Seagrass Status and Trends in the Northern Gulf of Mexico: 1940–2002

Edited by L. Handley,[1] D. Altsman,[2] and R. DeMay[3]

Abstract

Over the past century, seagrass habitats from the bays of Texas to the gulf shores of Florida have decreased. Seagrass beds, which are highly dependent on water quality and clarity for survival, are home to a multitude of aquatic plants and animals and a source of economic activity through commercial and recreational fishing and ecotourism. The U.S. Environmental Protection Agency's Gulf of Mexico Program (GMP) and its partners have made a commitment to restore, enhance, and protect this important ecosystem. As seagrass habitats decrease, the need for information on the causes and effects of seagrass loss, current mapping information, and education on the importance of seagrassess becomes greater. This report is the initial effort of the GMP's research and restoration plan for seagrasses. The purpose of this report is to provide scientists, managers, and citizens with valuable baseline information on the status and trends of seagrasses in coastal waters of the Gulf of Mexico. Within the northern Gulf of Mexico region, 14 individual estuarine systems where seagrasses occur, as well as statewide summaries for Texas, Louisiana, Mississippi, Alabama, and Florida, are examined in this study. Each estuarine system is detailed in vignettes that address current and historical extent and quality of seagrasses, seagrass mapping and monitoring, causes of status change, restoration and enhancement activities, background information for the entire study area as well as the subareas for study, and the methodology employed to analyze and document the historical trends and current status of seagrasses.

The systems, moving from west to east, include the Laguna Madre, Texas Coastal Bend region, and Galveston Bay in Texas; the Chandeleur Islands in Louisiana; the Mississippi Sound; and Perdido Bay, Pensacola/Escambia Bay, Choctawhatchee Bay, St. Andrew Bay, Florida's Big Bend region, Tampa Bay/St. Joseph Sound, Sarasota Bay, Greater Charlotte Harbor, and Florida Bay in Florida. (Mobile Bay is dealt with only in the statewide summary for Alabama.)

Introduction

The Gulf of Mexico provides a wide array of valuable natural resources to the nations that border its shores. As the value of the gulf coastal environment continues to be recognized, it becomes increasingly important to invest in the conservation of those resources. Reductions in both abundance and diversity of various organisms and habitats emphasize a critical need to protect these natural assets, many of which serve important ecological functions. In response to increasing trends in habitat degradation, several organizations and institutions have begun to act together with local residents to address these issues. One such effort, facilitated by the U.S. Environmental Protection Agency's (EPA) Gulf of Mexico Program, will integrate the efforts of a wide range of scientific experts from Federal, State, and local partners to increase the environmental quality of the habitats of the northern Gulf of Mexico.

In 1999, the Gulf of Mexico Program committed to restoring, enhancing, and protecting 20,000 acres of important coastal habitats within the northern Gulf of Mexico region by the year 2009. The northern Gulf of Mexico region is defined as those waters lying adjacent to the States of Texas, Louisiana, Mississippi, Alabama, and Florida. This region encompasses over 2,414 km (1,500 miles) of coastline and is home to more than 25 million residents. Marine ecosystems such as sandy beaches, salt marshes, mangroves, coral reefs, and seagrass beds combine to create important coastal habitats that allow this region to flourish. Modern land development practices in the northern gulf, however, threaten these aquatic habitats, risking the economic values that form the foundation of these coastal communities.

Seagrasses have been particularly impacted by the degradation of coastal waters in the northern Gulf of Mexico. Over the past century, seagrass beds, which are highly dependent on water quality for survival, have decreased from the bays of Texas to the shores of Florida.

[1] U.S. Geological Survey, National Wetlands Research Center.

[2] U.S. Environmental Protection Agency, Gulf of Mexico Program.

[3] Barataria-Terrebonne National Estuary Program.

Seagrasses are submerged flowering plants that grow in bays, lagoons, and shallow coastal waters. Because seagrasses require light for photosynthesis, water clarity is very important for their survival. They anchor themselves to the seafloor with strong root systems that allow them to withstand strong currents and waves. Seagrasses differ from terrestrial vegetation in that they must reproduce underwater and accomplish reproduction with filamentous pollen grains that can be transported by water currents.

