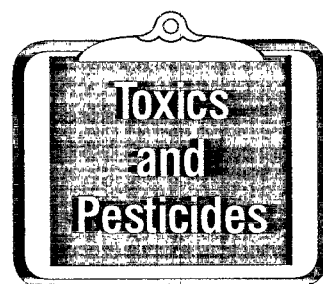
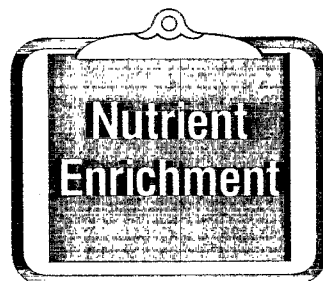
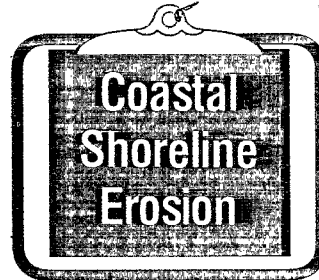
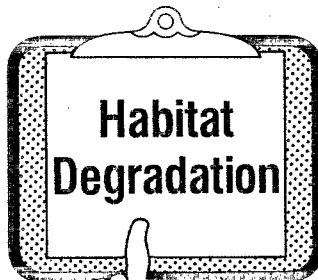
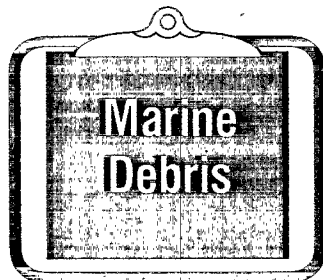




Habitat Degradation Action Agenda For The Gulf Of Mexico

First Generation—Management Committee Report

Framework for Action



Habitat Degradation Action Agenda for the Gulf of Mexico



Recycled/Recyclable
Printed on paper that contains
at least 50% recycled fiber

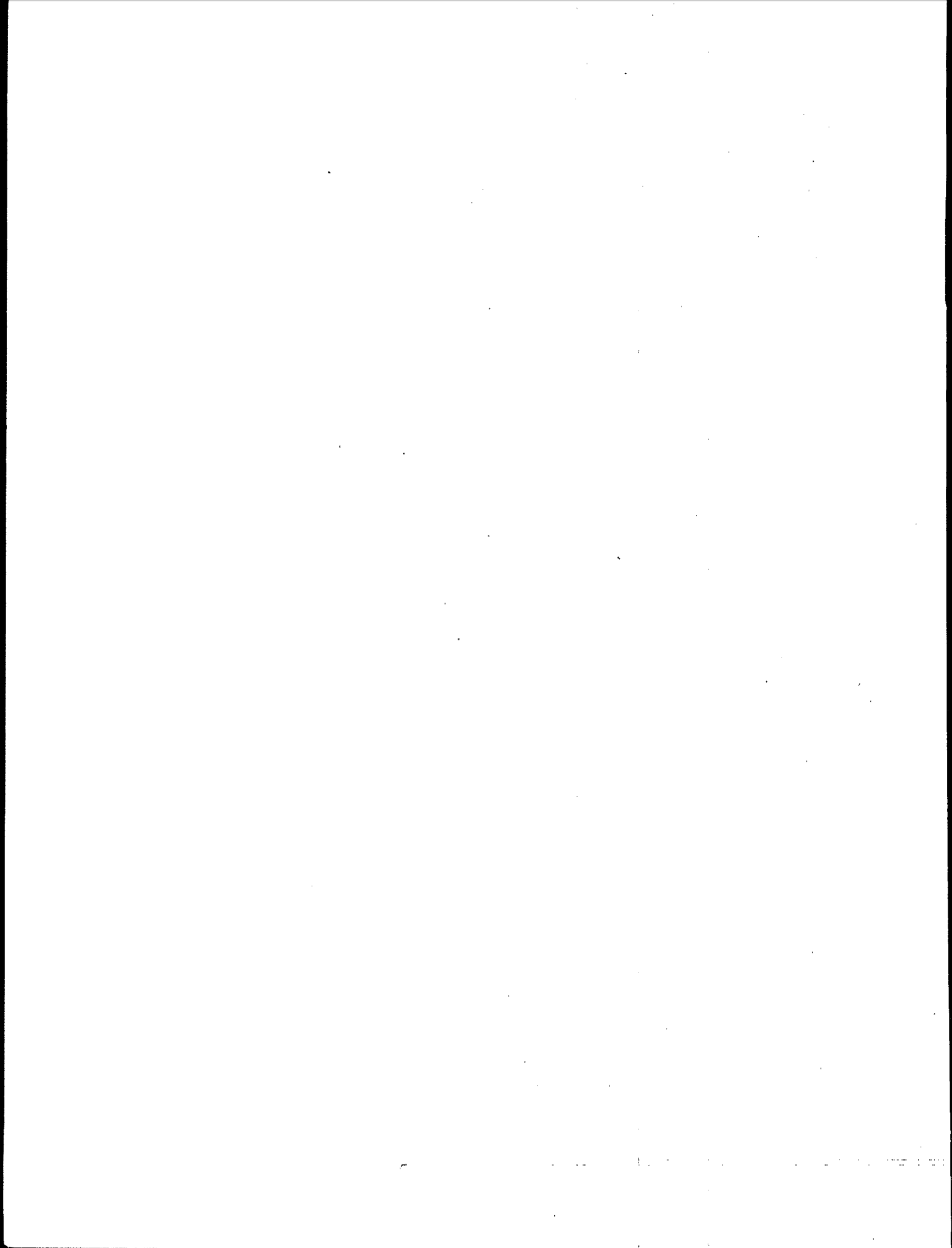
PREFACE

One of the initial goals for the first five years of the Gulf of Mexico Program was to establish a "framework-for-action" for implementing management options for pollution controls, determining research direction and environmental monitoring protocols, and implementing remedial and restoration measures for environmental losses. As a means of developing this framework-for-action, the Gulf Program established eight committees, composed of experts, to deal with the following environmental issue areas:

- ☐ Habitat Degradation
- ☐ Marine Debris
- ☐ Freshwater Inflow
- ☐ Nutrient Enrichment
- ☐ Toxic Substances & Pesticides
- ☐ Public Health
- ☐ Coastal & Shoreline Erosion
- ☐ Living Aquatic Resources

Each committee was charged with: 1) characterizing the status of the issue, 2) developing goals and objectives for remedial and restoration activities, and 3) developing descriptions of the projects and tasks to be implemented in order to achieve the stated objectives. This information was incorporated into an "Action Agenda" for each environmental issue area.

This document is the first generation of one of these Action Agendas. Representing the consensus of a large number of subject specialists, this document is considered to be a draft working paper for the Gulf of Mexico Program Management Committee. Since this first generation Action Agenda has not been reviewed and approved by all agencies, it is being made available for informational purposes only.



EXECUTIVE SUMMARY

The Gulf of Mexico contains ecological and commercial riches matched by few other bodies of water. Yet its blue-green waters disguise the increasing environmental threats that endanger those resources. In recognition of these threats, Regions 4 and 6 of the U.S. Environmental Protection Agency (USEPA), which share jurisdiction over the five Gulf Coast States (Alabama, Florida, Louisiana, Mississippi, and Texas), initiated the Gulf of Mexico Program in August 1988. The goal of the Gulf of Mexico Program is to protect, restore, and enhance the coastal and marine waters of the Gulf of Mexico and its coastal natural habitats, to sustain living resources, to protect human health and the food supply, and to ensure the recreational use of Gulf shores, beaches, and waters--in ways consistent with the economic well being of the region.

The Gulf of Mexico Program is a cooperative partnership among federal, state, and local government agencies, as well as with people and groups who use the Gulf of Mexico. During the early stages of Program development, eight priority environmental problems were identified and the following Issue Committees have been established to address each of these problems: Marine Debris, Public Health, Habitat Degradation, Coastal & Shoreline Erosion, Nutrient Enrichment, Toxic Substances & Pesticides, Freshwater Inflow, and Living Aquatic Resources. There are important linkages among these various Issue Committees, and the Gulf of Mexico Program works to coordinate and integrate activities among them.

The Habitat Degradation Committee was charged with characterizing habitat degradation problems and identifying ways to restore damaged habitat and prevent this damage from continuing. The Issue Committee has been meeting for more than four years--to review information and data collected by citizens and scientists, identify problem areas, discuss actions that can resolve the problems, and evaluate methods for achieving and monitoring results. The culmination of Issue Committee efforts is this Habitat Degradation Action Agenda which specifies an initial set of activities needed to reduce, and eventually eliminate, habitat degradation in the Gulf of Mexico. This Action Agenda is the first generation of an evolving series of Action Agendas that will be developed to meet the future needs of the Gulf of Mexico.

Chapter 1 of the Action Agenda provides an overview of Gulf of Mexico resources, and the threats now facing those resources. In addition, Chapter 1 describes the structure of the Gulf of Mexico Program including the Action Agenda development process.

Chapter 2 is a summary of the scientific characterization information compiled by the Habitat Degradation Committee. Chapter 2 is currently heavily focused on coastal wetland and seagrass habitats of the Gulf of Mexico coastal plain, because the characterization work describing the status and trends of areal coverage of these habitats has been completed. The Issue Committee acknowledges the need for

further characterization work and addresses this need through action items in Chapter 4. Action items for eliminating habitat degradation in non-wetland coastal habitats will be addressed in future iterations of this Action Agenda as additional characterization research is completed.

Chapter 3 describes the legal and institutional framework currently in place in the Gulf of Mexico to address habitat degradation issues and support protection and restoration efforts.

Chapter 4, **The Unfinished Agenda**, contains the goals, objectives, and specific activities established by the Gulf of Mexico Program to address habitat degradation. The two long-term goals established by the Habitat Degradation Committee are to:

- ☐ Protect, restore, enhance, and create Gulf of Mexico habitats.
- ☐ Foster public understanding, appreciation, and stewardship of Gulf of Mexico habitats.

Forty-two action items have been developed to support these goals and are grouped under six types of activities and ten objectives (see **Index of Habitat Degradation Objectives**). The action items included in Chapter 4 have been screened by the Gulf of Mexico Program and represent those activities that are currently the most significant and most achievable. This is a fairly comprehensive, but not exhaustive, list. This document begins an evolving process of Action Agendas in which action items are designated, implemented, and then reassessed as progress in the Gulf is made. In the future, new action items will be developed to meet the changing needs in the Gulf of Mexico.

Action items contained in Chapter 4 are not listed in priority order. Each action item is supported by one or more project descriptions. Some of the actions are already underway but not yet completed. Others are included because they will guide federal, state, and local government agencies and private sector organizations in allocating resources where they are most needed and in justifying future management strategies. This Action Agenda should prompt specific agencies and groups to become involved.

The Gulf of Mexico Program recently developed ten short-term environmental challenges to restore and maintain the environmental and economic health of the Gulf. Within the next five years (1993-1997), through an integrated effort that complements existing local, state, and federal programs, the Program has pledged efforts to obtain the knowledge and resources to:

- ☐ Significantly reduce the rate of loss of coastal wetlands.
- ☐ Achieve an increase in Gulf Coast seagrass beds.
- ☐ Enhance the sustainability of Gulf commercial and recreational fisheries.

- ☐ Protect the human health and food supply by reducing input of nutrients, toxic substances, and pathogens to the Gulf.
- ☐ Increase Gulf shellfish beds available for safe harvesting by ten percent.
- ☐ Ensure that all Gulf beaches are safe for swimming and recreational uses.
- ☐ Reduce by at least ten percent the amount of trash on beaches.
- ☐ Improve and expand coastal habitats that support migratory birds, fish, and other living resources.
- ☐ Expand public education/outreach tailored for each Gulf Coast county or parish.
- ☐ Reduce critical coastal and shoreline erosion.

This Habitat Degradation Action Agenda supports these five-year environmental challenges.

For the public, this Gulf of Mexico Action Agenda should serve three purposes. First, it should reflect the public will with regard to addressing habitat degradation. Second, it should communicate what activities are needed for eliminating habitat degradation and provide the momentum for initiating these actions. Third, it should provide baseline information from which success can be measured.

This Action Agenda is a living document; therefore, the Gulf of Mexico Habitat Degradation Committee intends to periodically revise and update this document.

Index of Habitat Degradation Objectives

Monitoring & Assessment

Objective: Assess the status and trends of important Gulf of Mexico coastal habitats to establish a framework for developing corrective measures and setting priorities.

Objective: Identify the causes of habitat declines in the Gulf of Mexico region to assist in determining necessary and appropriate corrective measures.

Objective: Plan and monitor pilot restoration projects Gulfwide in coordination with local, state, and other federal programs, and evaluate the effectiveness of enhancement, restoration, and creation in replacing Gulf of Mexico habitats.

Research

Objective: Conduct research to increase knowledge of the functions of Gulf of Mexico habitats and to determine the relationships between habitat types and the effects of stress on these habitats.

Objective: Conduct research to improve habitat restoration and enhancement projects in the Gulf of Mexico.

Planning & Standards

Objective: Enhance the effectiveness of federal and state standards and management programs to protect and conserve coastal habitats in the Gulf of Mexico region.

Compliance & Enforcement

Objective: Provide maximum protection for Gulf of Mexico habitats by assuring full compliance with federal and state regulatory permit conditions and vigorous violation detection and resolution.

Preservation & Protection

Objective: Provide a comprehensive preservation and protection framework for Gulf of Mexico habitats of significant ecological value.

Public Education & Outreach

Objective: Develop educational materials and programs to promote awareness and appreciation of Gulf of Mexico habitats, as well as their value and importance.

Objective: Prevent or correct Gulf of Mexico habitat degradation and loss through public involvement activities.

TABLE OF CONTENTS

List of Tables.....	vii
---------------------	-----

List of Figures.....	viii
----------------------	------

1 OVERVIEW OF THE GULF OF MEXICO..... 1

<i>The Gulf of Mexico - A Vast & Valuable Resource.....</i>	1
<i>The Gulf of Mexico - A Resource at Risk.....</i>	3
<i>The Gulf of Mexico Program - Goals & Structure.....</i>	4
<i>The Habitat Degradation Committee.....</i>	9

2 HABITAT DEGRADATION IN THE GULF OF MEXICO..... 11

<i>Geographical & Ecological Limits.....</i>	11
<i>Value of Gulf Resources.....</i>	11
<i>Climatological Influences.....</i>	14
<i>Causes of Habitat Degradation.....</i>	15
<i>Status of Habitats in the Gulf of Mexico.....</i>	17
<i>State-By-State Overview.....</i>	29
Alabama.....	29
Florida.....	29
Louisiana.....	30
Mississippi.....	31
Texas.....	31
<i>Conclusion.....</i>	33

3 FEDERAL & STATE FRAMEWORK FOR ADDRESSING HABITAT DEGRADATION..... 34

4	THE UNFINISHED AGENDA	35
	Goal.....	35
	Action Agenda Framework.....	35
	Monitoring & Assessment.....	41
	Research.....	54
	Planning & Standards.....	60
	Compliance & Enforcement.....	68
	Preservation & Protection.....	72
	Public Education & Outreach.....	76
	 In Closing.....	 83
	 Bibliography.....	 84
	 APPENDIX A <i>Federal & State Framework</i>.....	 92
	 APPENDIX B <i>Acronym Guide</i>.....	 130
	 APPENDIX C <i>Glossary</i>.....	 133
	 APPENDIX D <i>Participants in the Action Agenda Development Process</i>.....	 137

LIST OF TABLES

Table 2.1	<i>Totals (Acres) of Selected Wetlands by State for the Gulf of Mexico.....</i>	14
------------------	--	-----------

LIST OF FIGURES

Figure 1.1	<i>Gulf of Mexico Coastal Population per Shoreline Mile.....</i>	3
Figure 1.2	<i>Gulf Program Structured Partnership.....</i>	6
Figure 2.1	<i>Wetland Resources of the Gulf of Mexico</i>	12
Figure 2.2	<i>Coastal Habitats of the Gulf of Mexico.....</i>	18
Figure 2.3	<i>Zones & Localities of Major Biogeographical Significance in the Gulf of Mexico.....</i>	26
Figure 2.4	<i>Locations of Known Chemosynthetic Communities at Hydrocarbon Seeps in the Northern Gulf of Mexico.....</i>	28

1 OVERVIEW OF THE GULF OF MEXICO

The Gulf of Mexico - A Vast & Valuable Resource

Bounded by a shoreline that reaches northwest from Florida along the shores of Alabama, Mississippi, and Louisiana, and then southwest along Texas and Mexico, the Gulf of Mexico is the ninth largest body of water in the world. The Gulf's U.S. coastline measures approximately 2,609 km (1,631 miles)--longer than the Pacific coastline of California, Oregon, and Washington. The Gulf region covers more than 1.6 million km² (617,600 mi²) and contains one of the nation's most extensive barrier-island systems, outlets from 33 major river systems, and 207 estuaries (Buff and Turner, 1987). In addition, the Gulf receives the drainage of the Mississippi River, the largest river in North America and one of the major rivers of the world. A cornerstone of the nation's economy, the Gulf's diverse and productive ecosystem provides a variety of valuable resources and services, including transportation, recreation, fish and shellfish, and petroleum and minerals.

Encompassing over two million hectares (five million acres) (about half of the national total), Gulf of Mexico coastal wetlands serve as essential habitat for a large percentage of the U.S.'s migrating waterfowl (USEPA, 1991). Mudflats, salt marshes, mangrove swamps, and barrier island beaches of the Gulf also provide year-round nesting and feeding grounds for abundant numbers of gulls, terns, and other shorebirds. Five species of endangered whales, including four baleen whales and one toothed whale, are found in Gulf waters. These waters also harbor the endangered American crocodile and five species of endangered or threatened sea turtles (loggerhead, green, leatherback, hawksbill, and Kemp's Ridley). The endangered West Indian (or Florida) manatee inhabits waterways and bays along the Florida peninsula. The Gulf of Mexico also provides essential habitat for the endangered brown pelican and the threatened piping plover and Arctic peregrine falcon.

