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SEAGRASS HABITAT
IN THE NORTHERN GULF OF MEXICO:
Degradation, Conservation and Restoration of a Valuable Resource

The Gulf of Mexico Program Habitat Team

The Gulf of Mexico Program (GMP) is a network of citizens dedicated to managing and protecting the resources of the Gulf of Mexico in ways consistent with the economic well-being of the region. Administered by the U.S. Environmental Protection Agency (USEPA), the GMP engages many organizations across the Gulf for leadership on four ecological issues across the Gulf watersheds: (1) public health, (2) excess nutrient enrichment, (3) habitat degradation and loss, and (4) introduction of nonindigenous species. The GMP includes representatives from state and Federal agencies, non-profit organizations, the scientific community, business and industry, and an organized citizens group whose members are individually appointed by the governors of the five Gulf States (Texas, Louisiana, Mississippi, Alabama and Florida).

The GMP has long recognized estuaries and coastal wetlands as vital to providing food and shelter for certain plants and animals, improving water quality, providing sediment filtration and flood and erosion control. In 1999, the GMP's Habitat Team set a goal to restore, enhance, or protect 20,000 acres of important coastal and marine habitats in U.S. areas of the Gulf by 2009. The GMP Habitat Team also developed several objectives to support this goal, including the production of an updated Seagrass Status and Trends Report. The purpose of this report is to provide scientists, managers, and citizens with valuable baseline information on the status of seagrasses in coastal waters of the Gulf of Mexico, and to increase awareness that the seagrasses of the Gulf are of global significance.

To produce this report, the GMP's Habitat Team formed a Seagrass Subcommittee consisting of scientists and environmental managers along the Gulf Coast. This committee provided valuable information regarding the latest seagrass maps, seagrass status and trends, causes of change and current monitoring, restoration, and enhancement activities important to their area.

Cover Image:
Small Photo: Extensive seagrass damage as a result of propeller scarring and boat wake from recreational boating in East Flats, Texas. Photo provided by Bill Harvey, Texas Parks and Wildlife Department.

Large Photo: Undisturbed seagrass habitat in the northern Gulf of Mexico. Photo provided by South Florida Water Management District.

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Gulf of Mexico. Source: SeaWiFS Project, NASA/Goddard Space Flight Center, and ORBIMAGE

Gulf of Mexico Overview

The Gulf of Mexico is a partially landlocked sea that lies in the southeastern quadrant of the North American continent. Mexico and the United States form a continuous shoreline around the majority of the Gulf that extends over 2,500 miles in distance (Britton & Martin, 1989). An arbitrary boundary between northeastern Yucatan and the southern tip of Florida defines the southern boundary and separates the Gulf of Mexico and Caribbean Sea.

For the purposes of reporting the status and trends of seagrasses in the United States, the study area is defined as the waters of the Gulf that lie adjacent to five Gulf States: Texas, Louisiana, Mississippi, Alabama, and Florida, also known as the "Northern Gulf Region." This boundary spans a distance of approximately 1,500 miles, with significant additional shoreline enclosed behind barrier islands or estuarine embayments along the coast. The southwestern boundary of the Northern Gulf Region begins near Brownsville, Texas and spans clockwise, terminating at the eastern most reaches of Florida Bay, which includes the northern boundary of the Florida Keys and Dry Tortugas.

Ecologically, the region is a rich and productive subtropical environment that supports extensive wetland and seagrass habitats (Beck et al, 2000). In 1997, the estimated commercial value of harvested finfish and shellfish from the Gulf was $823 million (NOAA, 1997). Geologically, the region consists of low sandy banks or marshlands that characterize the northern temperate and subtropical gulf shores, with extensive barrier islands, salt marshes, and mangroves present (Britton & Martin, 1989). The shores of the most northern reaches of the Gulf occur in temperate regions and are a product of sedimentary processes influenced by several rivers including the Trinity, Mississippi, Mobile-Tensaw and Apalachicola Rivers. The southern reaches of Florida and Texas experience more tropical climatic conditions, where rainfall and riverine influence are reduced, and clear-water habitats prevail.

The Gulf of Mexico is a dynamic system that has evolved over great lengths of time. However, recent declines in seagrass abundance have impacted the environmental quality of local estuaries, mangroves, and coastal areas. Changes to seagrass habitat can occur over short time periods such as weeks or even days. For example, alteration can be induced by tropical hurricanes, many of which form in the southern Atlantic and move through the Gulf of Mexico. Fortunately, the effects of these destructive events are short-lived and the system usually recovers naturally. Other impacts may be cumulative, such as those caused by anthropogenic sources, and may require remedial action and much longer time periods for recovery.

What are Seagrasses?

Seagrasses are submerged flowering plants growing in bays, lagoons, and shallow coastal waters. Similar to terrestrial vegetation, seagrasses have leaves, stems, flowers, seeds and roots, using the process of photosynthesis to produce food and oxygen. Because seagrasses require light for photosynthesis, good water quality is very important for seagrass survival.

Seagrasses anchor themselves to the seafloor with their root systems. A strong root structure allows seagrasses to withstand strong currents and waves, especially during storm events. Seagrasses differ from their land-based counterparts in that they must reproduce underwater. They accomplish this by producing filamentous pollen grains that can be transported by water currents. Another means of propagation is by the use of underground storage organs called rhizomes. By spreading underground, the seagrass system expands and facilitates vegetative reproduction.

Seagrasses are able to tolerate a wide range of climates, located as far north as Alaska and as far south as the equator in the northern hemisphere. They can withstand temperatures as low as negative 6 degrees Celsius to readings as high as 40.5 degrees Celsius (Phillips & Meñez, 1988). Seagrasses can grow in salinities that range from freshwater to 42 parts per thousand (ppt). However, seagrass has tolerated 50 ppt in Laguna Madre and Florida Bay. The most vibrant stands are normally found occurring in environments between 10 to 30 ppt (Phillips & Meñez, 1988).

Seagrass Species in the Northern Gulf of Mexico

A total of 58 species of seagrasses can be found around the world, consisting of two main families (Phillips & Meñez, 1988; Kuo & McComb, 1989). Short & Coles (2001) state that recent work establishes that there are 60 seagrass species in 4 families and 12 genera. In the Northern Gulf Region, 6 species of seagrass are common. Below is a listing of common species, including family, species, and common name found in the Gulf of Mexico.