Continuous expanses of seagrass beds provide valuable habitat by stabilizing coastal sediments, decreasing wave energy, and providing shelter for a variety of aquatic organisms. A multitude of plants and animals inhabit seagrass ecosystems, forming complex food webs that link a variety of species together. Large species, such as Florida manatees (*Trichechus manatus*), green sea turtles (*Chelonia mydas*), and bottlenose dolphins (*Tursiops truncatus*), are found in seagrass beds throughout the northern Gulf of Mexico region and use this habitat for feeding, either eating the seagrass directly or capturing smaller species drawn to the ecosystem.

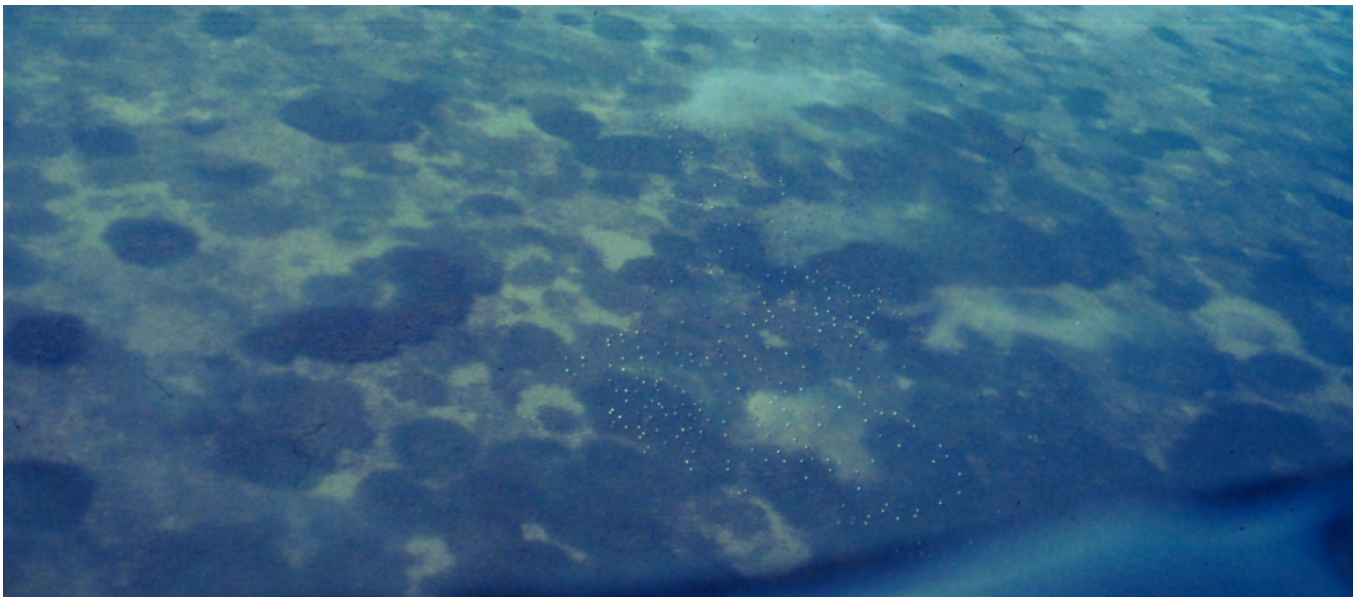
Finfish species that use seagrass habitat include drum (Sciaenidae), sea bass (Serranidae), porgy (Sparidae), grunt (Haemulidae), and snapper (Lutjanidae). Larger fish use seagrass habitat as nursery areas, while smaller species use the cover provided by seagrass as protection from predators.

Shellfish that populate seagrass habitat include the Caribbean spiny lobster (*Panulirus argus*), queen conch (*Strombus gigas*), West Indian sea star (*Oreaster reticulata*), pink shrimp (*Penaeus duorarum*), and eastern oyster (*Crassostrea virginica*). Most of these species live at the base of seagrass plants, while others, such as the spiny lobster, are drawn from nearby locations to feed at night.

Birds that use seagrass habitat include wading and diving birds, such as common merganser (*Mergus merganser*), common loon (*Gavia immer*), great cormorant (*Phalacrocorax carbo*), brown pelican (*Pelecanus occidentalis*), and redhead duck (*Aythya americana)*. Most of these birds use seagrass habitat as regular feeding grounds, consuming seagrass blades and rhizomes or fish swimming among the grasses. Other species temporarily inhabit the areas during their seasonal migrations along the coast.