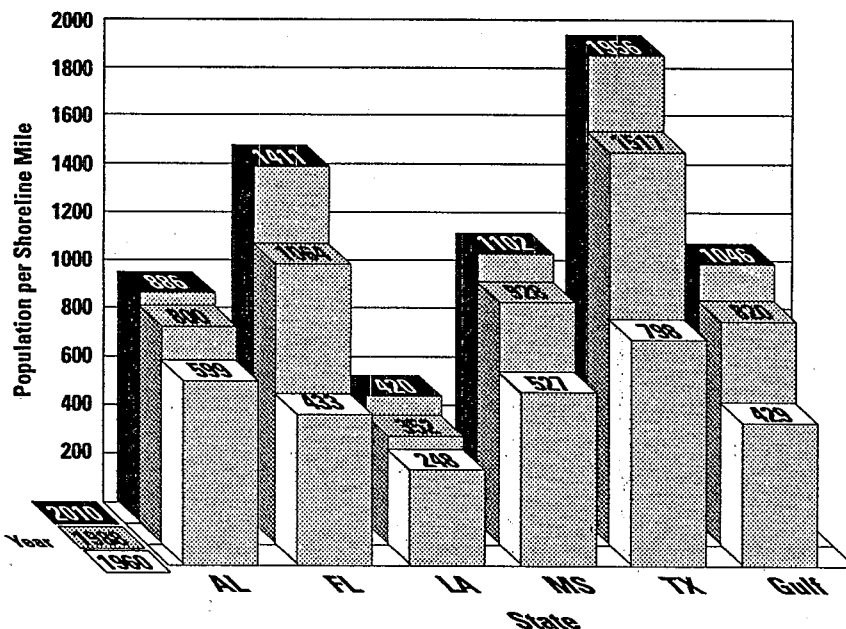
In addition, a complex network of channels and wetlands within the Gulf shoreline provides habitat for estuarine-dependent commercial and recreational fisheries. The rich waters yielded approximately 771 million kg (1.7 billion pounds) of fish and shellfish in 1991. Worth more than \$641 million at dockside, this harvest represented 19 percent of the total annual domestic harvest of commercial fish (USDOC, 1992). The Gulf boasts the largest and most valuable shrimp fishery in the U.S. and also contributed 41 percent of the U.S. total oyster production in 1991 (USDOC, 1992). Other Gulf fisheries include diverse shellfisheries for crabs and spiny lobsters and finfisheries for menhaden, herring, mackerel, tuna, grouper, snapper, drum, and flounder. The entire U.S. Gulf of Mexico fishery yields more finfish, shrimp, and shellfish annually than the South and Mid-Atlantic, Chesapeake, and Great Lakes regions combined.

The Gulf's bountiful waters draw millions of sport fishermen and beach users each year. It is estimated that the Gulf supports more than one-third of the nation's marine recreational fishing, hosting four million fishermen in 1985 who caught an estimated 42 million fish (USDOC, 1992). Popular nearshore catches include sea trout (weak fish), cobia, redfish, flounder, grouper, red snapper, mackerel, and tarpon; offshore catches include blue marlin, white marlin, sailfish, swordfish, dolphin, and wahoo. Tourism-related dollars in the Gulf Coast States contribute an estimated \$20 billion to the economy each year (USEPA, 1991).

Gulf oil and gas production are equally valuable to the region's economy and are a critical part of the nation's total energy supply. In 1990, more than 1,600 Outer Continental Shelf (OCS) leases were in production, yielding approximately 90 percent of U.S. offshore production. These OCS royalties annually contribute about \$3 billion to the Federal Treasury. Thirty-eight percent of all petroleum and 48 percent of all natural gas reserves in the U.S. are estimated to be in the Gulf of Mexico. The industry employs some 30,000 people in the Gulf of Mexico.

Approximately 45 percent of U.S. shipping tonnage passes through Gulf ports, including four of the nation's busiest: Corpus Christi, Houston/Galveston, Tampa, and New Orleans. The second largest marine transport industry in the world is located in the Gulf of Mexico. According to USEPA, vessel trips in and out of American Gulf ports and harbors exceeded an estimated 600,000 trips in 1986. The U.S. Navy is also implementing its Gulf Coast Homeporting Plan, designed to dock at least 25 vessels in Ingelside, TX, Pascagoula, MS, and Mobile, AL.

Millions of people depend on the Gulf of Mexico to earn a living and flock to its shores and waters for entertainment and relaxation. The temperate climate and abundant resources are attracting more and more people. The region currently ranks fourth in total population among the five U.S. coastal regions, accounting for 13 percent of the nation's total coastal population. Although the Gulf region is not as densely settled as others, it is experiencing the second fastest rate of growth; between 1970 and 1980, the population grew by more than 30 percent (USDOC, 1990b). According to the U.S. Department of Commerce, the Gulf's total coastal population is projected to increase by 144 percent between 1960 and 2010, to almost 18 million people. **Figure 1.1** shows the Gulf of Mexico coastal population density or population per shoreline mile projected to the year 2010. Florida's population alone is expected to have skyrocketed by more than 300 percent by the year 2010. The increasing coastal population is of concern because as the population increases, so does the potential for environmental degradation.

Figure 1.1 Gulf of Mexico Coastal Population per Shoreline Mile

(Source: USDOC, 1990b)

The Gulf's resources and environmental quality are affected not only by the millions living and working in the region, but also by activities occurring throughout much of the nation. Two-thirds of the land area of the contiguous U.S. drains into the Gulf, bringing with it potential environmental problems associated with pesticides, fertilizers, toxic substances, and trash.

The Gulf of Mexico - A Resource At Risk

Increasing population pressures mean increased use and demands on Gulf of Mexico resources. Until recently, the Gulf was considered too vast to be affected by pollution and overuse. Recent trends indicate, however, serious long-term environmental damage unless action is initiated today. Potential problems or causes of degradation throughout the Gulf system include the following (USEPA, 1991):

- ☐ Fish kills and toxic "red tides," and "brown tides" were an increasing phenomenon in Gulf waters during the 1980s.

- ❑ Alabama, Mississippi, Louisiana, and Texas are among those states that discharge the greatest amount of toxic chemicals into coastal waters.
- ❑ Diversions and consumptive use for human activities have resulted in significant changes in the quantity and timing of freshwater inflows to the Gulf of Mexico.
- ❑ More than half of the shellfish-producing areas along the Gulf Coast are permanently or conditionally closed. These closure areas are growing as a result of increasing human and domestic animal populations along the Gulf Coast (USDOC, 1991a).
- ❑ Louisiana is losing valuable coastal wetlands at the rate of approximately 14-66 km²/year (5-25 mi²/year) (Dunbar, *et al.*, 1992).
- ❑ Almost 1,800 kg/mi (2 tons/mi) of marine trash covered Texas beaches in 1988.
- ❑ Up to 9,500 km² (4,000 mi²) of oxygen deficient (hypoxia) bottom waters, known as the "dead zone," have been documented off the Louisiana and Texas coasts (Rabalais, *et al.*, 1991).
- ❑ Gulf shorelines are eroding up to 30 m/year (100 ft/year). Few coastal reaches in the Gulf can be characterized as "stable" or "accreting."

The Gulf of Mexico Program - Goals & Structure

Problems plaguing the Gulf cannot be addressed in a piecemeal fashion. These problems and the resources needed to address them are too great. The Gulf of Mexico Program (GMP) was formed to pioneer a broad, geographic focus in order to address major environmental issues in the Gulf before the damage is irreversible or too costly to correct.

The program is part of a cooperative effort with other agencies and organizations in the five Gulf States, as well as with people and groups who use the Gulf. In addition to the U.S. Environmental Protection Agency (USEPA), other participating federal government agencies include: National Aeronautics and Space Administration (NASA), U.S. Army Corps of Engineers (USACE), U.S. Department of Agriculture (USDA), U.S. Department of Commerce (USDOC), U.S. Department of Defense (USDOD), U.S. Department of Energy (USDOE), U.S. Department of the Interior (USDOI), U.S. Department of Transportation (USDOT), U.S. Food & Drug Administration (USFDA), and Agency for Toxic Substances & Disease Registry (ATSDR).

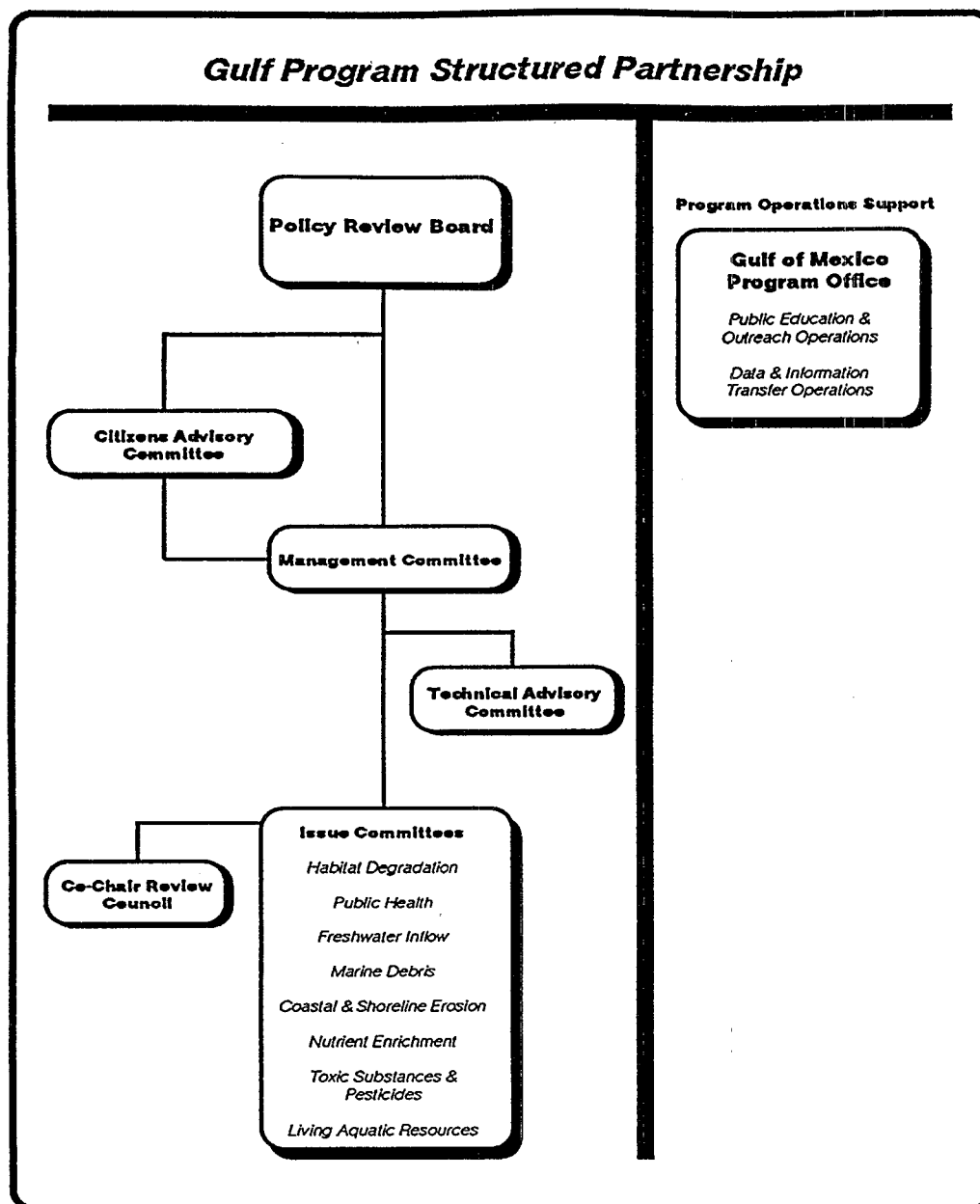
The Gulf of Mexico Program also works in coordination and cooperation with five National Estuary Programs (NEPs) within the Gulf: Tampa Bay, Sarasota Bay, Galveston Bay, Corpus Christi Bay, and the Barataria-Terrebonne Estuarine Complex. The Gulf of Mexico Program supports and builds on certain activities of these programs, bringing a Gulfwide focus and providing a forum for addressing issues of Gulfwide concern.

By building on and enhancing programs already underway, as well as by coordinating new activities, the Gulf of Mexico Program will serve as a catalyst for change. The program's overall goals are to provide:

- ☐ A mechanism for addressing complex problems that cross federal, state, and international jurisdictional lines;
- ☐ Better coordination among federal, state, and local programs, thus increasing the effectiveness and efficiency of the long-term effort to manage and protect Gulf resources;
- ☐ A regional perspective to address research needs, which will result in improved transfer of information and methods for supporting effective management decisions; and
- ☐ A forum for affected groups using the Gulf, for public and private educational institutions, and for the general public to participate in the solution process.

The Gulf of Mexico Program is supported by four committees: Policy Review Board (PRB), Management Committee (MC), Citizens Advisory Committee (CAC), and Technical Advisory Committee (TAC) (see **Figure 1.2**). Composed of 20 senior level representatives of state and federal agencies and representatives of the technical and citizens committees, the Policy Review Board guides and reviews overall program activities. The Management Committee guides and manages Gulf of Mexico Program operations and directs the Action Agenda activities of the Issue Committees. The Citizens Advisory Committee is composed of five governor-appointed citizens who represent environmental, fisheries, agricultural, business/industrial, and development/tourism interests in each of the five Gulf Coast States. This committee provides public input and assistance in publicizing the Gulf of Mexico Program's goals and results. Representatives of state and federal agencies, the academic community, and the private and public sectors are members of the Technical Advisory Committee and provide technical support to the Management Committee.

Figure 1.2



The Gulf of Mexico Program has established the following eight Issue Committees, each co-chaired by one federal and one state representative, to address priority environmental problems:

- ☐ **Habitat Degradation** of such areas as coastal wetlands, seagrass beds, and sand dunes;
- ☐ **Freshwater Inflow** changes resulting from reservoir construction, diversions for municipal, industrial, and agricultural purposes, and modifications to watersheds with concomitant alteration of runoff patterns;
- ☐ **Nutrient Enrichment** resulting from such sources as municipal waste water treatment plants, storm water, industries, and agriculture;
- ☐ **Toxic Substances & Pesticides** contamination originating from industrial and agriculturally based sources;
- ☐ **Coastal & Shoreline Erosion** caused by natural and human-related activities;
- ☐ **Public Health** threats from swimming in and eating seafood products coming from contaminated water;
- ☐ **Marine Debris** from land-based and marine recreational and commercial sources; and
- ☐ **Living Aquatic Resources.**

Two cross-cutting technical operating committees support the public education and information and resource management functions of the eight environmental Issue Committees. These are:

- ☐ **Public Education & Outreach Operations**
- ☐ **Data & Information Transfer Operations**

The action planning process used by each Gulf of Mexico Program Issue Committee includes the following key activities:

- ☐ Definition of environmental issues;
- ☐ Characterization of identified problems, including sources, resources, and impacts;
- ☐ Establishment of goals and objectives;

- ☐ Evaluation/assessment of corrective actions and control measures, including cost/benefit analysis;
- ☐ Selection of priority action items;
- ☐ Establishment of measures of success;
- ☐ Implementation of actions; and
- ☐ Evaluation of success and revision of the Action Agenda.

As the Issue Committees progress through each of these activities, ample opportunities are provided for public review and Policy Review Board endorsement is requested at appropriate points. The Gulf of Mexico Program will continuously work to integrate related activities of the eight Issue Committees. Through the consensus of Program participants, a coordinated response will be directed to the successful maintenance and enhancement of resources of the Gulf of Mexico.

The Habitat Degradation Committee

The Co-Chairs and membership of the Habitat Degradation Committee are as follows:

Co-Chairs:

Larry Goldman	U.S. Fish & Wildlife Service
Eugene Turner	Louisiana State University

Members:

Steve Branstetter	Gulf & South Atlantic Fisheries Development Foundation, Inc.
Carl Brown	U.S. Army Corps of Engineers
Tom Calnan	Texas General Land Office
William Cibula	National Aeronautics & Space Administration
Art Dyas	Southeastern Natural Resources--CAC
Johnny French	U.S. Fish & Wildlife Service
Gary Gaston	University of Mississippi
Bill Good	Louisiana Department of Natural Resources
Kenneth Haddad	Florida Department of Natural Resources
Kenneth Heck	Dauphin Island Sea Lab
Rex Herron	National Marine Fisheries Service
Clyde Hoeft	U.S. Fish & Wildlife Service
Bill Kruczynski*	U.S. Environmental Protection Agency--Region 4
Bennett Landreneau	Soil Conservation Service
Larry Lewis	Brown & Mitchell
Robin Lewis	Lewis Environmental Services, Inc.
Andreas Mager Jr.	National Marine Fisheries Service
Paul Montagna	University of Texas
Rudy Nyc	U.S. Army Corps of Engineers
Leland Roberts	Texas Parks & Wildlife Department
Robert Rogers	Minerals Management Service
Stephanie Sanzone	U.S. Environmental Protection Agency
Peter Sheridan	National Marine Fisheries Service
Brent Smith	U.S. Department of Energy
Robert Stewart Jr.	U.S. Fish & Wildlife Service
Ronald Ventola	U.S. Army Corps of Engineers

*Previous Co-Chair

The Habitat Degradation Committee developed the following long-term goals for addressing habitat degradation in the Gulf of Mexico:

- ☐ Protect, restore, enhance, and create Gulf of Mexico habitats.
- ☐ Foster public understanding, appreciation, and stewardship of Gulf of Mexico habitats.