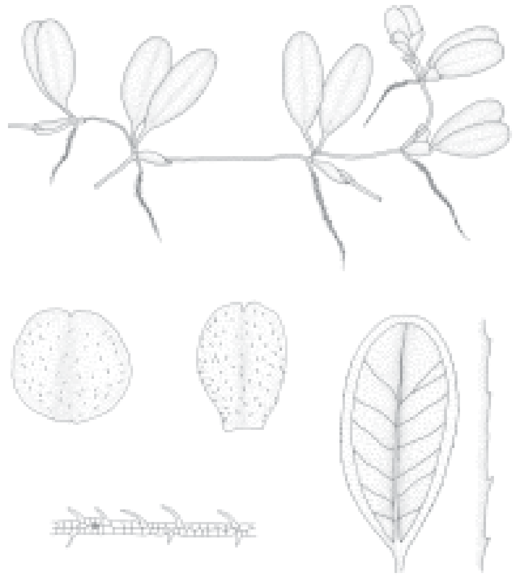
Family	Species	Common Name
Hydrocharitaceae	*Halophila decipiens*	paddle grass
Hydrocharitaceae	*Halophila engelmannii*	star grass
Hydrocharitaceae	*Thalassia testudinum*	turtle grass
Potamogetonaceae	*Halodule wrightii*	shoal grass
Potamogetonaceae	*Syringodium filiforme*	manatee grass
Potamogetonaceae	*Ruppia maritima*	wigeon grass

Due to the diversity of climates in the region, a wide variety of seagrasses are present in the Northern Gulf Region. Some seagrasses adapt better to the more tropical conditions of southern Texas and Florida, while others fare better in the more temperate conditions of the north. The following section provides a brief description of each of the 6 species found in the Gulf and their respective biological and ecological characteristics (Phillips & Meñez, 1988; Fonseca, 1994).

Paddle Grass **(Halophila decipiens)**

Physical Characteristics – Paddle grass is a small species that normally stands 3 to 5 centimeters (cm) tall. Oval blades occur in pairs and are very thin, appearing translucent to the eye. Rhizomes are often located near the surface and are often exposed to the water column.

Habitat Preferences – Due to a shallow rhizome structure, paddle grass is easily uprooted, and therefore, typically grows at depths between 10 and 30 meters (m). *Halophila decipiens* requires less light than other seagrasses and can be found in turbid areas, below docks, or at depths of up to 40 m in clear tropical waters.



Paddle grass. Source: Phillips & Meñez, 1988.

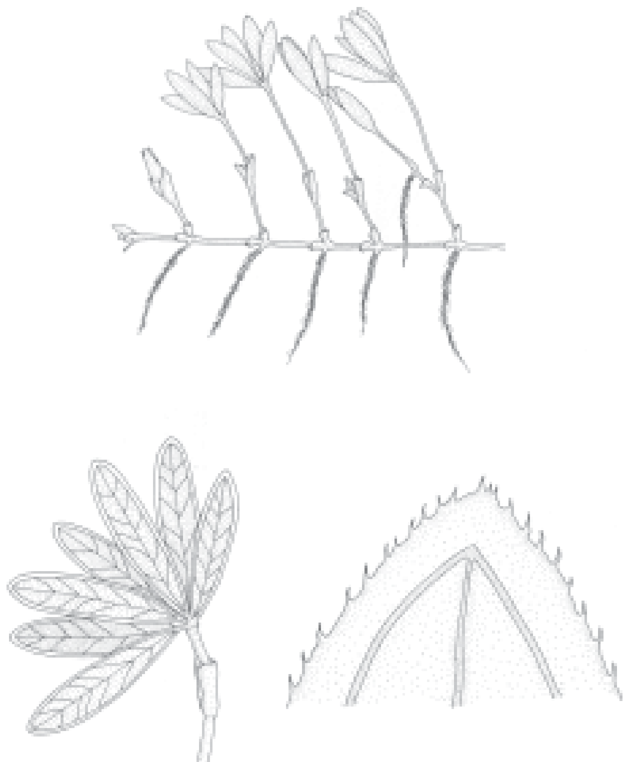
Distribution – This pantropical species is found mostly in the warmer water of the Northern Gulf Region. Extensive acreage of seasonal beds have been observed in southern Florida.

Star Grass *(Halophila engelmannii)*

Physical Characteristics – Star grass, also a member of the *Halophila* genus, has many similar physical characteristics to paddle grass. A very small plant *Halophila engelmanni* rarely exceeds 10 cm in height.

Habitat Description – Halophila engelmannii can be found in sheltered sites from low-spring tide level up to 90 m in clear waters. Its habitat is generally in sandy and muddy substrates, but it can also be found in areas with gravel or rock bottom.

Distribution – Plants are distributed similarly to paddle grass, being widely distributed in the Northern Gulf Region near Florida, but are also present along the Chandeleur Islands, located southeast of Louisiana.

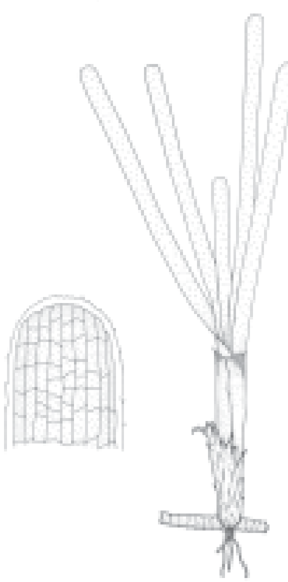


Star grass. Source: Phillips & Meñez, 1988.

***Turtle Grass* (Thalassia testudinum)**

Physical Characteristics – This species' common name comes from it being a favorite food of the endangered green sea turtle. Turtle grass has broad, deep-green blades that are normally over 1 cm wide and range from 10 to 75 cm long. The thick rhizomes are often located at depths of 20 cm below the surface

Habitat Description – Thalassia testudinum is often found from just below the low tide surface to depths of 30 m in clearer waters. This plant generally prefers mud or sand substrate



Turtle grass. Source: Phillips & Meñez, 1988.

for colonization.

Distribution – Turtle grass can be found in dense, extensive stands, throughout the Northern Gulf Region. Individual shoots of the plant can live for over 10 years, enduring seasonal temperature changes and powerful tropical storms.

Shoal Grass **(Halodule wrightii)**

Physical Characteristics – Shoal grass has fine blades that are 1 to 3 millimeters (mm) in width that grow to between 5 and 40 cm in length. Rhizomes are located close to the surface, often found less than 5 cm below the sea floor. However, roots may be found as deep as 25 cm below the sea floor.

