and Quantity

Examples:

Shoreline erosion and habitat and wetland loss threaten productive estuarine marshes and wetlands, as well as some of the state's important bird rookeries.

Improving water quality to safeguard the region's diverse habitats is a critical concern for the sustained health and productivity of the Matagorda Bay system.

REGION 3**Regional Priority Issues/Concerns:**

- » Altered, Lost or Degraded Habitat
- » Impacts on Coastal Resources
- » Gulf Beach Erosion and Dune Degradation
- » Impacts on Water Quality and Quantity

Examples:

Bay shoreline erosion and habitat loss jeopardize this region's bay systems, which provide important nursery areas for commercial and recreational fisheries and wetland habitat for wildlife and resident and migratory waterfowl and shorebirds.

Population growth and coastal development in this region are causing a loss of coastal habitats and a decline in water quality and quantity, which are both essential for maintaining healthy bay ecosystems.

REGION 4**Regional Priority Issues/Concerns:**

- » Gulf Beach Erosion and Dune Degradation
- » Altered, Lost or Degraded Habitat
- » Impacts on Water Quality and Quantity
- » Impacts on Coastal Resources

Examples:

Gulf beach erosion and dune degradation diminish tourism and critical habitats and reduce public and emergency access.

The decline in water circulation and connectivity in the Bahia Grande and Lower Laguna Madre degrade critical habitats like seagrass beds, which provide habitat and nursery areas for commercial fish and shrimp – a main food source for 80 percent of wintering redhead ducks in the U.S. and further expose communities to impacts from dust and storm surge.

About the Coastal Resources Division of Texas General Land Office

As the steward of state-owned lands, the GLO is responsible for management of the 367 miles of Texas coastline from the beach to nearshore waters and out to 10.3 miles into the Gulf of Mexico, as well as millions of acres of submerged land in our coastal bays. Texas has one of the longest coastlines in the country, where critical coastal habitat lives alongside communities, businesses, refineries and ports.

The Texas coast suffers some of the worst erosion in the country. The GLO works to address erosion problems by renourishing beaches, rebuilding dunes, protecting and stabilizing the shoreline and restoring marsh habitat. GLO coastal programs also help to protect and conserve critical coastal areas, mitigate damage to natural resources, enhance public access to beaches (including ADA-compliant ramps), assist with beach maintenance costs for statutorily-approved counties, and allow the public to access up-to-date information regarding the water quality of the state's recreational beaches.

With diverse responsibilities related to protecting the Texas coast, the GLO works every day to encourage, promote and engage in sound stewardship practices that preserve and enhance the use and enjoyment of the state's natural resources, while fostering economic growth along the Texas coast.

For more information about the General Land Office and its coastal programs, visit www.glo.texas.gov.

"As Texans, we are proud of the shared heritage of our coast. And we will fight to protect that heritage. At the GLO, we have a vision that we can do more to preserve it for generations to come."

*George P. Bush,
Commissioner, Texas
General Land Office*



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A publication of the Texas General Land Office. Funded by a grant from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration pursuant to Award No. NA14NOS4190139. Visit www.ShoringUpTexas.org. Photos courtesy of the Texas General Land Office, Texas Parks and Wildlife Department and the Texas Department of Transportation. Printed **August 2016**.