In developing this draft Action Agenda, the Habitat Degradation Committee has sought input and advice from other technical Issue Committees as well as from organizations, interest groups, and private concerns outside of the Gulf of Mexico Program. An "Action Agenda Workshop" was sponsored by the Issue Committee in New Orleans, LA, on January 8-10, 1992. Approximately 40 persons comprising a mix of Program and non-Program participants gathered to review an early version of this Action Agenda. In addition to Gulf of Mexico Program participants, representatives from the following agencies, organizations, and industries attended the workshop: Chevron, Office of the Governor of Louisiana, Center for Marine Conservation, Louisiana Department of Wildlife & Fisheries, Mote Marine Laboratory, Mississippi Power Company, Gulf of Mexico Fishery Management Council, The Nature Conservancy, Louisiana Landowners Association, Alabama Department of Environmental Management, and Florida Audubon Society. That workshop generated a significant number of comments that were addressed in the present document. (See **Appendix D: Participants in the Action Agenda Development Process.**)

2 HABITAT DEGRADATION IN THE GULF OF MEXICO

Geographical & Ecological Limitations of This Action Agenda

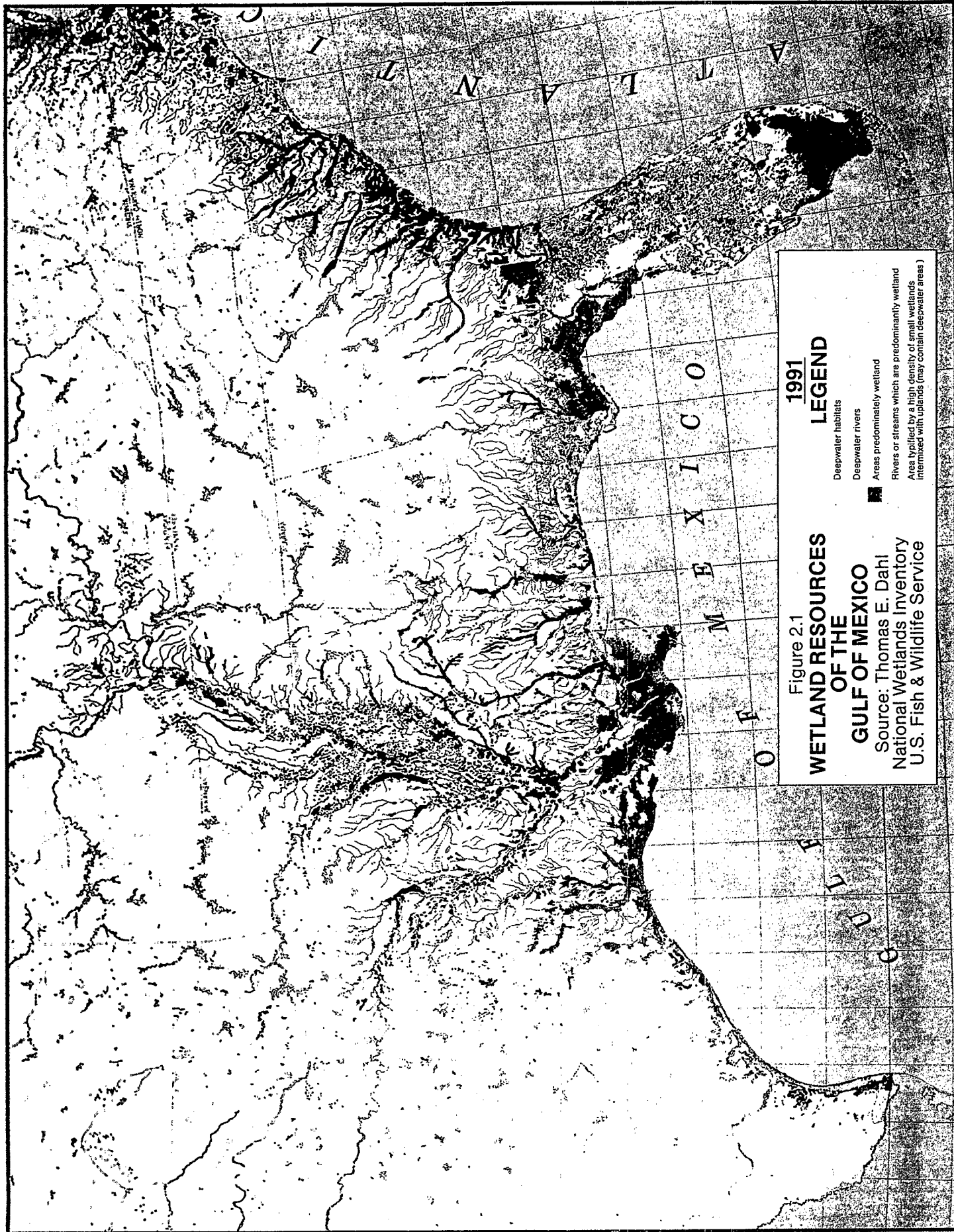
This section describes the function and status of coastal habitats that nourish marine and estuarine species along the Gulf of Mexico coast. For the purposes of this Action Agenda, habitats are defined as those elements of an environment that sustain organisms and communities. Funding and scheduling restrictions allowed the Habitat Degradation Committee to consider only those habitats occurring between the seaward edge of the continental shelf [water depth about 200 m (656 ft)] and the landward limits of coastal management zones defined by each state. However, it is recognized that many valuable habitats exist outside this area which contribute to the biodiversity of the Gulf region. In addition, this Habitat Degradation Action Agenda is heavily focused on coastal wetland and seagrass habitats of the Gulf of Mexico coastal plain because the characterization work describing the status and trends of areal coverage of these habitats has been completed. *Action items for addressing degradation of non-wetland coastal habitats will be addressed in future versions of this document.* **Figure 2.1** depicts the wetland resources of the Gulf of Mexico region.

Value of Gulf Resources

Coastal habitats provide food and shelter for many coastal species, including some that are considered threatened or endangered by extinction. For example, five species of threatened or endangered sea turtles inhabit the coastlines of all five Gulf Coast States. Other documented rarities which are found in Gulf coastal habitats are the West Indian manatee, Florida panther, key deer, Mississippi sandhill crane, Florida everglade kite, Arctic peregrine falcon, Kirtland's warbler, red-cockaded woodpecker, piping plover, whooping crane, gopher tortoise, pine barrens tree frog, and red hills salamander (USDOI, 1980).

Coastal emergent wetland habitats, such as salt marshes and mangrove forests, seagrass beds, and reefs provide a nursery habitat for many species and offer protective cover from prey. Also, coastal wetlands contribute organic matter to the estuarine food web and are integral to the processing and flow of nutrients needed by marine life.

Coastal wetlands provide habitats for numerous species of sport and commercial fishes. In the Gulf of Mexico alone, an estimated 95 percent of commercial fish landed and 85 percent of the sport fish catch (by weight) spend at least a portion of their lives in coastal wetland and estuarine habitats (Thayer and Ustach, 1981; Lindall and Thayer, 1982).



Annually, Gulf of Mexico habitats yield more than 771 million kg (1.7 billion pounds) of fish and shellfish; in addition, the Gulf contains six of the top ten fishery ports in the nation by weight (USDOC, 1992). Bell (1989) studied the importance of estuarine wetlands to commercial and recreational marine fisheries in Florida and found that wetlands were linked to approximately 80 percent of the total weight of fish landed by recreational fishermen and to nearly 92 percent of Florida's commercial landings. These data are probably applicable to the Gulf Coast in general.

Because they store water, wetland habitats can play a significant role in controlling flood waters. Wetlands associated with streams can absorb flood waters, decrease the velocities of stream waters, reduce downstream peaks during flooding, and decrease the duration of floods. They also may lessen wind damage to inland areas during storms and hurricanes and reduce the impact of droughts by holding and slowly releasing water.

Wetland habitats also tend to purify waters by acting as natural filters. They remove organic pollutants, excess nutrients, and suspended particles from water as it flows from the land to the sea. Because of this capacity, natural and created wetlands have been used to treat waste waters (Sather and Smith, 1984).

Although it is difficult to place a monetary value on many coastal habitat functions, several studies have quantified the role of coastal wetlands in fisheries production. For example, data presented by Turner and Boesch (1987) support the hypothesis that wetland habitat quality and quantity control adult stocks of penaeid shrimp. Also, the fact that other aquatic animals inhabit similar ecosystems and have similar life histories implies that the quantity and quality of these habitats directly limit the productivity of other fisheries as well. In a 1982 study, Turner concluded that, if the reported figure of a one percent loss of wetland habitats per year is equivalent to a one percent decline in the potential fishing yield, then the impact on cumulative loss in dockside dollar value over a 20-year period (1982-2002) would be \$380 million (Turner, 1982).

The Gulf of Mexico's coastal estuaries, wetlands, and barrier islands also support large populations of wildlife, including waterfowl, shorebirds, and colonial nesting birds. For example, the Gulf provides essential habitat for a large percentage of the migratory waterfowl crossing the U.S.

The coastal zone of the Gulf of Mexico is endowed with immensely productive habitats whose ecological functions enhance all of the Gulf's wildlife and fishery resources. The Gulf Coast contributes approximately half of the nation's total wetland areas (USEPA, 1988). The Gulf of Mexico provides approximately 19 percent of commercial fish landings, supports the most valuable shrimp fishery in the U.S., and contributes approximately 41 percent of the U.S. total oyster production annually (USDOC, 1992). This may be due to the vast acreage of wetland habitats which contribute to the productivity of Gulf Coast estuaries.

The pressure to develop coastal habitats has not abated despite increased awareness of the value of these natural habitats, particularly emergent marshes, mangroves, and submerged aquatic vegetation. The most recent comprehensive summary of current emergent wetland acreage was performed by the National Oceanic & Atmospheric Administration (Field *et al.*, 1991). Current acreage estimates for Gulf Coast States are summarized in **Table 2.1**.

Table 2.1 **Totals (Acres) of Selected Wetlands by State for the Gulf of Mexico^{1,2}**

State	Salt Marsh	Fresh Marsh (Tidal)	Forested Scrub-Shrub (Estuarine)	Forested Scrub-Shrub (Tidal Fresh)	Tidal Flats	Total	Percentage of Total
Texas	432,000	22,500	2,600	7,400	275,100	739,600	20
Louisiana	1,722,800	65,000	10,200	4,800	31,800	1,834,600	49
Mississippi	58,800	— ³	900	—	2,300	62,000	2
Alabama	25,500	100	2,800	2,000	4,100	34,500	0
Florida	257,200	9,800	613,700	18,400	192,900	1,092,000	29
TOTALS	2,496,300	97,400	630,200	32,600	506,200	3,762,700	

¹ Acreage originally reported as acres x 100

² Calculations based on USFWS wetland inventory maps

³ None recorded

(Source: USDOC, 1991)

Climatological Influences

Habitats are unique combinations of ecological variables including primary productivity, nutrient availability, and physical structure. These factors are, in turn, influenced by seasonal and daily climatic changes, tidal regime, the amount and distribution of rainfall, temperature ranges, and the type and distribution of soils. Catastrophic events, such as floods, droughts, and hurricanes, are overprinted on local climatic conditions.

Both latitude and orientation are important in the evolution of Gulf coastal habitats. The region is subtropical which both defines and limits habitat diversity. Darnell (1992) observed that the Gulf shoreline has an east-west orientation throughout most of its length and is directly exposed to north-south winds throughout much of the year. North winds generate colder temperatures than normal for subtropical latitudes, and prolonged southerly winds result in water levels higher than predicted. Year round, incoming radiation exceeds outgoing

radiation by about $0.0003 \text{ cal cm}^{-2} \text{ sec}^{-1}$ at this latitude (Weyl, 1970). As a result, evaporation often exceeds precipitation, resulting in increased salinity which is periodically offset by heavy rainfall or flooding. Hypersaline basins develop along the South Texas Coast where rainfall and runoff are low and circulation is limited.

Hurricanes, originating from a south-southeasterly direction, occur on an average of once every two years and may generate waves with heights of 6 m (19 ft) or greater (Darnell, 1992). Waves of that magnitude are capable of flooding most coastal fresh and salt water wetland habitats. Floods caused by excess rainfall in the watersheds of area rivers reduce temperatures and salinities in coastal habitats. In summary, Gulf coastal habitats are marked by a tolerance for temperature and salinity extremes not common in other locations at similar latitudes. Accommodation of this tolerance has resulted in the biodiversity found in the area.

Causes of Habitat Degradation

Coastal habitats are extremely vulnerable to natural and human-induced destructive forces. Adverse human activities include the construction of canals and channels; dredging; disposing of spoil (dredged material); draining and filling; industrial, municipal, and agricultural point and nonpoint source discharges and runoff; and construction of dams upstream on rivers, resulting in the loss of freshwater inflows and sediment deposition to coastal estuaries. Human activities far upstream from Gulf of Mexico estuaries can also seriously degrade coastal habitats. These upstream activities include reduction of sediments and freshwater inflows through dam construction and nutrient-laden storm water runoff from urban areas and farms. Physical and biological processes that can adversely affect coastal wetland habitats include erosion, rising sea level, subsidence (*i.e.*, the sinking of wetlands and their replacement by open water), storms and droughts, phytoplankton blooms, plant diseases, and "eat-outs" by animals (*e.g.* nutria).

Subsidence, an ongoing natural occurrence, is the fate of delta marshes that undergo cyclic periods of construction and deterioration. Much of the subsidence resulting in wetland losses is probably caused by oil and gas extraction (White and Calnan, 1990). The destructive phase occurs when subsidence rates exceed the accumulation rates of organic and inorganic materials. This results in the loss of large areas of wetlands (Leibowitz and Hill, in preparation). Rising sea level can cause or hasten the conversion of subsiding wetlands to open water habitats. Darnell (1992) estimates that sea level has risen by 130 m (426 ft) in the past 18,000 years and converted most of the continental shelf to an open water habitat. Natural events (hurricanes and storms), and oil, gas, and water extraction, and other human activities that disrupt hydrologic and sedimentation patterns accelerate this cycle. For example, of the more than 8,000 hectares (20,000 acres) of submerged vegetation that were located and mapped in Mississippi Sound in 1969, about 4,700 hectares (11,650 acres) were lost to Hurricane Camille (Eleuterius and Miller, 1976).

Construction and maintenance of dams in Texas and navigation canals and levees in Louisiana are major causes of changes in sedimentation patterns and wetland loss in these states (Johnson and Gosselink, 1982; Turner, 1987; Turner *et al.*, 1982; Chabreck, 1982; Lindall *et al.*, 1979; Baumann and Turner, 1990). Johnson and Gosselink (1982) reported that construction of canals contributes directly and indirectly to the disappearance of Louisiana's coastal wetlands. First, dredging to create the canals results in the conversion of wetlands to open water. Then propeller wash from both high speed pleasure boats and large, slow moving ships erodes the banks and widens the canals, resulting in further wetland losses. In addition, canal construction related to oil and gas production, especially those that breach natural ridges, can result in saltwater intrusion which has resulted in the loss of many acres of Louisiana's freshwater coastal marshes. The end result has been a dramatic decrease in Louisiana's marshes and swamps and a concurrent increase in areas of open water, mud flats, canals, and spoil disposal sites.

Historic dredging and filling operations in coastal habitats have significantly altered the ecological balance of many coastal ecosystems throughout the Gulf Coast. For example, Taylor and Saloman (1968) demonstrated that dredging and filling for a development near Tampa, Florida, resulted in the loss of an estimated 1 million kg (1,100 tons) of seagrass, 1.6 million kg (1,800 tons) of invertebrates, and 66 thousand kg (73 tons) of fishery products.

Urban development and population increases affect coastal wetlands, often resulting in coastal habitat losses and water quality degradation. As new homes are constructed, in many localities, the original sand or drained marsh is covered with lawn grasses that are fertilized, watered, and treated with pesticides and herbicides. Runoff from lawns carries the nutrients and pesticides, as well as particulate material, into the poorly flushed canals. Hopkinson and Day (1979) found that nutrient runoff and subsequent episodes of hypoxia, resulting from eutrophication, have caused fish kills in Louisiana's Lake Cataouatche, following storm runoff from the West Bank area of New Orleans. These fish kills indicate that the lake is losing its value as a prime nursery area for commercial fish and other aquatic organisms.

Water quality in canals and adjacent waters is further reduced because of failed septic tank systems (USEPA, 1982) and by other pollutants such as oil, gasoline, and detergents related to shoreline development. Broutman and Leonard (1988) found that sources of fecal coliform pollution that contribute to the permanent or temporary closing of shellfish areas include sewage treatment plants that discharge inadequately treated wastes or raw sewage through an outfall pipe during an overload period; "straight pipes" through which untreated sewage is discharged directly; industrial discharges; septic systems that leach improperly treated material to surface waters; raw sewage from boats; urban runoff from storm sewers and drainage ditches; overland runoff from urban areas; runoff from agricultural operations and feedlots; and runoff from wildlife areas.

Status of Habitats in the Gulf of Mexico*

***NOTE:** This section is not intended to provide a comprehensive characterization, but rather an overview of the habitats found in the Gulf of Mexico region.

In this section, coastal habitats are described sequentially from infrequently flooded land to the abyssal plain (see **Figure 2.2**). Habitat names were liberally adopted from Cowardin *et al.* (1979). Coastal terrestrial habitats, although important ecologically, will be evaluated more extensively in future versions of this document.

The Gulf of Mexico is bordered by 207 estuaries (Buff and Turner, 1987). The total open water area of these estuaries at mean high water is about 3.2 million hectares (7.9 million acres), distributed among the states as follows (Lindall and Saloman, 1977):

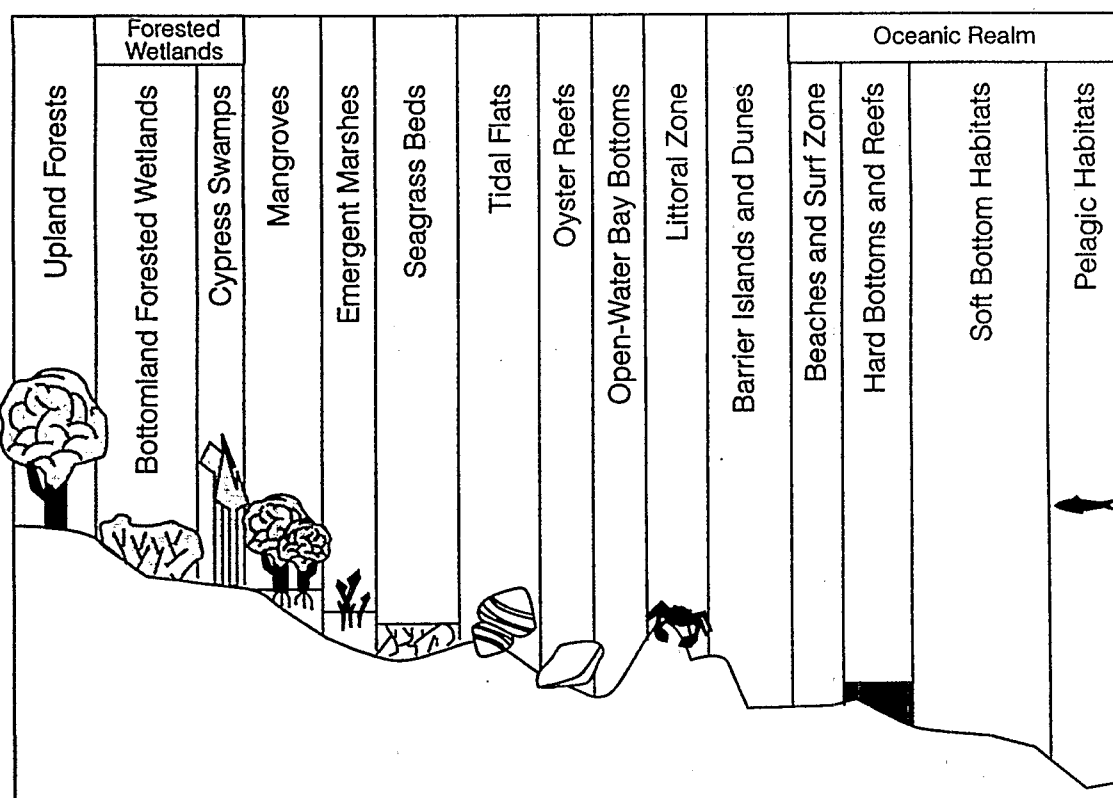
Louisiana	43 percent
Florida	26 percent
Texas	19 percent
Mississippi	6 percent
Alabama	5 percent

The Gulf's U.S. coastline measures approximately 2,609 km (1,631 mi) and is characterized by many diverse vegetated habitats: tidal marshes, mangroves, and submerged seagrass beds. These three habitats serve as feeding, reproductive, and nursery habitats for many species of aquatic organisms, and their existence is critical to important Gulf fishery and recreational resources (Thayer and Ustach, 1981).

Coastal marshes and mangrove forests typically occur between the marine and terrestrial habitats of the Gulf region. Seagrass beds are found between emergent vegetation and unvegetated estuarine and coastal bottoms. However, the extent of these habitats varies throughout the Gulf. In some areas, fringing wetlands and seagrass meadows are only narrow bands; in others, vegetated areas are broad and expansive.