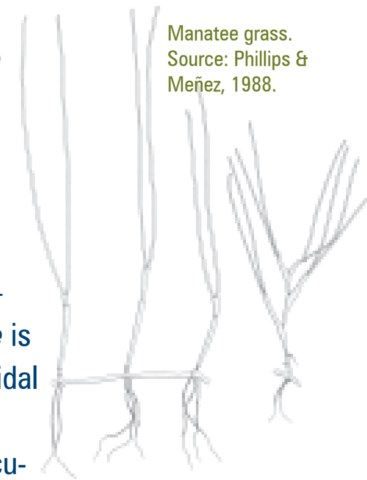
Shoal grass.
Source: Phillips & Meñez, 1988.

Habitat Description – Halodule wrightii is found in lower-intertidal and upper-subtidal zones as deep as 12 m. Large continuous meadows on shallow shoals and flats are predominant, with the grass often exposed at times of low tide. Sandy and muddy substrates are the most common habitat for shoal grass, but can also be found on coral reefs and in mangrove swamps.

Distribution – Shoal grass is widely dispersed throughout the Northern Gulf of Mexico, having significant populations in most bays and estuaries.

Manatee Grass (**Syringodium filiforme*****)***

Physical Characteristics – Manatee grass is distinguished by its nearly cylindrical appearance. Long, straight blades are approximately 1 to 3 mm in diameter and can grow up to 40 cm long. Rhizomes are located at depths between 1 and 10 cm below the sea floor, but may also extend into the water column, presumably as a means of vegetative reproduction.



Manatee grass.
Source: Phillips & Meñez, 1988.

Habitat Description – Syringodium filiforme is found mostly in subtidal environments. Macroalgae may accumulate into a large understory beneath *Syringodium*. Often these beds are mixed with turtle grass, but large monospecific stands may form down to 18 m.

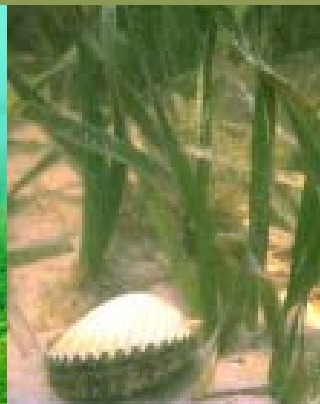
Distribution – Manatee grass is found on a limited basis in the Northern Gulf of Mexico, and becomes more widespread in South Texas and Florida.

Wigeon Grass **(Ruppia maritima)**

Physical Characteristics – Wigeon Grass is a submerged aquatic vascular plant considered by many to be a seagrass although it can grow in both freshwater and saline environments. Blades are 0.5 mm wide and 3 to 10 cm tall. A favorite food of migratory waterfowl, wigeon grass does not form a thick rhizome mat as compared to other seagrass species such as turtle grass.

Habitat Description – Ruppia maritima grows in soft sediments in sheltered shallow coastal waters of estuaries and lagoons at depths of 1 to 3 m.

Distribution – Wigeon grass is the most common submerged aquatic vascular plant in the parts of the Gulf estuaries most influenced by fresh water.

Why are Seagrasses Important?

Seagrass beds can be considered one of the foundations of coastal and estuarine ecosystems in the Northern Gulf Region. These highly productive marine plant communities provide valuable habitat in the waters that they populate. Continuous seagrass beds stabilize coastal sediments, decrease wave energy, and provide shelter for a variety of juvenile and adult aquatic species. In addition, seagrass beds support important recreational and commercial fisheries critical to the economic and social well-being of the region.

Seagrass Habitats

A multitude of plants and animals inhabit seagrass ecosystems forming complex food webs linking a variety of species together. The major functions of seagrasses in supporting both aquatic and terrestrial species include food production, nutrient recycling, and refuge from predation. The following lists the major species found in seagrass habitats, describes their relationship to the system, and elaborates on their role in the Northern Gulf ecological community (Japp & Hallock, 1990).

Mammals and Reptiles

Large species, such as manatees (*Trichecus manatus*), green sea turtles (*Chelonia mydas*), and bottlenose dolphins (*Tursiops truncatus*), are found in seagrass beds throughout the Northern Gulf Region. Manatees and green sea turtles feed directly on seagrasses, while bottlenose dolphins capture smaller species associated with the ecosystem. Because of these feeding relationships, all these species are affected by the loss or degradation of seagrass habitat.

Fish

Finfish species utilizing seagrass habitat include drums (Sciaenidae), sea bass (Serranidae), porgies (Sparidae), grunts (Haemulidae), snappers (Lutjanidae) and mojarras (Gerreidae). Seagrass habitat is used as nursery area by juveniles of larger species. Smaller species use the cover as protection from predation. Several of the larger finfish are recreationally and commercially important to the Northern Gulf Region.

Shellfish

Examples of shellfish utilizing seagrass habitat are the spiny lobster (*Panulirus argus*), queen conch (*Strombus gigas*), West Indian sea star (*Oreaster reticulata*), pink shrimp (*Farfantepenaeus*), and bay scallops (*Argopecten irradians*). The majority of these species dwell at the base of the seagrass beds, while others, such as the spiny lobster, come from nearby locations to feed at night.