There are 58 species of seagrasses found around the world, consisting of two main families: Potamogetonaceae and Hydrocharitaceae (Phillips and Menez, 1988; Kuo and McComb, 1989). Short and Coles (2001) stated, however, that recent work established that there were 60 seagrass species in 4 families and 12 genera. Six distinct species of seagrasses have been identified in the bays, lagoons, and shallow coastal waters of the northern gulf region. These species include paddle grass (*Halophila decipiens*), star grass (*Halophila engelmannii*), turtle grass (*Thalassia testudinum*), shoal grass (*Halodule wrightii*), manatee grass (*Syringodium filiforme*), and one freshwater species, wigeon grass (*Ruppia maritima)*, which is also capable of tolerating saline waters (Phillips and Menez, 1988; Fonseca, 1994). Wigeon grass and water celery (*Vallisneria americana*) are two salt-tolerant freshwater plants and have been included in the analyses of a few of the local areas along the Gulf of Mexico. The reason for their inclusion in these areas, which will be further identified in the State and local chapters, is that in early assessments, there was no differentiation between species, and differentiation in zones where fresh water and salt water mix was not possible from aerial photography (e.g., *Halodule* vs. *Ruppia*).

Seagrass habitats support important recreational and commercial fisheries which form the economic foundation of many northern Gulf of Mexico communities. Commercial fishing accounts for over $800 million in annual revenues gulfwide (National Oceanic and Atmospheric Administration, 1997). Recreational fishing is also a very important source of revenue for the northern gulf region, with both in-state and out-of-state anglers contributing to local economies. Species such as bonefish (*Albula vulpes*) and tarpon (*Megalops atlanticus*) support a multimillion dollar recreational fishery that delivers income to charter boats, marinas, hotels,



restaurants, and tackle shops. Tourism is a significant economic attribute of seagrass habitats, with direct benefits accruing from residents and nonresidents who take ecotourism trips to seagrass meadows. Nonresidents spend hundreds of millions of dollars annually at hotels, restaurants, and outdoor outfitting shops along the northern gulf coast. In addition, discarded shells of over 30 species of bivalves are actively collected by tourists and commercial retailers.

While there is no single estimate of the value of seagrasses in the northern Gulf of Mexico region, several attributes demonstrate the importance of the habitat to both the aquatic ecosystem and to the local economy. The State of Texas has attempted to quantify some of these attributes, finding that seagrass habitat produced an economic value of $9,000 to $28,000 per acre in commercial, recreational, and storm protection functions (Texas Parks and Wildlife Department, 1999). In Florida, the Department of Environmental Protection has estimated that each acre of seagrass has an economic value of approximately $20,500 per year, which translates into a statewide economic benefit of $55.4 billion annually (Florida Department of Environmental Protection, 2001).

Because seagrass habitat is so valuable, its degradation is a major concern for communities throughout the northern Gulf of Mexico. It is estimated that over the last 50 years, seagrass habitat losses ranged anywhere from 20% to 100% for most estuaries in the region. Seagrasses are threatened by increased loadings of nutrients into coastal waters, dredging activities, and shoreline development, as well as increased commercial and recreational boating and fishing practices. In 1992, the Gulf of Mexico Program's Habitat Degradation Committee produced a report on the status and trends of emergent and submerged vegetated habitats in the Gulf of Mexico (Duke and Kruczynski, 1992). At that time, the total seagrass coverage in the shallow estuarine and nearshore waters of the northern gulf was estimated to be 1,019,844 ha (2.52 million acres).

In 1999, the Gulf of Mexico Program's Habitat Focus Team and a panel of seagrass experts and researchers developed a comprehensive seagrass research and restoration program. The main objectives of this program are as follows:

- assess the areal and temporal extent and quality of seagrasses;
- determine trends in the extent and quality of seagrass habitats;
- identify factors that determine establishment and persistence of seagrasses; and
- identify the critical factors which determine natural structural and functional characteristics of seagrass habitats.