Upland Forests. The once vast coastal plain forests of loblolly, slash, and longleaf pines that encircled the Gulf of Mexico from central Florida to east Texas define a unique ecosystem. The slowly percolating, silty-sandy loams underlying the region are particularly suitable for growing herbaceous plants and shrubs. These plants and shrubs provide food and shelter, under the forest canopy, for a variety of open land and woodland wildlife, including game birds and animals that are popular with recreational hunters.

Figure 2.2 Coastal Habitats of the Gulf of Mexico



Many acres of pine forests have been clearcut and converted to farm land or replanted as sources for pulp wood. Clearcutting opened the land to erosion. In these areas, the physical, chemical, and biological characteristics of the natural community have been dramatically altered and have resulted in a marked decrease in habitat quality and biodiversity.

Forested Wetlands. Bottomland Forested Wetlands. Forested wetlands occur adjacent to streams and drainage ways, as well as depressional areas, which may or may not be stream fed. Forested wetland soils are frequently wet, highly acidic, less permeable, usually infertile, and poorly suited for agricultural or commercial use. Common trees in forested wetlands are water oak, overcup oak, sweet gum, sweet bay, black gum, tupelo gum, and loblolly and slash pines. The understory vegetation can include various sedges, joint grasses, ferns, shrubs (such as blueberries and hollies), and climbing vines (such as blackberries and catbriars). Zonation in forested wetland systems is dependent upon light, soil, moisture, and length of flood period. Forested wetlands are productive and diverse habitats.

Historically, many acres of forested wetlands have been drained and cleared for silviculture, agriculture, and other uses. The value of this habitat has been recently recognized, and programs are being implemented to curtail conversions to other uses.

Cypress Swamps. After the great cypress swamps were deforested, faster growing species such as willow, maple, poplar, and gum flourished along with the remaining scattered cypress. The soils supporting this habitat-type are semi-fluid clays that are acid to neutral at the surface and increasingly alkaline at depth. Undergrowth and open area vegetation, such as elephant ears and alligator weed, are highly productive. Frequently flooded, cypress swamps provide habitats for nutria, opossum, raccoons, deer, and other small mammals. However, these habitats are not well suited to intensive wildlife management because of the difficulty of installing and maintaining water control structures. Bald eagles favor the remaining tall cypress trees for nesting.

Mangroves. Approximately 202,350 hectares (500,000 acres) of mangroves occur along the Gulf Coast, almost exclusively in Florida. The organic productivity of the four native species of mangroves rivals that of agricultural crops (Wood *et al.*, 1969). Because of their high productivity, mangroves play a major role in the dynamics of estuaries. Many species of invertebrates and fishes derive energy directly from mangrove detritus (Odum *et al.* 1982). Odum *et al.* also observed that the diverse structural habitats of mangroves harbor a greater variety of bird life than salt marshes, mud flats, or beaches. In addition, intertwined mangrove roots act as a wave buffer by binding sediment and retarding erosion, thus extending coasts and building islands. Because mangroves can tolerate open ocean salinity, they form an effective and long lived buffer against storm surges.

Impounding or ditching for mosquito control, cutting or excessive trimming, dredging and filling, and reduction of freshwater flow are prime reasons for mangrove forest degradation. About 60,705 hectares (150,000 acres) or 23 percent of Florida's mangrove forests have been lost; irreparable decline in fisheries production will result from additional losses (Lewis *et al.*, 1985b).

Emergent Marshes. Tidal marshes exist throughout the Gulf Coast and represent 63 percent of the total area of tidal marsh in the U.S. (Lindall and Saloman, 1977). Field *et al.* (1991) summarized the distribution of Gulf tidal marsh habitat as follows:

Louisiana	69 percent
Texas	17 percent
Florida	10 percent
Mississippi	2 percent
Alabama	1 percent

Durako *et al.* (1985) reported that more than 1,100 species of vertebrates and invertebrates depend upon salt marsh estuarine habitats for at least one stage of their life cycle. In addition, most authors agree that fish and shellfish species that make up about 90 percent of the Gulf's commercial and recreational catch (by weight) spend a portion of their life cycles in tidal creeks and marshes, primarily because of the large detrital-based food supply. Fresh marshes occur in coastal areas and are characterized by common rush, cattails, pickerelweed, and bulltongue while marsh hay, cordgrass, olney and saltmarsh bulrush, and dwarf spikerush are common in brackish marshes. Saline marsh vegetation typically includes smooth cordgrass, seashore saltgrass, and needlegrass rush. All of these plants are very productive and produce great amounts of detritus.

Salinity differentiates marsh type. Fresh marsh salinity can reach 5 o/oo but is usually less than 3 o/oo; brackish marsh averages about 8 o/oo but may reach 18-20 o/oo. Gradational boundaries between marsh types are maintained by a delicate balance between freshwater and saltwater inflows.

Canal dredging and coastal development have resulted in significant losses in the areal extent of emergent marshes. Fresh marshes have a series of ridges [usually less than 30 cm (1 ft) relief] oriented parallel to drainage. These ridges serve to channel flow and maintain the balance between water types. Historically, canals were dredged and levees built without regard to local topography, resulting in the diversion of the freshwater supply and its replacement by saltwater. Saltwater intrusion has killed the freshwater vegetation in many areas and caused large open water ponds.

Seagrass Beds. Submergent seagrasses occupy over 323,760 hectares (800,000 acres) within the estuaries and shallow near-coastal waters of the Gulf (Iverson and Bittaker, 1986). Approximately 95 percent of this acreage is in Florida and Texas, where seagrasses occupy about 20 percent of the bay bottoms (Thayer and Ustach,

1981). Although often considered continuous around the Gulf's entire periphery, a combination of low salinity and high turbidity results in only scattered patches of seagrass communities, mostly in bays, from Alabama to Laguna Madre, TX. In fact, the distribution and species composition of seagrasses in the lower Laguna Madre has changed in recent years because of human impacts; these changes are a major cause for concern. Collectively, seagrasses provide shelter and sustenance for a variety of fishes, crabs, grass shrimps, gastropods, and burrowing worms. The diversity and amount of biomass produced in or dependent on seagrass beds are enormous.

The distribution of seagrass beds is limited by light attenuation. Two primary factors affecting light attenuation are depth and turbidity. Increased depth, resulting from subsidence, limits the occurrence and density of seagrass beds. Activities which increase water turbidity, such as dredging, runoff, and increased nutrient loading, result in phytoplankton and epiphyte blooms which can have devastating effects on the existence of seagrasses. Lewis *et al.* (1985a) noted that Tampa Bay had lost about 80 percent of its original seagrass beds by 1982. The seagrass beds which remain in Tampa Bay, and other bays and nearshore areas, are stressed and impacted by human activities (Zieman and Zieman, 1989). For example, propeller scars, prominent in many seagrass meadows, may take years to heal by revegetation. A large die-off of seagrasses in Florida Bay has been recently documented; the causes of this catastrophic loss are still being investigated (Robblee, *et al.*, 1991).

Tidal Flats. The term "tidal flats" is used to describe two habitat types. Landward of intertidal marsh or mangrove habitat is a supralittoral platform which is flooded only once or twice a month by high spring tides. These salt flats (or salterns) are most commonly found in Florida and Texas. Due to high interstitial salinities, greater than 50 percent of the surface area of these flats are typically unvegetated. Plant cover that is present is typically composed of fleshy halophytes such as *Salicornia*, *Batis*, and *Sesuvium* (Lewis, 1989). The second "flats" habitat is the sublittoral mud or sand flat lying between the lower tidal limit of intertidal vegetation and the upper edge of the submerged aquatic vegetated zone (seagrasses), if present. Both tidal flat habitats are seasonally important as feeding areas for wading birds and certain fish species, during those seasons of the year when high tides and rainfall may keep them flooded with very shallow water for weeks at a time (Powell, 1989; Lewis, 1989).

Intertidal flats are a distinct habitat and major resource of the middle and lower Texas coastal zone. Laguna Madre tidal flats are ideal foraging areas for resident and migrating wading birds because these birds prefer to feed in shallow water. Many flats are covered by algal mats and are very productive; their most important function may be the export of nutrients to other estuarine habitats (Pulich and Rabalais, 1986; Pulich and Scalan, 1987). Yet because of their superficial "wasteland" appearance, tidal flats continue to be developed and destroyed.

Oyster Reefs. Many Gulf estuaries support extensive subtidal oyster reefs and intertidal reefs formed and dominated by the American oyster. These calcified reef structures play important physical, ecological, and economic roles in the northern Gulf and support a great diversity of highly productive edaphic and epibenthic species.

In terms of physical function, oyster reefs, both living and fossil, can be important in absorbing wave energy and stabilizing shorelines. A perfect example is the shoreline of Marsh Island, Louisiana. This shoreline is fronted by oyster reefs and has remained stable while the adjacent coastline to the west has eroded during recent times (Adams *et al.*, 1976). The construction of new oyster reefs, from clumps of live oysters in wire mesh bags, is presently being considered as an experimental means of slowing shoreline erosion along several sites in Louisiana.

Oysters provide ecological, environmental, and commercial benefits. The ecological function of oyster reefs includes providing stable substrate for a dense concentration of epibenthic fauna. The filter feeding members of the oyster reef community reduce water turbidity and metabolize carbon at a high rate (Bahr and Lanier, 1981). The reef community is important in remineralizing organic matter and releasing nutrients to the water column (Dame *et al.*, 1985). The community also provides concentrated food sources for estuarine fish, shellfish, and birds. Oyster harvests provide a significant resource for fishing economies in Texas, Louisiana, and Florida. Environmentally, in the vicinity of active delta formation, buried reefs can enhance the deltaic building process by raising the subaqueous platform on which subaerial land can develop. In the past, oyster shell was dredged as a source of minerals for agricultural and farm animal nutrients and for building materials. This dredging depleted stocks severely. Between 1912 and 1964, the volume of oyster shell dredged from Texas bays 190 million m³ (248 million yd³) was greater than the volume dredged to create the Panama Canal 184 million m³ (240 million yd³) (Beasley, 1965). Most of the oyster shell (78 percent) came from Galveston Bay. Today, because of ancillary environmental damage, oyster dredging has been almost eliminated along the Gulf Coast.

Oyster reefs are currently threatened by point and nonpoint source pollution. Bay harvest closings due to human and animal generated contaminants are common throughout the Gulf of Mexico. In addition, construction of dams and reservoirs has cut off river inflow to estuaries, depriving oysters of a source of nutrients. In South Texas oyster beds have almost disappeared.

Related to oyster reefs in function, are the serpulid reefs in hyper-saline Baffin Bay, Texas. These carbonate reefs are formed by filter feeding polychaetes. Many of the reefs are relicts, and little is known about the cause of their death. Worm reefs also occur in the Ten Thousand Islands of Florida.

Open-Water Bay Bottoms. Open water covers the largest area in Gulf of Mexico estuaries and is typically associated with fine-grained sediments. Muddy bottoms

are a habitat for many fish and invertebrate species, a storehouse for organic matter and inorganic nutrients, and a site for many vital chemical transformations and physical interactions. Many important commercial species such as crabs, shrimps, oysters, flounder, and black drum utilize estuarine bottoms. Unfortunately, trawling and dredging to harvest these species disturb large bottom areas. This disturbance increases sediment turnover rates and water turbidity, and can mobilize contaminants in sediments. Other disturbances to bay bottoms include channelization and oil and gas activities.

Littoral Zone. Fringing the edges of bays is the littoral zone, an area of highly productive shallow water. The littoral zone is an important habitat for many fish and epibenthic invertebrate species. Waterfowl often use the littoral zone for feeding. The littoral zone also acts as a terrestrial buffer and a high tide refuge.

Littoral zones are areas often visited by man for recreation and occupation. Construction of marinas, homes, industries, and roads adjacent to littoral zones has resulted in their loss and degradation. Especially threatening is the potential contamination from numerous drain pipes and municipal and industrial outfalls. Drain pipes introduce contaminants from roadways and sewer systems. Outfalls are sources of thermal, saline, and contaminant inputs. The impacts of these sources of degradation are, individually and in combination, poorly understood.

Barrier Islands and Dunes. Much of the coastal zone of the Gulf of Mexico is bordered by barrier islands. These fragile ribbons of sand are unique habitats for many plants and animals. These habitats have a varied usage. For example, turtles use these beaches for nests and birds nest on the shorelines, dunes, and in adjacent wetlands. Many of the islands are subject to over-development.

The sand dunes form the primary natural protection for the coastal mainland during storms, yet construction activities have reduced or eliminated sand dune habitats in many areas. Beach erosion is exacerbated by the human proclivity to build breakwaters, groins, and other beach protection devices. Studies (Penland and Boyd, 1981) have shown that about 80 percent of the Gulf shoreline is actively eroding, possibly because of sediment starvation. This is due to leveeing, the breaching of barrier islands by hurricanes, and housing and pipeline construction.

Oceanic Realm. The oceanic realm extends from the low tide line to abyssal depths. For the purposes of this Action Agenda, the oceanic realm includes the surf zone, the continental shelf and slope, and the deep ocean floor. The surf zone extends from the lowest berm to wave base which is usually less than 10 m (33 ft), except during catastrophic events. The continental shelf is a gently sloping plain (less than 0.2°) extending from low tide level to the continental slope (2°- 5°). The Gulf of Mexico continental shelf varies in width from about 280 km (174 mi) off Florida to about 200 km (124 mi) off east Texas and Louisiana; off southwest Texas the shelf narrows to 110 km (68 mi). The continental shelf is more thoroughly studied than other oceanic areas because of the value of its fishery and petroleum reserves and its

proximity to shore. The continental slope extends from the shelf break at about 200 m (656 ft) to the Sigsbee Abyssal Plain at a depth of 3,650 m (12,000 ft). In the western Gulf, the abyssal plain floor and the shelf surface are disrupted by salt diapirs that form gentle hills and ridges and provide habitats for bottom dwelling fauna.

Habitats in the oceanic realm are horizontally and vertically zoned because of preferences of fauna and vegetation for specific water density, clarity, depth, bottom type, and circulation. In this discussion, species associated with beaches, reefs, and passive sediment regimes are considered occupants of horizontally zoned habitats. Vertically zoned habitats are home to both pelagic and benthic species. For example, according to Weyl (1970), four algae phyla (blue-green, green, brown, and red) occur between the shoreline and the maximum depth of light penetration [about 100 m (328 ft)].

Human activities in the oceanic realm are a primary cause of environmental concern. Commercial seining is largely species indiscriminate, resulting in the loss of large numbers of "incidental" species which may be important in the food chain. Many of the larger game fishes are heavily fished, resulting in decreases in the population. For example, the 1990-91 average commercial tuna harvest was about 50 percent lower than the 1986-90 average commercial tuna harvest (USDOC, 1992). Modern offshore oil drilling platforms are self-contained but the potential for accidental discharges is significant. The risk of a major tanker oil spill will increase as the number of tankers increase in response to oil import demands. Drilling support boats and commercial ships do not always follow prescribed regulations when discharging garbage and wastes. Pipeline burial can create significant short-term turbidity.

Beaches and Surf Zones. The surf zone extends from the lowest berm to breaker depth, which in the Gulf is less than 10 m (33 ft), except during catastrophic events. This depth is sufficient to keep submarine bars in a near-constant state of agitation and winnow clay-sized particles from incoming sediments. Many Gulf beaches are relatively low energy and, in the intertidal zone, support a benthic infauna of burrowing worms and molluscs and an epifauna of molluscs, crustaceans, and fish. Relative to other habitats, beach and surf zone productivity is low. Even so, this habitat comprises a critical foraging area for migratory shorebirds and other species. Shorebirds, collectively, are declining, and the loss of feeding habitats along their migration routes is recognized as a major cause of the decline. Open beach and washover areas in Texas are also foraging areas for peregrine falcons.

Several species of endangered sea turtles and some sea birds nest on the berm or higher on the dune. Erosion and human exploitation of beaches and surf zones have led to degradation of breeding grounds and loss of reproductive capacity for many species.

Hard Bottoms and Reefs. Hard bottoms and reefs (banks) are distinctive marine habitats found throughout the Gulf of Mexico along the continental shelf. Although they occur in waters of low nutrient availability compared to other coastal habitats, these

systems are biologically productive, taxonomically diverse, and form a unique ecosystem. Hard bottom substrates, which often occur in high energy environments, may consist of naturally occurring rock outcrops or shell middens and artificial substrates such as shipwrecks, dumpsites, and manmade reefs. Organisms that inhabit this environment depend, not only on the substrate and vegetation, but also on the associated sessile epifauna for their existence.

Many reefs (banks) occur in the Gulf (see **Figure 2.3**). The northerly location and selective isolation of the Flower Garden Banks, off the Texas coast, have resulted in their designation as a National Marine Sanctuary. The Banks, the most northern location of reef building corals in the Gulf of Mexico, have local relief of about 130 m (425 ft) and minimum crest depth of about 20 m (65 ft) (Rezak *et al.*, 1985). They are the surface expression of salt diapirs capped by living coral. A brine lake and numerous brine seeps show that the central salt core is dissolving. The crest of the Flower Garden Banks is occupied by leafy algae and live hermatypic corals, while the lower slopes are typically rubble with branching sponges, crinoids, and other sessile forms. Fish species are diverse and abundant (Rezak *et al.*, 1985).