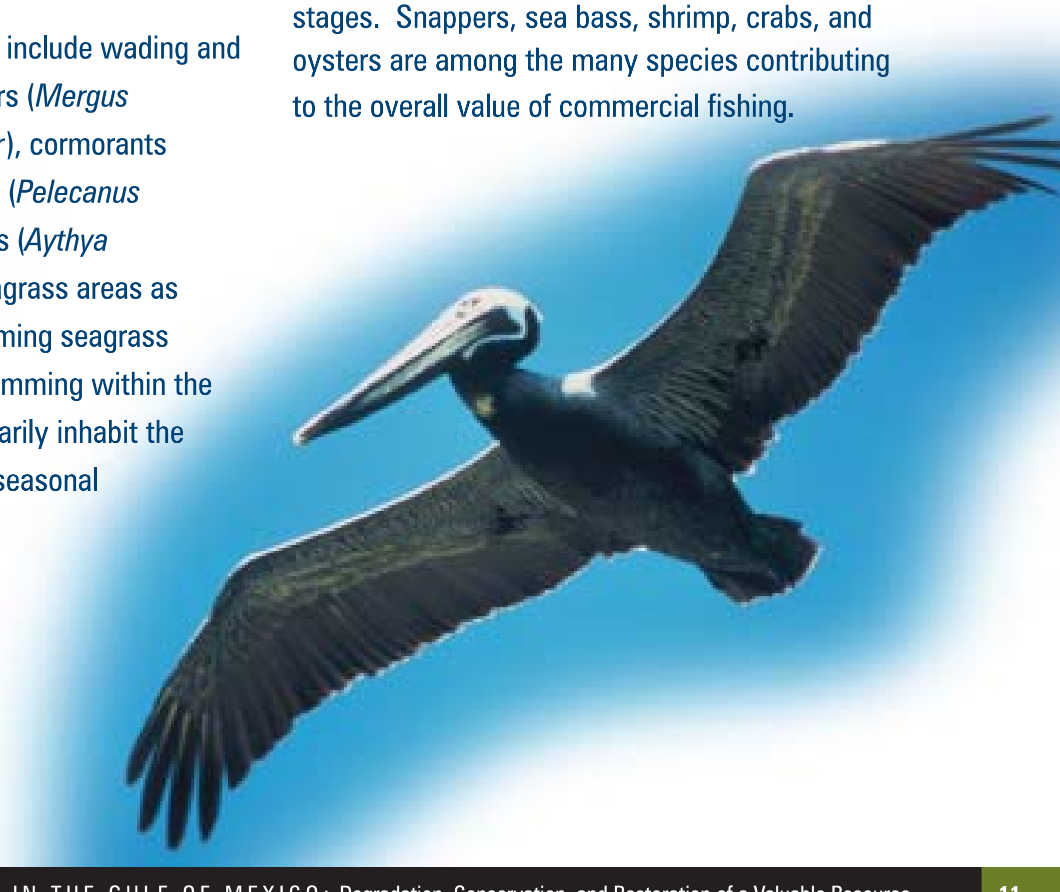
Birds

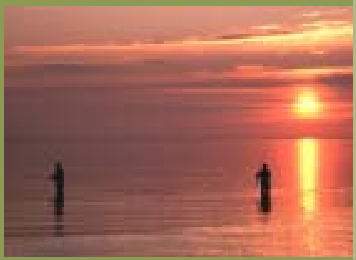
Birds inhabiting seagrass areas include wading and diving birds, such as mergansers (*Mergus merganser*), loons (*Gavia immer*), cormorants (*Phalacrocorax carbo*), pelicans (*Pelecanus occidentalis*) and redhead ducks (*Aythya americana)*. Most birds use seagrass areas as regular feeding grounds, consuming seagrass blades and rhizomes or fish swimming within the grasses. Other species temporarily inhabit the ecosystem as they make their seasonal migrations along the coast.

Value of Seagrasses

Seagrasses contribute significant value to the Northern Gulf Region. While there is no single estimate of the value of seagrasses in the region, there are several attributes that demonstrate the importance of the habitat to both the aquatic ecosystem and to the local economy. Finfish and shellfish use the beds as habitat for rearing juveniles and feeding as adults. Seagrass beds improve water quality by adding oxygen to the water column. They baffle sediments, reducing adverse effects from waves and currents. Seagrasses provide sediment stabilization, reduce coastal erosion, and filter nutrients and contaminants from the water. Economically, recreational fishing for finfish and shellfish supported by seagrass habitat increases tourism, which benefits the local economy.

It is estimated that between 70 percent to 90 percent of commercial fish spend some part of their life in seagrass habitat (FDEP, 2001). A wide variety of fish harvested in the region use seagrasses for rearing and feeding during their life stages. Snappers, sea bass, shrimp, crabs, and oysters are among the many species contributing to the overall value of commercial fishing.





The total commercial fish landings of the Northern Gulf Region totaled over 1.7 billion pounds in 2002, accounting for nearly $705 million in revenues (NMFS, 2003).

Recreational fishing is also a very important source of revenue for the Northern Gulf Region with both in- and out-of-state anglers contributing to local economies. Species such as bonefish, tarpon, and spotted seatrout support a multimillion dollar recreational fishery that derives its income from charter boats, marinas, hotels, restaurants, and tackle shops (FDEP, 2001). Many recreational fish species spend their juvenile years in seagrass meadows, migrating offshore in the adult years.

Tourism is another significant economic attribute of seagrass habitat. Direct benefits are observed when residents and non-residents take eco-tourism trips to seagrass meadows. Non-residents spend hundreds of millions of dollars annually at hotels, restaurants, and outdoor outfitting shops along the coast (FDEP, 2001). In addition, discarded shells of over 30 species of bivalves are actively collected by tourists and commercial retailers. One example of the economic value of seagrasses is from the Texas Parks and Wildlife Department (TPWD 1999). This agency estimates that based on the current account of seagrass distribution, recreational value, and commercial fishery harvest that wetland habitats contribute approximately 12.6 million dollars annually to regional economies. It is important to protect this valuable resource by utilizing effective conservation methods.

Propeller scarring of seagrass beds from boating. Source: Penny Hall, Florida Marine Research Institute

Seagrass Degradation and Loss

Two major disturbances affect seagrass growth, health, and survival in the Northern Gulf Region. Natural perturbations such as storms can increase wind and wave action, causing increased turbidity and erosion that damage seagrass beds. Other meteorological events, including floods, droughts, and hurricanes, all have detrimental effects on the short-term health of the ecosystem. However, seagrass beds usually rebound from the effects of these natural events, or slowly shift to a new equilibrium with their surroundings.

Alternatively, anthropogenic, or human induced impacts, can have much more severe and long-lasting negative effects on seagrass beds. Because seagrasses rely heavily on light for photosynthesis, any action decreasing water quality in the marine environment can harm seagrass plants. In addition, increases in nutrients can cause (1) macroalgae to "overgrow" seagrass; and (2) microalgae (phytoplankton) blooms that reduce water clarity. Finally, impacts directly damaging seagrass beds, such as scarring from boat propellers or trawl nets can have cumulative impacts on the ecosystem.

Causes of Degradation

Nutrient Loading Effects

Eutrophication due to nutrient loading is a leading cause of degradation to seagrass habitats in the Northern Gulf Region. There are several sources of nutrients in coastal communities, including:

- untreated or partially treated sewage,
- effluent from sewage treatment plants,
- point sources from industrial activities,
- urban stormwater runoff, and,
- other non-point sources (e.g., agricultural runoff, oil spills, septic tank leachate).