Many studies need to be conducted to address the objectives listed above. To better assess the areal and temporal extent of seagrasses, current seagrass acreage in the coastal waters must be quantified and mapped. Geological and historical seagrass coverage must also be determined to evaluate quantity and locations of seagrass decline. To help determine the quality of seagrass beds, indicators of seagrass health must be identified on appropriate spatial and temporal scales. Rapid assessment techniques and sample designs to routinely monitor seagrass beds also need to be developed. The water-quality parameters that will protect and preserve seagrasses need to be identified in order to evaluate the factors which determine seagrass establishment and persistence. Stressors (both natural and human-induced) need to be identified and quantified, as well as the cause and effect relationships between potential stressors and seagrasses. Water column and sediment characteristics required to establish seagrasses in areas needing to be restored should also be evaluated.

One of the initial activities proposed to support the research and restoration goals of the Gulf of Mexico Program was a comprehensive review of the current status and trends of seagrasses in the northern Gulf of Mexico. Fourteen estuarine systems experiencing various degrees of seagrass degradation were selected for the study. Scientists and environmental managers researching the seagrass communities in these systems have coordinated their sampling, monitoring, and reporting practices to develop a comprehensive review of historical seagrass coverage, current seagrass coverage, and significant threats to both short-term and long-term seagrass productivity in each of the systems. For this report, the majority of data produced used techniques described in the appendix. The resulting report includes information on the following:

- the Laguna Madre, Coastal Bend region, and Galveston Bay, three estuarine systems located along the Texas coast.
- the Chandeleur Islands, Mississippi Sound, and the Alabama coast in the central northern gulf region.
- Pensacola Bay, Perdido Bay, Choctawhatchee Bay, St. Andrew Bay, and Florida's Big Bend region along the northwest Florida coast.
- Tampa Bay and St. Joseph's Sound, Sarasota Bay, Charlotte Harbor, and Florida Bay along the southwest Florida coast.
- Statewide summaries of seagrass coverage of all five Gulf of Mexico Coast States.

This report's local estuarine systems (see fig. 1) are described in 14 vignettes, each beginning with a cover map that depicts the watershed of each seagrass acreage area. The watershed map also depicts the streams, rivers, and bays that ultimately can influence the health and conservation of the seagrasses in that area. The vignettes primarily discuss the local seagrass acreage, causes and effects of acreage change, and restoration and monitoring ongoing in the area.

All 14 estuarine systems have experienced some declines in seagrass habitat. Laguna Madre has experienced between 10% and 20% loss in seagrass habitat since 1965. Mississippi Sound, home of the Grand Bay National Estuarine Research Reserve, has lost over 4,500 ha (11,120 acres) of seagrass habitat since 1969, leaving only about 750 ha (1,853 acres) total seagrass coverage. In Tampa Bay, Fla., over 6,000 ha (14,826 acres) of seagrass have been lost since the 1950s.

It is important to note that, as scientists learn more about the ecological value of these key habitats and continue efforts to educate and inform the public on the critical nature of seagrass systems, conservation efforts in these areas are yielding positive results. For instance, Florida Bay, home to species such as the manatee, bottlenose dolphin, and loggerhead sea turtle (*Caretta caretta*), gained 5,000 ha (12,355 acres) of seagrass habitat between 1987 and 1994. In addition, the Coastal Bend of Texas, part of EPA's National Estuary Program, has seen an increase of 2,168 ha (5,357 acres) since 1958.

This report presents the initial efforts of the Gulf of Mexico Program and its partners to implement a comprehensive research and restoration plan for seagrasses. The purpose of the review is to provide scientists, managers, and citizens with valuable baseline information on the current status of seagrasses in the coastal waters of the northern Gulf of Mexico. In the following sections of this document, detailed backgrounds on each of the respective geographic areas are presented. Each section includes the areal extent, geology, bathymetry, and key aquatic species inhabiting the area. Additionally, seagrasses species, their abundance and distribution, and methods used to evaluate the historical and current trends are presented. For each system, information on the causes of seagrass habitat degradation is offered, as well as potential restoration opportunities and techniques for improving seagrass health in that specific estuary.

Figure 1. Local estuarine systems described in this report.


Alabama
Mississippi
Louisiana
Florida
Pensacola Bay
Choctawhatchee Bay
St. Andrew Bay
Big Bend
Chandeleur Sound
Perdido Bay
Mississippi Sound
Galveston Bay
Tampa Bay
Sarasota Bay
Charlotte Harbor
Coastal Bend
Laguna Madre
Florida Bay
Gulf of Mexico
Cuba
Mexico
N
km 0 100 200 300 400
mi 0 50 100 150 200

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