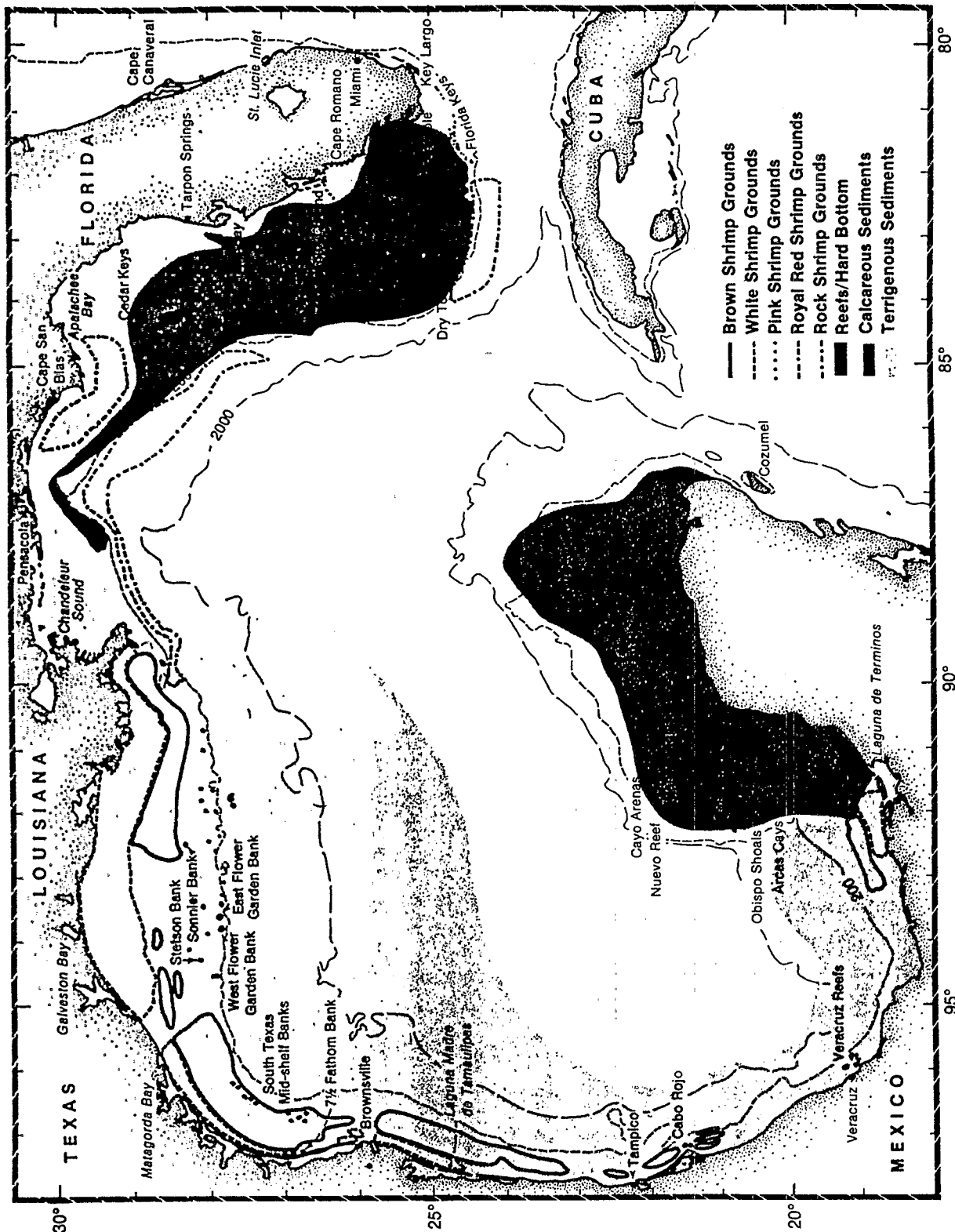
Hard bottom communities are susceptible to many pressures. Overfishing is thought to be a major reason for their decline. Vandalism and mistreatment by divers have caused other reefs to decline. Habitat destruction by dragging anchors and fishing nets has not been quantified but is known to be locally devastating. Studies that compare acreage, diversity, and abundance of current and historic reef habitats are geographically limited.

Soft Bottom Habitats. On the Continental Shelf, soft bottom habitats support organisms such as clams, shrimp, crabs, flatfishes, glass sponges, crinoids, worms, and some solitary, soft corals. The shrimp fishery is the most valuable Gulf of Mexico fishery.

Other rare habitats are located near the bottom of the continental shelf. These habitats are associated with cold water, hot water, or oil seeps and are caused by outcropping source rocks. Some faunas within this ecosystem appear to live on bacteria that grow by oxidizing hydrogen sulfide within the water or using the reduced compounds of sulfur and carbon in the seeping oil. Near the base of the Florida scarpment, a sulfur-rich cold water seep supports an assemblage of giant tube worms and large vent clams. In addition, 43 oil seep-related communities have been found between the 88°W and the 95°W meridians (see **Figure 2.4**) (MacDonald *et al.*, 1992). Water depths at these sites range between 350 m (1,150 ft) and 2,200 m (7,220 ft). Tube worms, mussels, and clams are the dominant fauna; at Alaminos Canyon these chemosynthetic species support an abundant epifauna of shrimp and galatheid crabs (MacDonald *et al.*, 1992). The areas occupied by seep generated fauna are generally small [less than 100 m² (1,075 ft²)] because the volume of seeping material is small and quickly dispersed.

Pelagic Habitats Water density, circulation, and turbidity are the primary factors controlling vertically distributed water column habitats. Temperatures average

Figure 2.3 **Zones and Localities of Major Biogeographical Significance in the Gulf of Mexico**

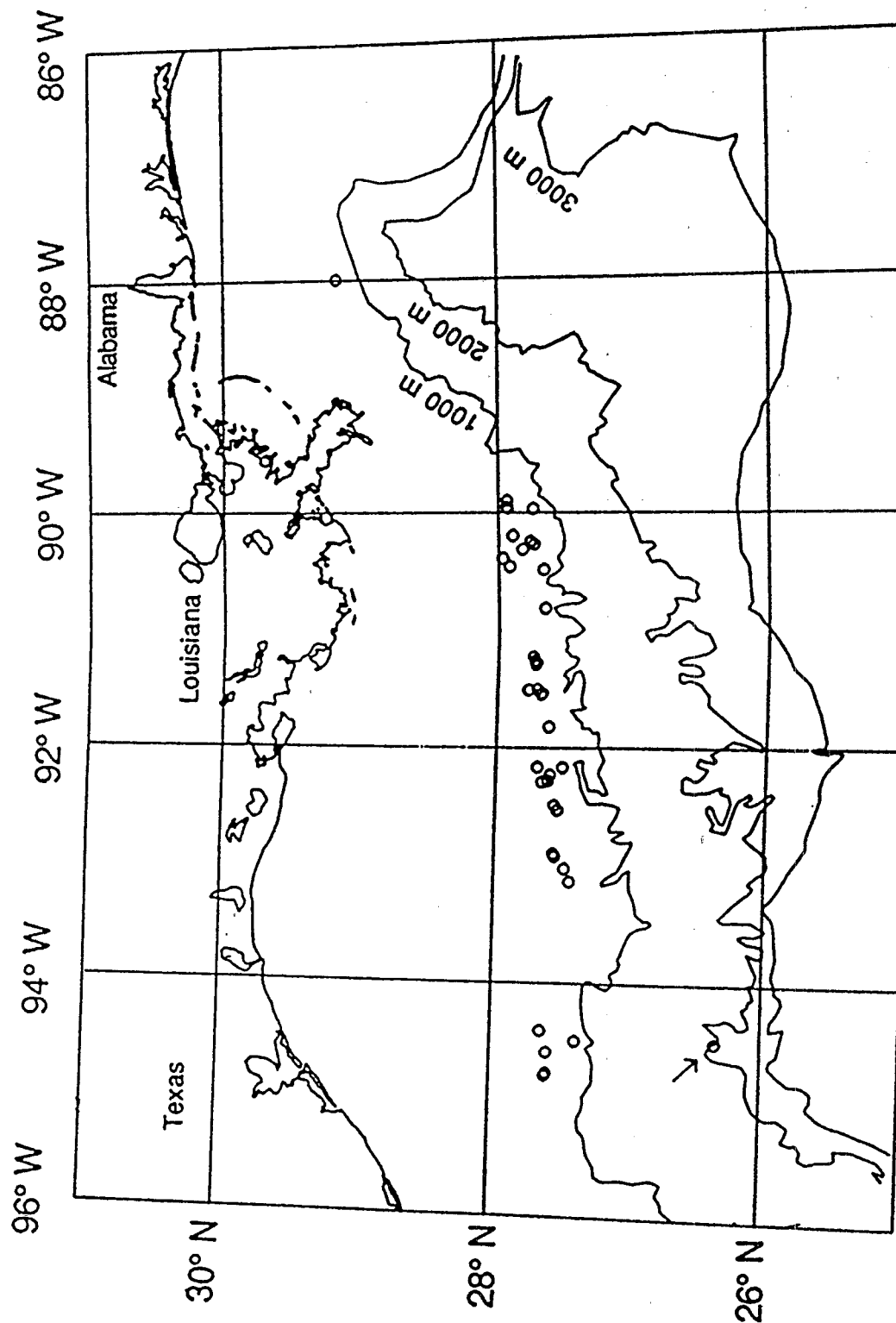


(Source: Rezak et al., 1985)

18°C (64°F) in winter and 29°C (84°F) in summer. In shallow coastal waters, air temperatures approximate sea surface temperatures. Freshwater from rivers entering the northern Gulf lowers surface salinity to about 32 o/oo over the inner shelf and increases turbidity; salinity in the upper 50 m (164 ft) of the outer shelf and abyssal Gulf is usually in excess of 35.5 o/oo. In both the eastern and western Gulf, surface salinity will be higher because of increased evaporation. To a depth of about 20 m (66 ft), the water column is turbid; in deeper water, turbidity evolves into a 5-25 m (16-82 ft) thick nepheloid layer that extends over the shelf break (Rezak *et al.*, 1985). An 8,000 km² (3,100 mi²) offshore area between the Mississippi and Sabine Rivers is subject to recurring incidences of oxygen depletion. This area is surrounded by the nation's richest and most extensive fishing grounds. Pollution in the form of nutrient enrichment is a major cause of oxygen depletion, although naturally occurring water column density stratification may be a contributor (Rabalais, 1992). Recently, a smaller oxygen depleted area was discovered off Florida. Certain pelagic species, such as menhaden, prefer turbid water; other species (marlin/tuna) avoid areas of high turbidity and tend to concentrate along the boundaries of density-differentiated water masses.

Figure 2.4

Locations of Known Chemosynthetic Communities at Hydrocarbon Seeps in the Northern Gulf of Mexico
(Arrow indicates Alaminos Canyon)



(Source: MacDonald, et al., 1992)

State-by-State Overview of Habitat Degradation

The following case histories provide a summary of specific wetland losses and modifications that have occurred in each of the five Gulf Coast States.

Alabama. Data from Watzin *et al.* (in preparation) reveal that, between the 1940s and 1979, emergent marsh habitat in Alabama's Mobile Bay declined by more than 4,047 hectares (10,000 acres), to 35 percent. Also, a probable loss of 50 percent or more of the submerged aquatic vegetation occurred during the same time period. In addition, the hydrology of the bay has been markedly altered by a profusion of spoil areas in open water and by the excavation of a deep channel through the center of the bay. According to Stout (1979), historically, the most significant human impacts noted in the bay were the direct and indirect effects of dredged material disposal.

Habitat loss due to erosion along the shoreline of the Mississippi Sound in Alabama, including adjacent islands, was about 8.5 hectares/year (21 acres/year), or a total of 255 hectares (630 acres) from 1955 to 1985. Much of this loss was marshland (Smith, 1989). Continued loss is expected under the prevailing natural system, and this progressive loss is due to the action of natural forces: wind-generated waves, tides, currents, and the predicted drowning effect of sea level rise.

Florida. Approximately 75 percent of Florida's population live in coastal counties. This has resulted in the continuing loss of fringing wetland habitats from filling activities, the decline of seagrass communities from pollution and dredging, and the deterioration of water quality from point and nonpoint discharges. About 31 percent of Florida's Gulf Coast estuaries are severely affected by pollution (Comp and Seaman, 1985).

Lewis *et al.* (1985a) also estimated that about 80 percent of Tampa Bay's seagrass meadows have been lost since the 1800s, a decrease that has been postulated to have adversely affected both the bay's fisheries and other organisms which are dependent on the bay. Seagrass losses were primarily caused by deteriorating water quality (Haddad, 1989).

In Sarasota Bay, alterations in wetland habitat acres, from 1948 to 1987, include losses of 35 percent of seagrass beds, 45 percent of mangrove swamps, 85 percent of tidal marshes, and increases of oyster beds (16 percent) and bay waters (12 percent) (McGarry MacAulay, personal communication). These losses of emergent and submerged aquatic plants are symptomatic of the rapid development of coastal Florida.

Large segments of the original Everglades have been separated from the natural system by canals and levees. Today, the Everglades face many complex water resource and environmental management issues including:

- ☐ Fragmentation resulting in the loss of connection between the central Everglades and adjacent transitional wetlands.
- ☐ Changes in timing, distribution, and quantity of discharges into and within freshwater wetlands and estuaries.
- ☐ Impacts on natural ecosystems due to agricultural water discharges.
- ☐ Invasion of native plant communities by exotic species.
- ☐ Timing and distribution of discharges from freshwater areas into estuaries of Florida Bay, Manatee Bay, and Barnes Sound.

Solutions proposed to alleviate the environmental problems of coastal Florida habitats must include an understanding of how physical features and hydrologic processes interact to affect water movement, quantity, and quality. The physical features and operational policies of the water management system must be linked to the natural features and hydrology of the region. This approach has been somewhat successful.

Although the establishment of a preserved wetland fringe around Charlotte Harbor was successful in maintaining the mangrove community, the concurrent loss of seagrass beds and salt marshes substantiates the need for managing the entire ecosystem, including the drainage basin. Salt marsh decreases were probably caused by dredging and filling, as well as by extensive upland development (Haddad, 1989).

Louisiana. Encompassing almost 728,000 hectares (1.8 million acres), not including forested wetlands, Louisiana's Mississippi River Deltaic Plain is the largest continuous wetland system in the U.S. These marshes represent about 22 percent of the total coastal wetlands area in the 48 continental states (Gosselink, 1984). The major environmental concerns include loss of salt marshes and the maintenance of habitat and water quality. If current trends continue, an ecosystem that supports 33 percent of the nation's fishing industry and North America's largest fur-producing area will become extinct (LGS and USEPA, 1987).

Wetland losses in the deltaic plain have been studied by Turner (1990), Gosselink (1984), and Leibowitz and Hill (in preparation). All authors agree that the rate of marsh loss to open water has accelerated over the past 50 years and that human activities have interfered with the cycle of delta formation and accretion. Between 1956 and 1978, approximately 51 percent of coastal Louisiana's freshwater marsh and 16 percent of the forested wetlands were lost; salt marsh increased by 2.4 percent. Total wetland acreage in coastal Louisiana declined by 21 percent (1956-1978) (Turner and Cahoon, 1988). During that time period, there also was a concurrent 272 percent increase in acreage used for disposing of dredged material. Other studies have shown that about 34 percent of Louisiana's marshes were changed to non-marshlands from 1945 to 1980, and that the current net loss of coastal wetlands is

approximately 80 km²/year (31 mi²/year) (Dunbar *et al.*, 1990). More recent analyses (Dunbar *et al.*, 1992) show that land loss in the Louisiana Coastal Plain peaked at approximately 110 km²/year (42 mi²/year) in 1970 and has since decreased to approximately 66 km²/year (25 mi²/year) in 1990.

Causes of these changes in wetland acreage include: direct loss from dredging, construction, filling, erosion, and machinery (marsh buggies); loss of river-borne sediments; oil and gas withdrawal; soil drying within diked areas; and alterations in the quantity and quality of vegetation from changes in organic deposition and sediment trapping and the death of plants from pollutants. Natural causes of emergent marsh habitat loss include rising sea level, catastrophic weather, and "eat-outs" by animals.

One of the Mississippi River Deltaic Plain's nine drainage basins, Barataria Basin, has been closed to river flow since the leveeing of the Mississippi River in the 1930s and 1940s. Marsh acreage in Barataria Basin decreased by 25 percent between 1956 and 1978. Subsidence and erosion are two major factors; however, human activities in the basin also have altered Barataria's natural hydrologic patterns, which may cause long-term modification of wetland habitats (Conner and Day, 1987). Ultimately, the entire basin may become an open-water brackish bay or sound unless the flow of the Mississippi River is reintroduced to the area.

Mississippi. The main estuaries feeding the Mississippi Sound include the Pascagoula River, Biloxi Bay, Bay St. Louis, and the Pearl River. The importance of Mississippi's estuaries as a breeding and nursery ground for a multitude of species has been well documented (USDOC, 1990a). At least 97 percent of the state's fisheries resources are estuarine dependent.

Eleuterius (in press) observed a decline of the area covered by seagrass and a decline in occurrence of seagrass species in the Mississippi Sound. In 1975, seagrass acreage was about 60 percent of that found in 1969, and losses are continuing. Hurricane damage, and destruction by freshwater discharged from the Mississippi River through a spillway and Lake Pontchartrain, account for approximately half of the observed loss. The cause of the remaining loss is not known, but may be related to sediment quality or disease (Eleuterius, Gulf Coast Research Laboratory, Ocean Springs, MS, pers. com.).

Texas. From 1930 to 1980, more than 70 percent of the total loss of wetlands from seven Texas river deltas (Colorado, Nueces, Guadalupe, Lavaca, Trinity, Neches, and San Jacinto) occurred along the San Jacinto and Nueces Rivers (White and Calnan, 1990). Major factors responsible for these losses included a rise in water level because of human-induced and natural subsidence; global sea-level rise; and the reduction of natural sedimentation in marshes caused by channelization, reservoir development in river drainage basins, and the disposal of spoil on natural levees. The general trend in deltaic wetlands along the Texas coast is conversion of wetlands to open water and barren flats.

The most extensive changes in the Beaumont-Port Arthur area have occurred along the river valleys. The Neches River is a dramatic example. Between Port Neches and Bridge City, extensive marshes which existed in 1956 had been replaced with open water by 1978. This habitat loss is attributed to dredged canals, the reduction of sedimentation, subsidence, and sea-level rise.

Galveston Bay is the seventh largest estuary in the U.S. and the largest in Texas. The Bay provides the nursery and spawning grounds for about 30 percent of the total fisheries harvest from the Texas coast (Sea Grant College Program, 1989). In addition, 139 species of birds associated with the bay's wetland and coastal habitats have been reported, and the numbers of active nesting colonies have increased from 20 in 1973 to 42 in 1987 (Whitledge and Rag, 1989).

Not only are large portions of Galveston Bay often closed to shellfishing, primarily as a result of bacteria introduced by runoff from surrounding lands, but seagrasses in the bay have also declined by approximately 90 percent since 1979 (Pulich and White, 1990).

The Laguna Madre is a narrow, 209 km-long (130 mi) estuary that is unique in the U.S. The estuary is hypersaline and has shallow bottoms dominated by seagrass beds. The Laguna Madre region has been the source of 53 percent of the commercial finfish harvest (predominately black drum) in Texas during the last 20 years (Texas Parks & Wildlife Department, 1988). Degradation of the Laguna Madre has been caused by construction and continued maintenance dredging of the Intracoastal Waterway, channelization to exploit hydrocarbon resources, and the construction of hundreds of "cabins" on the spoil islands. In addition, a recent brown tide lasting two years (1990-1992) has resulted in massive alteration of the food web structure and may result in future losses of seagrasses due to high turbidity (Montagna, 1991). Natural and human activities have also disrupted the dynamics and habitats of the Texas barrier islands (Longley and Wright, 1989).

Conclusion

Habitats of the Gulf of Mexico are rich and highly productive components of the ecosystem. They support wildlife and fisheries of the Gulf, abate the impact of flood waters and storms, help improve the quality of surface water, and generate and process nutrients essential to natural systems. An estimated 95 percent of commercial fish landed and 85 percent of the sport fish catch (by weight) spend a portion of their lives in coastal wetland and estuarine habitats (Thayer and Ustach, 1981; Lindall and Thayer, 1982). In addition to providing winter quarters for millions of game birds, coastal wetlands support North America's largest fur production.

Habitats, particularly wetlands, of the Gulf of Mexico region are being rapidly damaged or destroyed by a variety of causes. Human activities, such as flood control, agriculture, waste disposal, real estate development, shipping, commercial fishing, and oil and gas exploration and production, demand a high price. Natural processes, in the form of rising sea level, sediment compaction and submergence, droughts, animal "eat-outs," storms, and floods also exact a heavy toll. A focused and coordinated effort by all citizens, as well as local, state, and federal agencies, will be required to counter these negative factors.