The addition of nutrients to the system indirectly decreases the amount of light immediately available for seagrasses to use for photosynthesis. This occurs because several species of macroalgae, phytoplankton, and epiphytic organisms thrive in high nutrient environments, consequently "out-competing" seagrasses for valuable resources, especially light.

Coastal Development and Shore Protection Structures

Rapid development of coastal communities for residential and commercial purposes can cause harmful habitat changes to seagrass communities. Beyond increasing nutrient loading, increased development is often accompanied by alteration of coastal habitat that effectively diminishes critical shallow-water habitat. Examples of such alterations include the construction of seawalls, breakwaters, revetments, groins, and jetties. Each of these structures, aimed at protecting coastal property, refract energy away from the shore, and can cause erosion and increase currents that can harm seagrasses.

Dredging Activities

Dredging can cause short and long-term impacts to seagrass beds including physical removal or burial of beds. Increased channelization of rivers and streams can alter the balance between freshwater and saltwater, resulting in unfavorable salinity concentrations for seagrass. Indirect impacts caused by dredging activities include increased turbidity from suspended sediment, increased boat traffic, and changes in hydrological conditions.

Commercial and Recreational Boating

Commercial and recreational boating can have effects on seagrass beds. The most visible of these impacts is propeller scarring from recreational boaters. Scarred seagrass beds have been observed throughout the Northern Gulf Region, and can take as long as 10 years to return to a healthy state. Scarring from boats can lead to the complete degradation of a seagrass bed as erosion impacts exposed roots and rhizomes. In addition, sediments suspended by both recreational and commercial vessels reduce the sunlight available to seagrasses on a regular basis. Commercial fishing using dragging, trawling, or digging techniques can cause damage to the sea floor where grasses are present. For example, shrimping, the largest commercial fishery in the Gulf, is accomplished with the assistance of bottom trawls that scrape the sea floor to harvest the shrimp (Texas Parks and Wildlife Department, 1999).

Source: South Florida Water Management District

Source: South Florida Water Management District

What is the Status of Seagrasses

1 Overview of Seagrass Habitat in the Gulf

Laguna Madre

SC 69,517 hectares in 1998 in the Upper & Lower Laguna Madre
HT 25 % Decline in Lower Basin,67% increase in Upper Basin since 1965 4% decrease in the area as a whole.
CD Dredging, Sediment Resuspension from Dredge Deposits, “Texas Brown Tide”

2 Coastal Bend

SC 11,385 hectares in the Coastal Bend area in 1994.
HT Increase of 801 hectares since 1958 in the Redfish Bay/Harbor Island and Mustang Island subsegment of Corpus Christi Bay.
CD Nutrient Loading, Dredging Impacts, Waterfront Construction

3 Galveston Bay

SC 210 hectares in 1998
HT 2,025 hectares in 1956, Trinity River Delta Not Included in Estimate
CD Shoreline Development, Habitat Alteration, Nutrient Loading

4 Chandeleur Islands

SC 4,511 hectares Estimated in 1995
HT 6,377 hectares in April 1969, 4,669 October 1969, 6,536 in 1992
CD Tropical Storms, Natural Loss of Island Sediment

5 Mississippi Sound

SC 298 hectares of seagrass in 2003
HT 600 hectares of seagrass in 1992
CD Decline in water quality, Recreational uses

6 Mobile Bay

SC 57 hectares of seagrass alone, 200 hectares of seagrass mixed w/ freshwater species in 2003
HT 1,105 hectares of fresh and saltwater SAVs in 1981.
CD Tropical Storms, Increased Suspended Sediments from Development Practices

7 Perdido Bay

SC 120 hectares in 2003
HT 74 % Decline from 475 hectares in 1940
CD Nutrient Loading, Wastewater Effluent, Marinas, Docks, GIWW Dredging

8 Pensacola Bay

SC 1,814 hectares Estimated in 1992
HT Over 50 % Decline from 3,800 Hectares in 1960
CD Sewage/Industrial Waste, Dredging Activities, Beachfront Alteration

in the Northern Gulf of Mexico?

9 Choctawhatchee Bay
SC 1,722 hectares Observed in 1992
HT Significant Loss between 1949 and 1985, 1,237 hectares in 1983
CD Eutrophication, Propeller Scarring from Recreational Boats

10 St. Andrew Bay
SC 3,979 hectares recorded in 1992
HT 4,706 hectares recorded in 1964.
CD Atmospheric Deposition of Nutrients, Stormwater Runoff, Propeller Scarring

11 Big Bend
SC 250,000 hectares observed in 1992
HT 520,000 hectares in 1984
CD Hydrological Alterations, Nutrient Enrichment

12 Tampa Bay and St. Joseph Sound
SC 10,554 hectares Observed in 2002
HT 35 % Decline from 16,000 Hectares 1950, Increase from 1982 (8,800 Hectares)
CD Rapid Population Growth, Dredging Activities, Non-Point Pollution

13 Sarasota Bay
SC 3715 hectares Found in 2002
HT 215 hectare Increase from Total of 3500 in 1988.
CD Rapid Urbanization, Wastewater Treatment

14 Greater Charlotte Harbor
SC 21,802 hectares Recorded in 1999
HT 23,127 hectares in 1982, a 6% decrease on coverage
CD Increases in turbidity & total suspended solids in the water column, changes to freshwater flows, dredging

15 Florida Bay
SC 124,787 hectares Estimated in 1994
HT 142,473 hectares in 1987.
CD Increased Turbidity, Chronic Light Reduction

SC - Most Recent Seagrass Coverage Estimates,
HT - Historical Seagrass Coverage Trends,
CD - Most Common Causes of Seagrass Degradation.

Seagrass Habitat in My Area

This report represents an effort of several federal, state and local agencies and organizations within the Northern Gulf Region to estimate existing seagrass beds and to determine losses to this valuable habitat over the past century. The following section represents the initial results of this effort, exploring the historical seagrass coverages, current trends, and significant threats to both short- and long-term seagrass productivity.

Texas

Laguna Madre

Laguna Madre is located in southernmost coastal Texas between Padre Island, the longest barrier island in the world, and the mainland. This region provides 40-50 percent of the commercial fish catch in Texas and is also the wintering grounds of the Redhead Duck (*Aythya americana*). Seagrass meadows occur in separate Upper (Northern) and Lower (Southern) Basins. It is estimated that 67 percent of the Lower Basin and 63 percent of the Upper Basin are covered in seagrasses. Prevalent species found in the system include turtle grass, shoal grass and manatee grass. Seagrasses have declined by 25% in the Lower Basin while increasing by 67% in the Upper Basin since 1965. For the lagoon as a whole, seagrasses declined by 4% over the period. The construction of the Gulf Intracoastal Waterway and turbidity resulting from resuspension of dredge deposits, along with the appearance of the "Texas brown tide" in the 1990s, have contributed to seagrass declines in Laguna Madre.