Coastal habitats are an integral part of the coastal ecosystem and perturbations beyond normal ranges to any component may affect the entire system. This realization must guide efforts to devise and execute plans for protecting, restoring, enhancing, and creating habitats. This Habitat Degradation Action Agenda points the way, and effective action is the shared responsibility among many.

3 FEDERAL & STATE FRAMEWORK FOR ADDRESSING HABITAT DEGRADATION

Many federal agencies are mandated by legislative statutes to address habitat degradation issues and support protection and restoration efforts. These agencies include: U.S. Environmental Protection Agency, U.S. Department of Commerce, U.S. Department of the Interior, U.S. Department of Defense, U.S. Department of Agriculture, and U.S. Department of Transportation. Each of the five Gulf of Mexico States also has a regulatory framework for addressing habitat degradation. (For a description, see **Appendix A.**)

4 THE UNFINISHED AGENDA --

Both Current Commitments & Uncommitted Activities

Goal

This Habitat Degradation Action Agenda for the Gulf of Mexico sets forth a framework for protecting, restoring, and enhancing Gulf of Mexico habitats. The Gulf of Mexico Program has established the following two long-term goals for addressing habitat degradation in the Gulf of Mexico:

- ☐ Protect, restore, enhance, and create Gulf of Mexico habitats.
- ☐ Foster public understanding, appreciation, and stewardship of Gulf of Mexico habitats.

Action Agenda Framework

This chapter of the Action Agenda provides objectives, action items, and specific project descriptions for addressing habitat degradation in the Gulf of Mexico and for meeting the long-term goals as stated above. Objectives and action items are clustered under six types of activity: 1) Monitoring & Assessment 2) Research, 3) Planning & Standards, 4) Compliance & Enforcement, 5) Preservation & Protection, and 6) Public Education & Outreach (see **Index of Objectives and Action Items**). The forty-two action items represent the Committee's best judgment today, based on existing data and information, as to what must be done initially to tackle habitat degradation problems in the Gulf of Mexico.

Lead. The Habitat Degradation Committee has identified a lead agency for each project--the agency with the most authority or jurisdiction over the particular issue. A proposed action item or project may involve the execution of legislative or regulatory authorities or programmatic initiatives which derive from these authorities. In other cases, a proposed action item or project may involve the facilitation or coordination of activities among several agencies or organizations. In these cases, and where there is no clear legislative authority involved, the "lead" could be the agency or organization who expresses an interest in taking on the task during Gulf of Mexico Program Committee deliberations, the action planning workshop or public comment period, or, in the Issue Committee's judgment, is best able to guide multiple parties in carrying out the activity. *This does not necessarily mean that the agency has agreed to carry out the activity or that the agency has the necessary funding. The Habitat Degradation Committee understands these action items will require commitments by agencies and organizations that are dependent on budget decisions.* However, the Committee members hope this document

provides the rationale and support for such commitments and that future iterations of this document will include additional specific commitments.

Initiation Date. The date indicated represents a determination by the Committee of the most realistic *initiation date* for the project. As lead agencies begin implementation planning for specific activities, these initiation dates may change due to resource availability and prioritization within the individual agencies.

Underway or Completed Action Items/Projects. Some of the action item projects may already be underway or even completed. In these cases, short status reports are provided and completion dates are provided if known. These projects are designated with the following icons:



Underway



Completed

Some action items are cross referenced to other action items and are designated with a "→" sign in the left hand column. This signals a close relationship among those actions and a need for coordination.

The Gulf of Mexico Program recognizes the need to identify indicators of environmental progress relative to this Action Agenda for habitat degradation. Many of the action items specified in Chapter 4 of this document will aid the Program in developing a baseline for measuring success in the future. For the time being, however, acceptance and completion of action item projects specified in this Action Agenda will be considered a measure of success. As future iterations of this document are written, and current projects are completed, new action items and projects will be developed to better measure environmental progress.

Index of Habitat Degradation Objectives & Action Items**Monitoring & Assessment**

Objective: Assess the status and trends of important Gulf of Mexico coastal habitats to establish a framework for developing corrective measures and setting priorities.



Action Item 1: Convene the Gulf of Mexico Program--Habitat Degradation Committee to review data on Gulf of Mexico coastal habitat resources and prioritize important habitat types.



Action Item 2: Assess the status and trends of wetland and seagrass communities in the Gulf of Mexico.



Action Item 3: Assess the status and trends of Outer Continental Shelf habitats in the Gulf of Mexico.

Action Item 4: Analyze existing data on Gulf of Mexico habitats and develop ecosystem models to predict cumulative impacts.



Action Item 5: Develop techniques and data bases to measure the current state of habitat health and to continue long-term monitoring of habitat health in the Gulf of Mexico.

Objective: Identify the causes of habitat declines in the Gulf of Mexico region to assist in determining necessary and appropriate corrective measures.



Action Item 6: Quantify the loss of Gulf of Mexico coastal habitats due to physical and chemical alterations.



Action Item 7: Quantify the sources of man-induced declines of seagrass and wetlands habitats in the Gulf of Mexico.

Objective: Plan and monitor pilot restoration projects Gulfwide in coordination with local, state, and other federal programs, and evaluate the effectiveness of enhancement, restoration, and creation in replacing Gulf of Mexico habitats.



Action Item 8: Compile technical materials, techniques, and lists of technicians to support the restoration and enhancement of Gulf of Mexico coastal habitats.



Action Item 9: Convene an interagency Technical Working Group to review and select appropriate monitoring and success criteria for wetlands restoration, establishment, and management in the Gulf of Mexico.



Action Item 10: Develop and support a system of demonstration projects for the protection and restoration of Gulf of Mexico habitats.



Action Item 11: Monitor habitat changes associated with pilot demonstration projects in the Gulf of Mexico region, and assess the effectiveness of demonstration projects in protecting and restoring Gulf of Mexico habitats.

Index of Habitat Degradation Objectives & Action Items (continued)**Research**

Objective: Conduct research to increase knowledge of the functions of Gulf of Mexico habitats and to determine the relationships between habitat types and the effects of stress on these habitats.

Action Item 12: Determine the ecological role of pine flatwoods in Gulf of Mexico coastal communities and the need for appropriate regulation and management of these resources.

Action Item 13: Determine the effect of nutrient enrichment and the incidence of parasite life stages and hosts in Gulf of Mexico wetlands.

Action Item 14: Develop and implement a research agenda to provide information on linkages between and the cumulative impacts of habitats within Gulf of Mexico watersheds.

Action Item 15: Develop community profiles on the status and trends, significance, and future impacts of important Gulf of Mexico habitats.

Action Item 16: Develop a profile of the effects of dredged barrier island tidal passes on Gulf of Mexico coastal habitats.

Action Item 17: Determine the occurrence of phytoplankton blooms in the Gulf of Mexico, evaluate the impact and causes of such phenomena, and develop and implement appropriate Gulfwide management strategies.

Objective: Conduct research to improve habitat restoration and enhancement projects in the Gulf of Mexico.



Action Item 18: Determine the extent to which planted seagrass systems provide the ecological functions found in naturally occurring seagrass systems in the Gulf of Mexico.



Action Item 19: Summarize the state of knowledge of Gulf of Mexico habitat creation activities and identify and prioritize research needs.

Index of Habitat Degradation Objectives & Action Items (continued)**Planning & Standards**

Objective: Enhance the effectiveness of federal and state standards and management programs to protect and conserve coastal habitats in the Gulf of Mexico region.

Action Item 20: Review and evaluate the operation of federal, state, and local regulatory programs, and develop recommendations for improvement based on an assessment of losses and gains of Gulf of Mexico habitats.

Action Item 21: Develop an implementation strategy to improve the federal, state, and local regulatory programs that impact important Gulf of Mexico habitats.



Action Item 22: Minimize the loss of emergent Gulf of Mexico habitats due to sea level change through appropriate management and development techniques.

Action Item 23: Evaluate existing compensatory mitigation projects, and provide standardized guidance and success criteria for future projects in the Gulf of Mexico region.



Action Item 24: Promote, guide, and facilitate the development of state comprehensive wetland management plans in the Gulf of Mexico region.

Action Item 25: Promote, guide, and facilitate the development of seagrass community management plans in the Gulf of Mexico.

Action Item 26: Provide a Gulfwide agency framework and funding mechanisms for habitat restoration programs throughout the Gulf of Mexico.



Action Item 27: Implement Advanced Identification [Section 404 (c) Clean Water Act] projects for the Gulf of Mexico region to protect valuable habitats from dredging and filling activities.



Action Item 28: Develop specific water quality standards for the estuarine, nearshore, and offshore areas of the Gulf of Mexico.

Compliance & Enforcement

Objective: Provide maximum protection for Gulf of Mexico habitats by assuring full compliance with federal and state regulatory permit conditions and vigorous violation detection and resolution.

Action Item 29: Inventory and evaluate existing compliance and enforcement programs Gulfwide which support habitat protection.

Action Item 30: Promote increased interagency cooperation and consistent approaches within habitat compliance and enforcement programs throughout the Gulf of Mexico region.

Action Item 31: Provide training and sources of expertise to enhance compliance with habitat protection requirements across the Gulf of Mexico region.

Index of Habitat Degradation Objectives & Action Items (continued)**Preservation & Protection**

Objective: Provide a comprehensive preservation and protection framework for Gulf of Mexico habitats of significant ecological value.



Action Item 32: Identify and prioritize special ecological areas in the Gulf of Mexico that are worthy of increased levels of protection and preservation.



Action Item 33: Coordinate and facilitate, using all programs, resources, and mechanisms, the preservation and protection of special ecological habitats in the Gulf of Mexico.

Public Education & Outreach

Objective: Develop educational materials and programs to promote awareness and appreciation of Gulf of Mexico habitats, as well as their value and importance.



Action Item 34: Develop educational programs and materials for use in school systems to increase understanding of the value of Gulf of Mexico habitats and the need for preservation and protection.

Action Item 35: Develop public outreach materials and programs to increase understanding of the value of Gulf of Mexico habitats and the need for preservation and protection.

Action Item 36: Utilize interpretive centers, displays, and signs to inform the public about Gulf of Mexico resources through a "hands-on" experience.

Action Item 37: Inform business and industry groups about the value of Gulf of Mexico habitats and the need for preservation and protection.

Objective: Prevent or correct Gulf of Mexico habitat degradation and loss through public involvement activities.



Action Item 38: Initiate an outreach program to inform and involve the general public in activities necessary to prevent or correct habitat degradation and loss in the Gulf of Mexico region.

Action Item 39: Develop an outreach program for tourists that promotes an awareness of the value and the need to protect Gulf of Mexico habitats in important resort and recreational communities.

Action Item 40: Increase knowledge on the laws, regulations, and ordinances pertaining to regulation of coastal habitats in the Gulf of Mexico.

Action Item 41: Develop a citizen involvement program to monitor losses and gains in Gulf of Mexico habitat acreage and quality.

Action Item 42: Develop an "Adopt-A-Shoreline" Program to involve the public in the preservation and protection of Gulf of Mexico habitats.

Monitoring & Assessment

The quantity, occurrence, location, and type of habitat degradation in the Gulf of Mexico is currently reported on a limited basis. Increased monitoring in this area is crucial because this information forms the technical underpinnings of future policy. Monitoring is necessary to establish baseline conditions and determine trends. Geographical Information Systems (GIS) should be used to increase the ability to use and integrate all different types of data. Gulfwide priorities should be set for important and endangered habitats, and procedures should be established to improve inventorying, monitoring, and coordination among agencies and programs.

Specific objectives, action items, and project descriptions follow:

Objective: Assess the status and trends of important Gulf of Mexico coastal habitats to establish a framework for developing corrective measures and setting priorities.

Action Item 1: Convene the Gulf of Mexico Program--Habitat Degradation Committee to review data on Gulf of Mexico coastal habitat resources and prioritize important habitat types.

Project Description: Regularly convene the Gulf of Mexico Program--Habitat Degradation Committee and appropriate experts and citizens to identify and prioritize important habitat types, review status and trends data, and inform the Gulf of Mexico Program of new or continuing cases of habitat degradation.

Lead: Gulf of Mexico Program--Habitat Degradation Committee and Citizens Advisory Committee.

Initiation Date: 1989

Status: 1) With funding provided by the U.S. Environmental Protection Agency--Region 4, the Texas Parks & Wildlife Department is extending its wetlands prioritization project coastwide and is developing an interagency wetlands GIS data base. Completion of the prioritization project is scheduled for the end of August 1994. The Texas wetlands GIS data base and the Louisiana wetlands GIS data base, being developed with Coastal Wetlands Planning, Protection & Restoration Act support, are scheduled to be completed during 1995. Output from these projects will assist the Gulf of Mexico Program's panel of wetlands experts in reviewing status and trends data and prioritizing important habitat types.

2) The U.S. Coast Guard has initiated area contingency planning to respond to oil/hazardous material spills. Key habitat areas are being identified from this process on a Gulfwide basis.



Action Item 2: Assess the status and trends of wetland and seagrass communities in the Gulf of Mexico.

Project Description: Develop and periodically update a status and trends inventory of wetland and seagrass communities in the Gulf of Mexico.

Lead: U.S. Fish & Wildlife Service, in coordination with Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1992

Status: The U.S. Fish and Wildlife Service, Texas Parks and Wildlife Department, and Texas General Land Office have initiated an update of the National Wetland Inventory in Texas. Aerial photography was scheduled October through December 1992, however, inclement weather delayed completion of the photography until the spring of 1993. Completion of the updated inventory is targeted for December 1995. Seagrasses will be added from other databases.



Action Item 3: Assess the status and trends of Outer Continental Shelf habitats in the Gulf of Mexico.

Project Description A: Summarize data on status and trends of Outer Continental Shelf (OCS) habitats and living resources and identify agencies responsible for stewardship of OCS resources.

Lead: Minerals Management Service, in coordination with U.S. Environmental Protection Agency--Regions 4 and 6, National Oceanic & Atmospheric Administration, U.S. Army Corps of Engineers, and U.S. Fish & Wildlife Service.

Initiation Date: 1991

Status: The Minerals Management Service plans to continue three projects contributing to a definition of the status and trends of OCS habitats and living resources. These are as follows: a) Flower Garden Banks long-term monitoring project to monitor environmental conditions and biological health of the reef crest for three years; b) a project, initiated in 1991, with completion in 1994, to establish monitoring stations in chemosynthetic communities, relate community size to seep size, and develop methods of detection with remote sensing technologies; and c) a characterization, to be completed in 1996, of continental shelf habitats and communities, for the area from the Mississippi Delta to Apalachicola Bay, from the shoreline to the 400 meter isobath, to build on the recently completed Mississippi-Alabama Shelf Marine Ecosystems Study and on associated habitat mapping projects in the area.



Project Description B: Initiate a field investigation of long-term impacts versus natural variability on the Outer Continental Shelf (OCS). Based upon results of the OCS status and trends report and identification of sources of impacts, propose an appropriate long-term field investigation to document and quantify resource declines and habitat degradation.

Lead: Minerals Management Service, U.S. Environmental Protection Agency, and National Oceanic & Atmospheric Administration.

Initiation Date: 1992

Status: The Minerals Management Service is completing the second year of a six year study of the marine ecosystem between the Mississippi Delta and Apalachicola Bay. Efforts during the remaining years will be directed toward sedimentological and biological process studies and data synthesis. The National Oceanic & Atmospheric Administration plans a 1994 workshop on defining large marine ecosystems in the Gulf of Mexico. The Gulf of Mexico Program is working with the Ocean Studies Board of the National Research Council to convene a March 1994 workshop on science and policy which investigates the cumulative effects of the offshore oil and gas industry on coastal environments.



Action Item 4: Analyze existing data on Gulf of Mexico habitats and develop ecosystem models to predict cumulative impacts.

Project Description: Convene a Gulf of Mexico regional workshop (every five years) to summarize habitat or living resource impacts and conditions responsible for the impacts, analyze existing data bases and prioritize future studies, and develop appropriate ecosystem models to include cumulative impacts and long-term impacts.

Lead: Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1995

Action Item 5: Develop techniques and data bases to measure the current state of habitat health in the Gulf of Mexico and to continue long-term monitoring of habitat health.

Project Description A: Create, catalog, and link spatial data bases in the Gulf of Mexico in order to develop standards and methodology for short-term and long-term mapping programs. Catalog existing GIS-type data bases in terms of base map, aerial photography, satellite image coverage, resolution, adequacy of cultural parameters, and protocols for communication with other data bases.

Develop standards for communication between data bases and for the creation of new data bases. Adapt interactive mapping technology, such as developed by the Defense Mapping Agency, to habitat models to predict effects of habitat modifications.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in coordination with Data & Information Transfer Operations and federal and state agency GIS development groups.

Initiation Date: Ongoing

Status: Low resolution Gulfwide GIS habitat data bases are available commercially; high resolution habitat data bases are under construction by the U.S. Fish & Wildlife Service, Minerals Management Service, U.S. Army Corps of Engineers, Louisiana Department of Natural Resources, Texas Parks & Wildlife Department, and other coastal state agencies. The U.S. Environmental Protection Agency--Region 6 funding requires the Texas Parks & Wildlife Department's data base, currently under construction, to conform to data standards of the Texas Department of Information Resources.



Project Description B: Establish a long-term strategic assessment program for the Gulf of Mexico to monitor selected habitat types. Augment existing information with high resolution multispectral data and biomass stress analysis techniques in order to monitor and map changes in selected habitats.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, National Oceanic & Atmospheric Administration, and other state and federal agencies conducting mapping programs.

Initiation Date: 1993

Status: The Gulf of Mexico Program, through a Success in '93 Initiative, funded the Environmental Protection Information Center (EPIC) of Bishop State College to provide prototype GIS service for Alabama coastal communities. This project will consider factors necessary for data base linkage and a baseline for habitat mapping in that area. An interim report is due by the end of 1994.



Objective: Identify the causes of habitat declines in the Gulf of Mexico region to assist in determining necessary and appropriate corrective measures.

Action Item 6: Quantify the loss of Gulf of Mexico coastal habitats due to physical and chemical alterations.

Project Description: Identify and quantify the loss of coastal habitats in the Gulf of Mexico due to physical and chemical alterations, such as freshwater inflow, changes in salinity patterns, sedimentation rates, and subsidence.
Lead: Minerals Management Service, U.S. Fish & Wildlife Service, U.S. Army Corps of Engineers, Gulf State agencies, Gulf of Mexico Program--Freshwater Inflow Committee.
Initiation Date: Ongoing
Status: The lead agencies are continuing studies to quantitatively determine the loss of coastal habitats due to changes in salinity, sedimentation, subsidence, etc. by expanding GIS data bases, 7.5 minute quadrangle mapping of wetlands, comparative mapping, and analysis of multispectral thematic map data to determine the health of wetland biomass.



Action Item 7: Quantify the sources of man-induced declines of seagrass and wetlands habitats in the Gulf of Mexico.

Project Description: Quantify, on a recurring basis, man-induced declines of seagrass and wetlands habitats in the Gulf of Mexico, including industrial and municipal effluents, nonpoint source discharges, dredge and fill activities, and habitat conversions.
Lead: Gulf of Mexico Program--Habitat Degradation Committee, in conjunction with Nutrient Enrichment Committee, National Oceanic & Atmospheric Administration, U.S. Army Corps of Engineers, U.S. Fish & Wildlife Service, and Gulf States.
Initiation Date: 1992
Status: The report, "Status and Trends of Emergent and Submerged Vegetated Habitats, Gulf of Mexico, USA" (USEPA/800-R-92-003) has been completed, and much of the relevant information is summarized in Chapter 2 of this Action Agenda. Additional survey work is necessary.



→ 2

Objective: Plan and monitor pilot restoration projects Gulfwide in coordination with local, state, and other federal programs, and evaluate the effectiveness of enhancement, restoration, and creation in replacing Gulf of Mexico habitats.

Action Item 8: Compile technical materials, techniques, and lists of technicians to support the restoration and enhancement of Gulf of Mexico coastal habitats.

Project Description: Convene a Gulfwide workshop of agency and industry representatives to address plant suitability and availability to create and restore Gulf of Mexico habitats.

Lead: Soil Conservation Service, in coordination with Gulf of Mexico Program--Habitat Degradation Committee and Cooperative Extension Service.

Initiation Date: 1993

Status: A planning meeting is scheduled for Winter 1993, and the workshop is scheduled for Summer 1994.

The purpose of the workshop will be to identify and prioritize suitable plant species by Gulf region. The workshop will also develop recommendations for encouraging the development of commercial sources of plant material.



Action Item 9: Convene an interagency Technical Working Group to review and select appropriate monitoring and success criteria for wetlands restoration, establishment, and management in the Gulf of Mexico.

Project Description: Convene an interagency Technical Working Group to review and select appropriate monitoring and success criteria for wetlands restoration, establishment, and management in the Gulf of Mexico. Members of the group will include representatives from federal and state agencies, academia, conservation organizations, and the private sector. The final product will be a "Technical Manual of Wetlands Monitoring and Success Criteria."

Lead: U.S. Army Corps of Engineers, in coordination with Gulf of Mexico Program, U.S. Environmental Protection Agency, U.S. Fish & Wildlife Service, Soil Conservation Service, U.S. Forest Service, Federal Highway Administration, National Marine Fisheries Service, and Gulf States.

Initiation Date: 1992 **Completion Date:** 1994

Status: The Gulf of Mexico Program--Habitat Degradation Committee has funded a "Technical Manual of Wetlands Monitoring and Success Criteria."



Action Item 10: Develop and support a system of demonstration projects for the protection and restoration of Gulf of Mexico habitats.

Project Description A: Identify, develop, and facilitate the funding of a system of demonstration projects to protect and restore habitats at the county or conservation district level throughout the Gulf of Mexico region. Use these projects to demonstrate proven methods and for field-testing. Advertise the projects, encourage visitation as results appear, and communicate successes and failures to the public and to others involved in similar efforts.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in cooperation with state, local, and other federal programs.

Initiation Date: Ongoing

Status: A workshop, convened in December 1991, reviewed pre-proposals for demonstration projects. Pre-proposals were ranked and recommendations for funding were submitted to the Gulf of Mexico Program Office.

→ 26



Project Description B: Select and fund a Gulf of Mexico pilot project on habitat restoration to investigate techniques to restore wild celery beds (oligohaline grassbed habitat) using fruits. The pilot project should examine whether these techniques result in more rapid and less destructive revegetation than transplanting shoots taken from existing beds.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, using cooperative agreement with Dauphin Island Sea Laboratory, and in coordination with Coastal & Shoreline Erosion Committee.

Initiation Date: 1991 **Completion Date:** 1993

Status: A pilot project was selected and funded from pre-proposals received in 1991. Seeds were collected, stored, and planted during Summer 1991. The final report is scheduled for completion in 1993.



Action Item 11: Monitor habitat changes associated with pilot demonstration projects in the Gulf of Mexico region, and assess the effectiveness of demonstration projects in protecting and restoring Gulf of Mexico habitats.

Project Description A: Develop a monitoring system to establish baseline conditions and monitor habitat losses or gains associated with pilot demonstration projects around the Gulf of Mexico. The system should be accessible to Gulf States for use in preparing their comprehensive management plans.

Lead: National Wetlands Research Center and National Wetland Inventory, in coordination with Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: Ongoing

Status: The U.S. Army Corps of Engineers--Mobile District, has created data bases for permit information. The U.S. Geological Survey has twenty-six 7.5 minute quads of soil survey data almost digitized and is beginning the Alabama portions of the remaining five quads of soil surveys. The U.S. Fish & Wildlife Service has the 1955 and 1976 National Wetlands Inventory maps digitized and approximately 25 of 31 quads of the 1989-90 National Wetlands Inventory maps digitized. The National Aeronautics & Space Administration has georeferenced and classified two thematic satellite scenes of the study area. GIS coordination to assemble all coverage into one system and develop a user friendly menu for making information more usable by 404 permit reviewers in the cooperating agencies is currently lacking.

→ 24, 26, 41



Project Description B: Develop teams to monitor the on-site progress of selected demonstration projects to protect or restore Gulf of Mexico habitats. Monitoring should occur annually and teams should report status in a consistent format (to be developed).

Lead: Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1994

→ 41

Project Description C: Convene workshops (every two to three years) to evaluate the status of habitat demonstration, protection, and restoration projects in the Gulf of Mexico. Assessments and recommendations should be provided to the Gulf of Mexico Program--Habitat Degradation Committee. Workshop reports should be sufficient for making mid-course corrections in the field and in project development, developing new public outreach information, and refining the Gulf of Mexico's Five Year Strategy.

Lead: Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1994

→ 26

Research

Findings from monitoring efforts should be analyzed to understand and establish the underlying processes and relationships that result in particular observations. It is important to learn how something "works," to accurately predict succession patterns (for example) or other ecological changes in various similar and dissimilar environmental settings. To develop that understanding, it is essential to elucidate some of the important biological and environmental forces that structure and control the system.

In addition to improving scientific knowledge, research is also integral to developing more accurate, practical, and cost-effective methods and technologies for monitoring and sample analyses. Most research funds are administered by federal agencies or state program offices in support of specific missions, with only limited funding going to research that examines the cumulative effects of decisions on the ecosystem as a whole.

Mechanisms need to be developed to provide a means for producers, consumers, and funders of research to agree on the priorities for research. A closer connection should be established between the research agenda of the scientific community and the information needs of managers, regulators, and those involved in decisions for the management of the Gulf of Mexico.

Specific objectives, action items, and project descriptions follow:

Objective: Conduct research to increase knowledge of the functions of Gulf of Mexico habitats and to determine the relationships between habitat types and the effects of stress on these habitats.

Action Item 12: Determine the ecological role of pine flatwoods in Gulf of Mexico coastal communities and the need for appropriate regulation and management of these resources.

Project Description: Conduct a paired watershed study in the Gulf of Mexico to assess ecological changes resulting from conversion of pine flatwoods to monotypic pine stands grown on raised beds. This assessment will help elucidate the ecological role of pine flatwoods in the coastal community and lead to a more rationale regulation and management of these resources.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in conjunction with U.S. Army Corps of Engineers, U.S. Fish & Wildlife Service, U.S. Forest Service, and Soil Conservation Service.

Initiation Date: 1998

Action Item 13: Determine the effect of nutrient enrichment and the incidence of parasite life stages and hosts in Gulf of Mexico wetlands.

Project Description: Conduct field studies in Gulf States on the effect of nutrient enrichment and incidence of parasite life stages and hosts in constructed and natural wetland habitats.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in conjunction with University of Florida, Florida Game & Freshwater Fish Commission and Southwest Florida Water Management District.

Initiation Date: 1994

Action Item 14: Develop and implement a research agenda to provide information on linkages between and the cumulative impacts of habitats within Gulf of Mexico watersheds.

Project Description A: Sponsor a joint Gulf of Mexico Program--Habitat Degradation/Freshwater Inflow Committee workshop to determine the freshwater inflow needs of Gulf of Mexico estuaries, and develop a research agenda to provide information on linkages between and cumulative impacts of habitats within Gulf of Mexico watersheds.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in cooperation with Freshwater Inflow Committee.

Initiation Date: 1995

→ 6

Project Description B: Implement the research agenda developed in Project 14A to provide information on linkages between and cumulative impacts of habitats within Gulf of Mexico watersheds.

Lead: Appropriate federal and state agencies and academia.

Initiation Date: 1996

Action Item 15: Develop community profiles on the status and trends, significance, and future impacts of important Gulf of Mexico habitats.

Project Description A: Develop a community profile on the status and trends, significance, and future impacts of Gulf of Mexico estuarine hard bottom habitats (Gulfwide).

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in coordination with U.S. Fish & Wildlife Service.

Initiation Date: 1994

Project Description B: Develop a community profile on the status and trends, significance, and future impacts of Gulf of Mexico tidal flat habitats (Gulfwide).

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in coordination with U.S. Fish & Wildlife Service.

Initiation Date: 1995

Action Item 16: Develop a profile of the effects of dredged barrier island tidal passes on Gulf of Mexico coastal habitats.

Project Description: Develop a profile of the effects of dredged barrier island tidal passes on Gulf of Mexico coastal habitats (Gulfwide).

Lead: Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1997

Action Item 17: Determine the occurrence of phytoplankton blooms in the Gulf of Mexico, evaluate the impact and causes of such phenomena, and develop and implement appropriate Gulfwide management strategies.

Project Description A: Prepare a science-based review paper on the incidence of estuarine and marine phytoplankton blooms, conduct a survey of the severity of the problem in Gulf States, and develop management remedies at a workshop.

Lead: Gulf of Mexico Program-Habitat Degradation Committee.

Initiation Date: 1994

Project Description B: Prepare a long-term estuarine and marine phytoplankton bloom strategy document, including management remedies, for the appropriate state and federal agencies. This document should include a goal statement, strategy, and timetables for measuring success.

Lead: Gulf of Mexico Program-Habitat Degradation Committee.

Initiation Date: 1995

Project Description C: Based on the completion of Projects 17A and 17B, assign five-year responsibility to one federal agency to implement appropriate estuarine and marine phytoplankton bloom management strategies Gulfwide. Annual progress reports should be submitted to the Gulf of Mexico Program--Policy Review Board.

Lead: Gulf of Mexico Program-Habitat Degradation Committee.

Initiation Date: 1995

Objective: Conduct research to improve habitat restoration and enhancement projects in the Gulf of Mexico.

Action Item 18: Determine the extent to which planted seagrass systems provide the ecological functions found in naturally occurring seagrass systems in the Gulf of Mexico.

Project Description: Sponsor a study which compares the ecosystem structure and function of natural seagrass beds to created, planted beds of differing ages in Laguna Madre, Texas. The study will: 1) define important ecological parameters necessary to assure success of seagrass planting, 2) define measures of success, and 3) determine the extent to which planted systems provide the ecological functions found in naturally occurring seagrass systems.

Lead: Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1992 **Completion Date:** 1994

Status: The study has been completed and the final report is due by 1994.



Action Item 19: Summarize the state of knowledge of Gulf of Mexico habitat creation activities and identify and prioritize research needs.

Project Description A: Convene a panel of experts every five years to summarize the state of knowledge of important Gulf of Mexico habitat creation activities, identify and prioritize research needs, and inform regulators and potential funding agencies or organizations of the need to reduce the loss of important Gulf of Mexico habitats.

Lead: Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1990

Status: The first workshop was convened in April 1990, in Jackson, MS.



Project Description B: Prepare a report on the status of Gulf of Mexico coastal hardwood forest restoration/creation activities with recommendations on management and permit actions for this community type. The report will summarize all known information and develop a research plan to eliminate data gaps.

Lead: U.S. Fish & Wildlife Service, U.S. Forest Service, U.S. Environmental Protection Agency, and U.S. Army Corps of Engineers.

Initiation Date: 1995

Planning & Standards

The most effective way to reduce and eliminate habitat degradation is to control those activities and actions that threaten endangered and sensitive areas. It will cost far more to restore habitats after they have been destroyed than to control actions now before more damage is done. This should be a shared responsibility among all--federal, state, and local governments, the private sector, and citizens in the Gulf region. Numerous options include: open space programs, sensitive area protection programs, zoning ordinances, clearing and grading ordinances, drainage ordinances, as well as comprehensive and subarea plans. Restoration and enhancement of coastal habitats is also a necessary component of any program that seeks to balance out habitat gains and losses. Specific restoration programs must also be forged at all levels of government.

Specific objectives, action items, and project descriptions follow:

Objective: Enhance the effectiveness of federal and state standards and management programs to protect and conserve coastal habitats in the Gulf of Mexico region.

Action Item 20: Review and evaluate the operation of federal, state, and local regulatory programs, and develop recommendations for improvement based on an assessment of losses and gains of Gulf of Mexico habitats.

Project Description: Sponsor an interagency workshop to identify and assess federal, state, and local regulatory programs and their demonstrated performance in protecting important Gulf of Mexico habitats. Develop recommendations for improving the federal, state, and local regulatory programs.

Lead: U.S. Army Corps of Engineers.

Initiation Date: 1996

→ 21

Action Item 21: Develop an implementation strategy to improve the federal, state, and local regulatory programs that impact important Gulf of Mexico habitats.

Project Description: Convene an Interagency Regulatory Group to develop an implementation strategy to improve the federal, state, and local regulatory programs that impact important Gulf of Mexico habitats.

Lead: U.S. Army Corps of Engineers.

Initiation Date: 1996

→ 20

Action Item 22: Minimize the loss of emergent Gulf of Mexico habitats due to sea level change through appropriate management and development techniques.

Project Description: Identify and work with appropriate groups and agencies to regularly convene a workshop of all Gulf States to exchange information, and apprise regulators of development techniques, in order to minimize the loss of Gulf of Mexico emergent habitat and property due to sea level change.

Lead: The Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1993

Status: A workshop is being planned in conjunction with the Gulf of Mexico Program's third biennial symposium, scheduled Spring 1995.



Action Item 23: Evaluate existing compensatory mitigation projects, and provide standardized guidance and success criteria for future projects in the Gulf of Mexico region.

Project Description A: Evaluate compensatory mitigation projects throughout the Gulf of Mexico region conducted as a condition of recent federal and state permits. Prepare a report to all concerned agencies regarding study findings, as well as recommendations for changes and improvements in future permit-related mitigation projects.

Lead: U.S. Army Corps of Engineers, in cooperation with Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1994

Project Description B: Develop a standardized guidance for specific habitat types, targeted to regulatory agencies throughout the Gulf of Mexico region, on how compensatory mitigation should be performed to maximize the potential for successful habitat replacement. The guidance should also include standardized criteria by which the success of compensatory mitigation is evaluated.

Lead: U.S. Army Corps of Engineers, in cooperation with Gulf of Mexico Program--Habitat Degradation Committee and state and federal agencies.

Initiation Date: 1996

Action Item 24: Promote, guide, and facilitate the development of state comprehensive wetland management plans in the Gulf of Mexico region.

Project Description A: Sponsor workshops in each of the Gulf States for appropriate state and federal agencies to develop and/or review provisions for comprehensive coastal wetland management plans which embody area-specific strategies and projects for wetland protection, creation, restoration, and mitigation.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in cooperation with Gulf States.

Initiation Date: 1995

Project Description B: Based on the results of the workshops sponsored in Project 24A, develop guidelines for future state comprehensive coastal wetland management plans.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in cooperation with Gulf States.

Initiation Date: 1996

Project Description C: Facilitate and support the Gulf States in the preparation of comprehensive coastal wetland management plans, as well as initiatives leading up to the development of these plans.

Lead: U.S. Environmental Protection Agency and U.S. Fish & Wildlife Service.

Initiation Date: 1992

Status: 1) Alabama received a grant from the U.S. Environmental Protection Agency (USEPA)--Region 4 in 1992 to develop a Wetlands Conservation and Management Initiative. Committees have been formed to investigate mapping and delineation, functional assessment, and education and outreach. The Alabama Department of Transportation is in the process of developing regional mitigation banks.

2) Florida received a grant from the USEPA--Region 4 in 1992, to investigate the feasibility of state assumption of the federal wetlands permitting program. The Florida Department of Transportation is in the process of developing regional mitigation banks. The South Florida Water Management District received a USEPA--Region 4 grant to develop a comprehensive wetland management plan, including an inventory and conservation and monitoring provisions. The Seminole Indian Tribe received a USEPA--Region 4 grant to develop water quality standards and a wetland GIS system.

3) The Mississippi Department of Transportation has an active mitigation bank. The Mississippi Bureau of Marine Resources received a grant in 1991 from USEPA--Region 4 to map wetlands in Jackson County and enter data into a GIS system. Also, the State of Mississippi is developing a functional assessment of wetland types. Work will continue in 1994.

4) The development of a comprehensive coastal wetland management plan for Texas coastal wetlands has been mandated by state legislation. The Texas General Land Office and Texas Parks & Wildlife Department were funded during 1993 by USEPA--Region 6 to develop a wetlands management plan which may contain a provision for mitigation banking and be similar to Louisiana's marsh restoration plans (developed by the Louisiana Department of Natural Resources).

5) Comprehensive Louisiana wetlands conservation/restoration plans are being developed and implemented under provisions of state and federal law.



Action Item 25: Promote, guide, and facilitate the development of seagrass community management plans in the Gulf of Mexico.

Project Description A: Update, publish, and distribute throughout the Gulf of Mexico the results of the Florida Seagrass Task Force, U.S. Environmental Protection Agency/U.S. Fish & Wildlife Service seagrass workshop, and the National Oceanic & Atmospheric Administration/South Florida Water Management District workshop on seagrass and water quality standards.

Lead: Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1995

Project Description B: Sponsor a workshop to discuss the development and implementation of a seagrass community management plan that will help lead to informed stewardship of this important natural habitat. The report generated in Project 25A should be utilized.

Lead: Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1995

Action Item 26: Provide a Gulfwide agency framework and funding mechanisms for habitat restoration programs throughout the Gulf of Mexico.

Project Description A: Develop a framework to carry out habitat-related projects throughout the Gulf of Mexico region. The framework should include administrative criteria for prioritizing projects, identification of project leaders, and mechanisms for transferring funding. Substantive components of habitat restoration programs, such as establishing baseline conditions, monitoring changes, evaluating and adjusting projects, and assuring communication of successes and failures throughout the Gulf of Mexico region, should also be included in the framework.

Lead: Gulf of Mexico Program Office, in coordination with Habitat Degradation Committee.

Initiation Date: 1994

Project Description B: Develop a comprehensive Gulf of Mexico habitat restoration program budget request for consideration as part of the 1996 federal budget and thereafter.