Coastal Bend

The Coastal Bend region includes the estuarine complexes of Corpus Christi Bay, Redfish Bay, and the Nueces Bay system, receiving the waters of the Nueces, Mission and Aransas Rivers to the north and west. This environmentally sensitive area was incorporated into the National Estuary Program in 1988 and is home to several threatened or endangered species, including the bald eagle, piping plover, and Kemp's Ridley sea turtle. Total estimates of seagrasses in the Coastal Bend area in 1994 are 11,385 hectares (28,120 acres), with 8,278 hectares (20,446 acres) being located in the Nueces Bay/Redfish Bay/Corpus Christi Bay system and the remaining 3,107 hectares (7,674 acres) being located in the Copano Bay/Aransas Bay system. Shoal grass is the most common of the seagrasses in the area, with turtle grass and wigeon grass representing smaller populations. Historical trends have shown oscillating populations between 1958, 1975, and 1994. There were increases between 1958 and 1994 of 330 hectares for the Redfish Bay/Harbor Island subsegments and of 471 hectares for the Mustang Island subsegment of Corpus Christi Bay. Although the seagrass appears to be thriving in this area, potential future threats to seagrass in this area include nutrient loading, dredging impacts, and direct physical disturbances such as waterfront construction and propeller scarring.

Galveston Bay

Galveston Bay is the 7th largest estuary in the United States and a major contributor to state commercial fish landings, accounting for 35 percent of the shrimp, 30 percent of the blue crab, and 60 percent of the oyster catch during the 1990s. The Bay is composed of the Upper

Galveston Bay, West Galveston Bay, and the Christmas Bay system. Over 95 percent of the historic seagrass beds have been lost in the region. In 1956, approximately 2,000 hectares (5,000 acres) of seagrasses were observed in this area. However, this area did not include the Trinity River Delta, where considerable seagrasses are known to have existed. Primary species found in this region include wigeon grass with some shoal grass interspersed throughout the Bay. Major causes of seagrass degradation in the Galveston Bay are shoreline development, habitat alteration, nutrient loading, and tropical storms.

Central Northern Gulf Region

Chandeleur Islands

Located 25 kilometers (km) to the north of Venice, Louisiana, and 35 km south of Biloxi, Mississippi, the Chandeleur Islands are remains of the Mississippi River's St. Bernard Delta. These remote islands are accessible only by boat or seaplane. In 1905, the entire ecosystem was designated as a National Wildlife Refuge. Seagrass coverage was estimated in 1995 to be 4,511 hectares (11,148 acres), a decrease from 6,377 hectares in April 1969. However, it should be noted that total acreage has fluctuated as evidenced by estimates of 4,669 hectares in October 1969 and 6,536 hectares in 1992. The 1969 low is attributed to Hurricane Camille, while long-term declines are most likely associated with the disappearance of the actual Chandeleur Island land masses which have experienced a 65 percent decrease over the past century and a half. All species of Northern Gulf Region seagrasses have been observed in the region.

Mississippi Sound

Mississippi Sound is located to the south of Mississippi and is home to the Grand Bay National Estuary Research Reserve. The region is composed of Buccaneer State Park, Cat Island, Ship Island, Dog Keys Pass, Horn Island, Petit Bois Island, and Point-aux-Chenes Bay. Data from 1992 indicate approximately 600 hectares (1,483 acres) of total seagrass habitat in the Mississippi Sound, with the majority located at Horn Island and Petit Bois Island. A recent 2003 study by Barry Vittor & Associates, Inc. (2003), indicated the presence of approximately 298 hectares (746 acres), for the Alabama portion of the Mississippi Sound. Current populations are composed primarily of shoal grass, although other species have been found historically. An overall decline in water quality in the Mississippi Sound is thought to be the major cause of degradation, in addition to the anthropogenic effects of recreational boat use.

Mobile Bay

Mobile Bay, designated a National Estuary by the Environmental Protection Agency, receives the waters of the Mobile Basin, the sixth largest watershed in the United States. Several endangered and threatened species reside within the boundaries of the Bay including the American alligator, the peregrine falcon, the bald eagle, and the gulf sturgeon. A recent report by Barry Vittor & Associates (2003) indicated the presence of 0.52 hectares (1.3 acres) of shoal grass, 0.016 hectares (.04 acres) of turtle grass, 56.8 hectares (142.0 acres) of wigeon grass, and 200 hectares (500.8 acres) of wigeon grass mixed with other freshwater species.

Changes in seagrass acreage has occurred in coastal Alabama, but as of this date, there has been no investigation into the specific causes of change.

However, the large declines in seagrass coverage in Mobile Bay have been attributed to tropical storms and turbidity in coastal waters caused by land development practices that increase suspended sediments.

Perdido Bay

Perdido Bay and River form a boundary between the States of Alabama and Florida, and are home to several commercial and recreationally important species including shrimp, crabs, scallops, speckled trout, redfish, and mullet. Most recent (2003) estimates of seagrass habitat total 120 hectares (300 acres) of shoal grass. Based on historic studies in 1940, 1979, and 1987, the habitat has experienced a decline of 355 hectares (880 acres), or 74 percent of its seagrass coverage from a total coverage of 475 hectares (1,187 acres). The major seagrass species are wigeon grass, shoal grass, and turtle grass. These species have been degraded by nutrients from wastewater effluent and other non-point sources of pollution. In addition, coastal development, in the form of marinas and docks, and dredging activites in the Gulf Intracoastal Waterway (GIWW) have contributed to the overall decline.

Northwestern Florida

Pensacola Bay

Pensacola Bay is located in the westernmost section of Florida's panhandle and supports diverse ecological communities, productive fisheries, and various recreational uses. The Pensacola Bay system is composed of Escambia Bay, East Bay, Pensacola Bay, Big Lagoon, and Santa Rosa Sound, accounting for 50,400 hectares (126,000 acres) of aquatic habitat and 885 km (550 miles) of coastline. As of 1992, approximately 1,800 hectares (4,500 acres) of seagrass existed in the Pensacola Bay system. This represents a nearly 2,000 hectare loss from 1960, when over 3,800 hectares (9,500 acres) of seagrass were observed in the area. Santa Rosa Sound has experienced the greatest loss, with 2,600 hectares (6,500 acres) of seagrass in 1960 being reduced to 1,120 hectares (2,800 acres) by 1992. Shoal grass and turtle grass are the common species of this region. The major causes of seagrass losses in the Pensacola Bay system appears to be sewage and industrial waste discharges, dredge and fill activities, and beachfront alteration.

Choctawhatchee Bay

Choctawhatchee Bay, located along northwest Florida's "Emerald Coast," is an area that has historically supported a wealth of biological resources and provided substantial quality of life benefits. Divided between Okaloosa and Walton Counties, the system is separated into three segments: Western Choctawhatchee Bay, Middle Choctawhatchee Bay, and Eastern Choctawhatchee Bay. The most recent study, in 1992, reported a total of 1,722 hectares (4,261 acres) of seagrasses in the Choctawhatchee Bay. Of this total, it was determined that 1,408 hectares (3,477 acres) were deemed "patchy" seagrass beds and 314 hectares "continuous" habitats. The majority of the seagrass occurs in the western segment of the Bay, which is comprised of shoal grass and wigeon grass. This total represents a significant increase from studies performed in 1983, which reported 1,237 hectares of seagrass in the area. However, comparisons of aerial photographs from 1949 and 1985 indicated "significant loss" for most areas. Major causes of seagrass degradation in the region include eutrophication and propeller scarring from boats.

St. Andrew Bay

Located in Bay County, Florida, St. Andrew Bay exhibits a wealth of biological diversity, providing habitat for over 2,900 species of plants and animals. Several of these species are commercially and recreationally important to the socio-economic well-being of the region. The Bay covers an area of about 27,392 hectares and is composed of St. Andrew Bay, West Bay, North Bay, East Bay and St. Andrew Sound. A survey of seagrass habitat in 1992 found a total of 3,979 hectares (9,832 acres) in this area. This represents a loss of approximately 800 hectares since 1953. Of the subunits, West Bay has suffered the greatest losses, with the seagrass habitat diminishing 50 percent (to 800 hectares) by 1992. Turtle grass and shoal grass are the major species in the region with smaller amounts of manatee grass and wigeon grass present. Potential causes of loss in St. Andrew Bay include atmospheric deposition of nutrients, stormwater runoff, and propeller scarring from recreational boats.

Big Bend

Florida's Big Bend is an area that has been described as one of the least polluted coastal regions in the United States. The region can be divided into two subsections; the northern half, "Big Bend Proper," and the southern half, "Springs Coast." Within the Big Bend region are the Big Bend Seagrasses Aquatic Preserve, managed by the Florida Department of Environmental Protection, and five National Wildlife Refuges (St. Marks, Lower Suwannee, Cedar Keys, Crystal River, and Chassahowitzka). It is estimated that between 25 and 33 percent of the total blue crab landings in Florida are from Big Bend. A variety of studies have been performed on the Big Bend area, however due to study methods and boundary definitions they are not comparable. In 1984, 520,000 hectares of seagrass were mapped in the area. In 1992, 250,000 hectares (619,000 acres) of seagrass were reported. Turtle grass, manatee grass, and shoal grass are the major species present. Threats to seagrass in the Big Bend region include hydrologic alterations to watersheds and nutrient enrichment of estuaries and coastal waters.

Southwestern Florida

Tampa Bay

Tampa Bay, the largest estuary in Florida, is home to 40,000 breeding pairs of shorebirds and over 100 bottlenose dolphins. In 1990, Tampa Bay was accepted into the U.S. EPA's National Estuary Program. The system is divided into seven bay segments: Hillsborough Bay, Old Tampa Bay, Middle Tampa Bay, Lower Tampa Bay, Boca Ciega Bay, Terra Ceia Bay, and the Manatee River. In 1999, 10,053 hectares (24,830 acres) of habitat were reported in Tampa Bay with 10,554 hectares (26,068 acres) reported in 2002. This figure represents a 35 percent decrease from historical studies that recorded over 16,000 hectares (40,000 acres) of seagrasses. It should be noted that the 1999 total is an increase from 1982 when total acreage was estimated at 8,800 hectares (22,000 acres). Middle Bay, Old Tampa Bay and Boca Ciega Bay have all suffered losses. Shoal grass and turtle grass are the most abundant in the Bay, and consequently have most likely suffered the largest losses over time. Likely causes of degradation include rapid population growth, dredge and fill activities, and non-point source nutrient loading.

Sarasota Bay

Sarasota Bay, part of the National Estuary Program, is divided into five bay segments that include

Upper Sarasota Bay – Sarasota County, Upper Sarasota Bay – Manatee County, Roberts Bay, Little Sarasota Bay, and Blackburn Bay. Commercial fishing has been a popular activity in the region dating back as far as the late 18th century. In 2002, 3,715 hectares (9,181 acres) of seagrass were identified in Sarasota Bay. This total represents an increase from studies performed in 1988 that indicated more than 3,500 hectares (8651 acres) of seagrass present. However, it should be noted that historical observations noted declines in acreage between 1880, 1950, and 1988. Shoal grass is distributed throughout the bay, while turtle grass, manatee grass and wigeon grass are found with less regularity. Changes in seagrass habitat are most likely due to the rapid urbanization of the watershed (causing seagrass loss), and improvements in wastewater treatment practices (leading to increases).

Greater Charlotte Harbor

Charlotte Harbor, located on the west coast of Florida south of Tampa Bay, is one of the State's most pristine and productive estuaries. The harbor is surrounded by an extensive conservation buffer system of well over 21,610 hectares (53,400 acres) managed by agencies of the State of Florida. A series of National Wildlife Refuges exist along Sanibel and Pine Islands. One of these refuges, J.N. "Ding" Darling, attracts over 900,000 visitors per year. In addition, the region is home to the federally endangered American crocodile, and many recreationally important fish species such as the tarpon, snook, and redfish. Charlotte Harbor's most recent seagrass studies estimate that 21,802 hectares (53,850 acres) were present in 1999. This total is about 1325 hectares (3,272 acres) less than historical seagrass estimates recorded in 1982 of 23,127 hectares (57,123 acres). Shoal and turtle grass compose the majority of the present and historic grasses in Charlotte Harbor. Major threats to seagrass habitat in the region include increases in turbidity, total suspended sediment in the water column, changes to freshwater flows, dredging, and propeller scarring from boats.

Florida Bay

Located in the southernmost portion of Florida's west coast, Florida Bay is home to nearly 259,000 hectares (1,000 square miles) of interconnected basins and mangrove islands. The region acts as nesting, nursery, and feeding grounds for a variety of species including manatees, bottlenose dolphins, and loggerhead sea turtles. In addition, parts of the Bay are fished commercially for pink shrimp. Seagrass estimates in 1994 found 124,787 hectares (308,223 acres) of habitat in the region. In 1987, 142,473 hectares (351,908 acres) of seagrass habitat were reported. Species found within Florida Bay include turtle grass, followed by smaller populations of shoal grass and manatee grass. Current threats to habitat are increased turbidity and associated chronic light reduction.

How are We Improving Damaged Seagrass Habitat?

Seagrass degradation and loss of habitat in the Northern Gulf Region have had significant impacts on natural resources and socio-economic vitality. However, with the right approach, it is possible to reverse the current trends of seagrass loss. The most important aspect of enhancing seagrasses is having a comprehensive planning strategy that includes management practices, conservation, educational efforts, monitoring, and restoration to enhance the likelihood of success.

Management Practices

A variety of regulations and management policies can improve the protection and restoration of seagrass habitats in the Northern Gulf Region. The most significant of these are comprehensive management plans developed by state and Federal environmental organizations. These policies create a planning framework that allows stakeholders to engage in the decision making process.

Most comprehensive management plans include committees focusing on topics such as research, monitoring, conservation, restoration, protection, and education, facilitating discussion and the prioritization of major issues. While comprehensive management plans are ordinarily directed at the state and Federal level, they are most often implemented at the local level, allowing scientists and managers to apply general mandates for seagrass enhancement to a specific region.

Some regulations, such as boating restrictions focused on reducing propeller scarring, create enforceable guidelines that directly enhance the quality of seagrass habitats. With proper enforcement these regulations prevent unnecessary degradation throughout critical areas. Other examples of regulations, such as those aimed at point and non-point pollution or coastal development practices (e.g., zoning, coastal structure permits) act indirectly to reduce anthropogenic impacts the Northern Gulf Region.

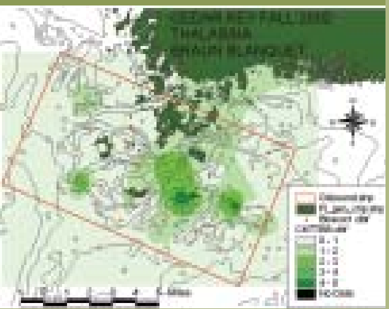
Educational Programs

Promotional literature and informational websites are excellent tools for communicating with the general public. Federal and state authorities also can coordinate with local government and non-profit organizations to engage local citizens in restoration efforts and educational workshops. Mechanisms for financing (e.g., grants) for public participation are important to assure regional policies are implemented at the local level.

Monitoring

Monitoring is the cornerstone of any comprehensive program to protect or restore seagrass species in the Northern Gulf of Mexico. This Status and Trends Report represents an initial effort to create a baseline of information and increase stakeholder awareness. While historic seagrass monitoring in the Gulf has been sporadic, recent efforts (United States Geological Survey, 1992) have established large-scale consistent data sets for the Northern Gulf Region.

Keys to successful monitoring efforts include establishing geographic parameters, creating consistent data sets and interpretation techniques, investing in field verification of aerial photos, identifying seagrass species, and measuring water and sediment quality. Monitoring efforts are best implemented by local entities that have an understanding of their dynamic ecosystem, and coordinated by larger organizations (e.g., GMP, USGS) that can guarantee consistent methodologies.



Restoration

Restoration of seagrasses is an important part of any comprehensive plan to manage seagrass loss in the Northern Gulf Region. Seagrass programs often attempt to achieve “no net loss” of habitat through compensatory mitigation practices. Compensatory mitigation depends on the success of efforts by state and local agencies to increase the quality and quantity of degraded seagrass beds. Critical to these programs is the planning process, which identifies priority sites for restoration based on a comparison of regional seagrass habitats (Texas Parks and Wildlife Department, 1999; Beck et al., 2000).

Seagrass planting efforts to reestablish beds requires a detailed effort and although these efforts may further research and educate on the importance of seagrasses, they do not necessarily result in large areas of seagrass restoration. Seagrass coverage has increased in some areas of the Gulf primarily as a function of improvements in water quality, and water quality has improved as anthropogenic influences, both point and non-point sources have been reduced.

Seagrass ready for planting in the northern Gulf of Mexico. Source: Ron Phillips.

What Does the Future Hold for Seagrasses?

This document presents a brief overview of the status and trends of seagrasses in the Northern Gulf Region. Historic trends in several areas show that within the past decade seagrasses are increasing, mostly as a function of improvements in water quality. Water quality improves in an area when point and non-point source pollution are reduced.

With the establishment of baseline seagrass coverage estimates the Gulf States now have a tool to monitor the seagrass beds and to detect which areas are improving and which areas are being damaged or compromised in some way. Going forward, the Gulf of Mexico Program hopes to reverse the current trend of seagrass habitat degradation by implementing a comprehensive research, conservation, and restoration program. This program, created by the habitat focus team and its expert panel members, intends to:

- Assess the areal and temporal extent and quality of seagrasses,
- Analyze trends in the extent and quality of seagrass habitats,
- Identify factors that determining the establishment and persistence of seagrasses, and,
- Ascertain the critical factors determining natural structural and functional characteristics of seagrass habitats.

In order to reach these objectives it will be necessary to take several steps to better understand the quality and extent of seagrass habitat in the Northern Gulf. These will include: quantifying and mapping current seagrass acreage; identifying indicators that best describe the health or quality of seagrass beds; identifying water quality, water column, and sediment characteristics and their impacts on seagrasses; determining the relationships between primary and secondary productivity and landscape features; and exploring how habitat functions differ among different seagrass species.

The next decade will be crucial for seagrass in the region due to the expectation that coastal populations will continue to rapidly increase. Without comprehensive planning, education, and enforcement, it is very possible that seagrasses will continue to disappear from the estuaries and coastal waters of the Northern Gulf Region. However, with the assistance of Federal, state and local agencies, as well as a coordinated effort of citizens at the local level, the chances of increasing seagrass habitat are very real.

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