Lead: Lower Mississippi Valley, South Atlantic, and Southwest Division Offices of U.S. Army Corps of Engineers, in conjunction with Gulf of Mexico Program--Habitat Degradation Committee and Gulf States.

Initiation Date: 1994

Project Description C: Provide future funds for habitat-related projects to the five Gulf States upon completion of required plans for comprehensive wetland management and seagrass community management. Gulf of Mexico Program funds should then be allocated for cost share projects that are consistent with such plans.

Lead: Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1997

Action Item 27: Implement Advanced Identification [Section 404 (c) Clean Water Act] projects for the Gulf of Mexico region to protect valuable habitats from dredging and filling activities.

Project Description: Support completion of existing Advanced Identification projects and implement at least four new Advanced Identification [Section 404 (c) Clean Water Act] projects for the Gulf of Mexico region based upon recommendations of the Gulf of Mexico Program--Habitat Degradation Committee.

Lead: U.S. Environmental Protection Agency--Regions 4 and 6, in coordination with Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1993

Status: Advanced Identification Projects have been funded by U.S. Environmental Protection Agency--Region 4 for Rookery Bay, Western Broward County, Shark River Slough, and the Florida Keys. All projects should be completed during 1994.



Action Item 28: Develop specific water quality standards for the estuarine, nearshore, and offshore areas of the Gulf of Mexico.

Project Description A: Establish nutrient, turbidity, and color standards which are required for the continuance and establishment of coastal seagrass communities in the Gulf of Mexico. Gather water quality data in areas where seagrasses are established, where they were historically located, and areas of known sources of poor water quality, and manipulate variables in a mesocosm study to define limits for different seagrass species.

Lead: U.S. Environmental Protection Agency and Gulf States, in coordination with Gulf of Mexico Program--Habitat Degradation Committee and Nutrient Enrichment Committee.

Initiation Date: 1993

Status: The U.S. Environmental Protection Agency's Environmental Research Laboratory, as part of the Agency's Wetlands Research Program, has finalized a cooperative agreement with the University of Virginia to conduct field-shading experiments on seagrasses at three sites in the Gulf of Mexico in order to establish limits of light to seagrass growth, survival, and recovery.

→ 41

Project Description B: Convene a workshop of state and federal experts on marine water quality and living aquatic resources habitat requirements to discuss and make recommendations about additional needs for defensible water quality criteria and standards for Gulf of Mexico coastal and estuarine waters and wetlands.

Recommended criteria and standards should be submitted to the Gulf States and U.S. Environmental Protection Agency in 1996.

Lead: U.S. Environmental Protection Agency, in coordination with Gulf of Mexico Program--Habitat Degradation Committee, Nutrient Enrichment Committee, and Living Aquatic Resources Committee.

Initiation Date: 1995



Compliance & Enforcement

The effectiveness of regulatory programs is greatly enhanced by active compliance monitoring and enforcement programs. Strong permit conditions are only effective if permittees conform to permitted specifications. Self monitoring by the regulated community is not, at this time, acceptable to the public for assuring permit compliance.

The existing federal laws which regulate activities which can impact coastal habitats include: Clean Water Act, Endangered Species Act, Coastal Barrier Resources Act, and Coastal Zone Management Act. In addition, there are many state and local laws and ordinances which can restrict the loss of coastal habitats. Many programs condition construction permits to include compensatory mitigation to replace habitats unavoidably impacted by the permitted activity.

Regulators recognize that compliance monitoring must be performed to assure that projects are constructed as permitted. If permits are conditioned to include compensatory mitigation, compliance monitoring must include investigations to ascertain the success of attempted habitat replacement. Also, it is widely recognized that enforcement surveillance and resolution of violations is essential to an effective regulatory program.

Currently, many federal and state regulatory programs do not have the number of field-level personnel which are required to achieve effective compliance and enforcement. In addition, agencies which have not been historically active in this arena may find it difficult to initiate new or improved compliance and enforcement monitoring programs because of lack of required ancillary facilities, such as airplane or helicopter time, photographic equipment, legal staff, vehicles, and training. Finally, management must support enforcement and compliance efforts and actively pursue resolution of cases to deter continued non-compliance and/or violations.

Specific objectives, action items, and project descriptions follow:

Objective: Provide maximum protection for Gulf of Mexico habitats by assuring full compliance with federal and state regulatory permit conditions and vigorous violation detection and resolution.

Action Item 29: Inventory and evaluate existing compliance and enforcement programs Gulfwide which support habitat protection.

Project Description A: Inventory and evaluate existing compliance and enforcement programs Gulfwide which support habitat protection. The inventory should include a listing and description of agencies and authorities throughout the Gulf States.

Lead: U.S. Army Corps of Engineers Districts, in coordination with federal, state, and local regulatory agencies.

Initiation Date: 1995

→ 20

Project Description B: Evaluate the effectiveness of permitting agencies, identified in Project 29A, in resolving: 1) enforcement cases and 2) achieving restoration or compensation for unpermitted losses.

Lead: U.S. Army Corps of Engineers, in coordination with regulatory agencies.

Initiation Date: 1996

Action Item 30: Promote increased interagency cooperation and consistent approaches within habitat compliance and enforcement programs throughout the Gulf of Mexico region.

Project Description A: Institute a program in each Gulf State for regular joint inspections of selected permittees to assure compliance with permit conditions. Permittees will be identified based on potential for habitat impacts.

Lead: U.S. Army Corps of Engineers Districts, in coordination with federal, state, and local regulatory agencies.

Initiation Date: 1995

Project Description B: Develop a compliance monitoring guidance document for federal and state regulatory agencies that operate in the Gulf of Mexico region. The document should include consistent and concise permit conditions for habitat protection and compensatory mitigation across the Gulf States, and permit monitoring requirements for compensatory mitigation.

Lead: U.S. Army Corps of Engineers, in coordination with federal and state regulatory agencies.

Initiation Date: 1996

Project Description C: Develop and initiate effective interagency surveillance programs in each Gulf State to detect unauthorized destruction of Gulf of Mexico habitats.

Lead: U.S. Army Corps of Engineers, in coordination with federal, state, and local regulatory programs.

Initiation Date: 1996

Project Description D: Select one Gulf State for use as a model, and provide assistance in developing an effective habitat compliance and enforcement program. This model should then be utilized by the other Gulf States in developing their own habitat compliance and enforcement programs.

Lead: Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1997

Action Item 31: Provide training and sources of expertise to enhance compliance with habitat protection requirements across the Gulf of Mexico region.

Project Description A: Convene a workshop for regulatory agencies Gulfwide to examine management and work sharing options to allow increased compliance monitoring and enforcement activities for habitat protection without increased staffing.

Lead: U.S. Army Corps of Engineers, in cooperation with Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1995

→ 30A, 30D

Project Description B: Regularly sponsor enforcement and compliance seminars and training Gulfwide which provide up-to-date methods to identify, track, and resolve enforcement cases throughout the Gulf of Mexico region.

Lead: U.S. Army Corps of Engineers, in coordination with appropriate regulatory agencies.

Initiation Date: 1997

→ 30B

Project Description C: Implement training programs and a certification process for wetlands mitigation specialists who carry out Clean Water Act requirements. Maintain a list of qualified experts who have completed training programs and a certification process for wetlands mitigation.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, working with nonprofit service groups, such as the Society of Wetland Scientists and Association of State Wetland Managers.

Initiation Date: 1996

Project Description D: Develop lists of qualified expert witnesses to be used in the legal resolution of habitat-related enforcement cases throughout the Gulf of Mexico region.

Lead: Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1995

Preservation & Protection

Many of the critical coastal habitats along the Gulf of Mexico have been altered by man. Increasing development pressures and the lack of clear regulatory policies to control impacts will obviously result in additional impacts in the future. Programs that provide a higher level of protection, including preservation for sensitive areas, are needed. The programs should focus on maintaining the functional integrity of the ecological system including its importance as a spawning, nesting, and nursery area.

Coordination of coastal preservation and protection activities should be facilitated in the Gulf of Mexico and partnerships among those agencies and governments with a vested interest in habitat management should be established. Critical coastal habitats and special ecological areas worthy of increased protection need to be identified by each Gulf State. The individual lists could be compiled to form a comprehensive list of critical areas throughout the Gulf of Mexico which could then be prioritized based on value, levels of sensitivity, and vulnerability.

Methods and mechanisms for preservation including enhanced regulations, conservation easements, and acquisition should be identified and outlined in a catalog for implementation. Finally, states should form a coalition for action where relevant information and resources can be shared to develop and fulfill habitat preservation goals for the Gulf of Mexico.

Specific objectives, action items, and project descriptions follow:

Objective: Provide a comprehensive preservation and protection framework for Gulf of Mexico habitats of significant ecological value.

Action Item 32: Identify and prioritize special ecological areas in the Gulf of Mexico that are worthy of increased levels of protection and preservation.

Project Description A: Develop a mechanism for defining critical habitats (*i.e.*, limited, threatened, endangered) throughout the Gulf of Mexico. These habitats will be classified in terms of their geographic area, environmental significance, and geographical extent.

Lead: Gulf of Mexico Program, operating through Texas Parks & Wildlife Department, and in conjunction with appropriate experts at state and federal level.

Initiation Date: 1993

Status: The Gulf of Mexico Program provided funds to the Texas Parks & Wildlife Department in 1993 to develop a model comprehensive ecological protection program. The project will be fully coordinated with all interested parties and produce an inventory and approach/mechanism for protecting these most vital areas.



Project Description B: Conduct a survey of Gulf of Mexico coastal habitats to identify and prioritize candidate systems for habitat preserves or management areas both on a state and regional basis.

Lead: Gulf of Mexico Program, operating through Texas Parks & Wildlife Department, and in conjunction with federal, state, and private groups.

Initiation Date: 1993

Status: The Gulf of Mexico Program's Success in '93 Initiative funded proposals to select habitat preserve coordinators for each of the five Gulf Coast States, compile lists of suitable and available sites, and develop a management and reporting system. Coordinators are in place. Site compilations and the management and reporting plan will be completed by the end of 1994. The Texas Parks & Wildlife Department is developing a coastal wetlands priority acquisition plan, with U.S. Environmental Protection Agency--Region 6 funds, which will be completed by the end of 1994.



Action Item 33: Coordinate and facilitate, using all programs, resources, and mechanisms, the preservation and protection of special ecological habitats in the Gulf of Mexico.

Project Description A: Develop a compendium of preservation and protection mechanisms for sensitive habitats. This manual would also include information regarding funding available to Gulf States for coastal protection, including programs sponsored by the federal government, foundations, private industry, as well as the Gulf States themselves.

Lead: Gulf of Mexico Program, operating through Texas Parks & Wildlife Department, and in conjunction with federal, state, and private groups.

Initiation Date: 1993 **Completion Date:** 1994

Status: The Gulf of Mexico Program provided funds to the Texas Parks & Wildlife Department in 1993 to develop a manual describing sensitive habitat preservation methods. The manual will also include potential funding sources and procedures for habitat acquisition and is scheduled for completion in October 1994.



Project Description B: Establish a network of Gulf State representatives and appropriate federal agencies, local governments, foundations, and private groups to facilitate the preservation and protection of sensitive ecological habitats through the exchange of information, techniques, methods, etc.

Lead: Gulf of Mexico Program, operating through Texas Parks & Wildlife Department, and in conjunction with federal, state, and private groups.

Initiation Date: 1994

Project Description C: Develop a strategy for collecting, maintaining, and distributing a network/inventory of contacts, information sources, and sensitive area protection efforts throughout the Gulf of Mexico region.

Lead: Gulf of Mexico Program, operating through Texas Parks & Wildlife Department, and in conjunction with federal, state, and private groups.

Initiation Date: 1994

Public Education & Outreach

People living in two-thirds of the U.S. may ultimately affect the environmental quality of the Gulf of Mexico. Effective prevention of habitat degradation requires an ongoing commitment from an informed citizenry; public outreach nurtures such a commitment. Public information, education, and involvement are three components of an effective outreach strategy, which can reap significant benefits for the Gulf. More and more, public outreach is recognized as an effective resource management tool to address problems resulting from individual actions. A committed citizenry presents both a supplement and an alternative to enforcement programs.

Public outreach activities can foster recognition of the Gulf of Mexico as a regional and national resource, stimulating civic, governmental, and private sector support for changing lifestyles and developing the financial commitments necessary to preserve the environmental quality of the Gulf. A strong outreach program showing the effects human activities have upon the health of Gulf ecosystems should enable all individuals, whether living on the coast or along the upper stretches of the Mississippi River, to see themselves as caretakers of a vital, shared resource.

Specific objectives, action items, and project descriptions follow:

Objective: Develop educational materials and programs to promote awareness and appreciation of Gulf of Mexico habitats, as well as their value and importance.

Action Item 34: Develop educational programs and materials for use in school systems to increase understanding of the value of Gulf of Mexico habitats and the need for preservation and protection.

Project Description A: Develop materials, curricula, and programs for teachers to introduce the concepts about Gulf of Mexico critical habitats, including restoration and protection needs, into public school education.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in conjunction with Public Education & Outreach Operations, National Oceanic & Atmospheric Administration, National Science Foundation, U.S. Department of Defense, and Center for Marine Conservation.

Initiation Date: 1993

Status: The Gulf of Mexico Program and Navy Oceanographic Office personnel are assisting Long Beach High School (Mississippi) science teachers in developing coastal habitat science projects that can be worked cooperatively with another Caribbean or Central American high school. This is planned as a continuing program.



Project Description B: Support innovative educational programs on the value of coastal habitats as a pilot project for one to two years. As a start, the University of West Florida's Wetlands Weekend should be supported and highlighted.

Lead: Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1994

Action Item 35: Develop public outreach materials and programs to increase understanding of the value of Gulf of Mexico habitats and the need for preservation and protection.

Project Description: Develop materials to educate the general public on the economic and societal values of natural habitats in the Gulf of Mexico.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in conjunction with Public Outreach & Education Operations and regulatory agencies.

Initiation Date: 1995

Action Item 36: Utilize interpretive centers, displays, and signs to inform the public about Gulf of Mexico resources through a "hands-on" experience.

Project Description: Promote and improve existing interpretive centers and develop new centers throughout the Gulf of Mexico. These centers could be adjacent to, or part of, existing parks, museums, research institutes, refuges, and demonstration sites to inform the public about resources and values through a "hands-on" experience. Develop new displays and signs for distribution.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in coordination with Public Education & Outreach Operations.

Initiation Date: 1995

→ 11

Action Item 37: Inform business and industry groups on the value of Gulf of Mexico habitats and the need for preservation and protection.

Project Description: Develop outreach activities targeted for specific business and industry groups to promote an understanding of the value of Gulf of Mexico habitats and emphasize the need for protection and preservation.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in coordination with Public Education & Outreach Operations and Citizens Advisory Committee.

Initiation Date: 1995

Objective: Prevent or correct Gulf of Mexico habitat degradation and loss through public involvement activities.

Action Item 38: Initiate an outreach program to inform and involve the general public in activities necessary to prevent or correct habitat degradation and loss in the Gulf of Mexico region.

Project Description A: Develop educational materials to inform the public of simple actions which can be taken to help eliminate habitat loss in the Gulf of Mexico. This should include educational signs and press releases which inform the public of environmentally sensitive areas and simple measures that can be taken, such as addressing propeller damage to seagrass areas. Educational materials, field trip opportunities, and guest lecturers to public school systems, as well as colleges and universities which border the Gulf, should also be provided.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, Citizens Advisory Committee, and Public Education & Outreach Operations.

Initiation Date: 1995

→

32B, 36



Project Description B: Prepare a handbook and a public information brochure on "How to Restore or Establish Wetlands Communities", which includes identification and evaluation of wetland restoration and establishment techniques used by federal and state agencies and private groups to: 1) select locations for wetland establishment, 2) restore or establish hydrology, 3) prepare soils, 4) select, handle, and plant vegetation, and 5) select appropriate engineering structures and procedures.

Lead: U.S. Army Corps of Engineers, U.S. Fish & Wildlife Service, and Soil Conservation Service, in coordination with Gulf of Mexico Program, U.S. Environmental Protection Agency, U.S. Forest Service, National Marine Fisheries Service, and Gulf States.

Initiation Date: 1993 **Completion Date:** 1994

Status: The Gulf of Mexico Program--Habitat Degradation Committee will fund a handbook and a public information brochure on "How to Restore or Establish Wetland Communities," however, personnel and funding constraints have delayed this project by one year. A draft brochure will be available in 1993, and a draft handbook will be available in 1994; both will be finalized by the end of 1994. Publication of the handbook and brochure will require additional funding.

→ 8, 10A

Project Description C: Expand involvement activities conducted by Boater's Pledge leaders in each Gulf State by providing generic materials and program guidance on habitat degradation issues.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in conjunction with Public Outreach & Education Operations and Marine Debris Committee.

Initiation Date: 1994

Project Description D: Add a column to "Gulf Watch" that promotes habitat protection, restoration, creation and enhancement projects, successes, and strategies.

Lead: Gulf of Mexico Program Office.

Initiation Date: 1994

→ 19A, 22A, 26A, 27, 29B, 32B

Action Item 39: Develop an outreach program for tourists that promotes an awareness of the value and the need to protect Gulf of Mexico habitats in important resort and recreational communities.

Project Description: Develop educational materials targeted toward tourists that promote awareness of the value and the need to protect Gulf of Mexico habitats in important resort and recreational communities.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in coordination with Public Education & Outreach Operations.

Initiation Date: 1995

Action Item 40: Increase knowledge on the laws, regulations, and ordinances pertaining to regulation of coastal habitats in the Gulf of Mexico.

Project Description A: Develop materials to educate the public on the laws, regulations, and ordinances pertaining to regulation of coastal habitats in the Gulf of Mexico.

Lead: Gulf of Mexico Program--Habitat Degradation Committee, in conjunction with Public Outreach & Education Operations and regulatory agencies.

Initiation Date: 1995

→ 20, 21, 27

Project Description B: Develop a system to educate developers and their employees about the conditions of selected permits in terms of expected habitat results. Follow-up on key permits to evaluate compliance. Develop recognition programs for developers with outstanding compliance records and involve them in educational programs.

Lead: Gulf of Mexico Program--Habitat Degradation Committee.

Initiation Date: 1996

→ 29A, 29B, 30A

Action Item 41: Develop a citizen involvement program to monitor losses and gains in Gulf of Mexico habitat acreage and quality.

Project Description: Identify mechanisms to allow concerned citizens to be involved in monitoring losses and gains in Gulf of Mexico habitat acreage and quality.
Lead: Gulf of Mexico Program--Habitat Degradation Committee, in coordination with Citizens Advisory Committee and Public Education & Outreach Operations.
Initiation Date: 1995
→ **7, 10A, 11B, 26A, 28A**

Action Item 42: Develop an "Adopt-A-Shoreline" Program to involve the public in the preservation and protection of Gulf of Mexico habitats.

Project Description: Develop an "Adopt-A-Shoreline" Program to involve the public in the preservation and protection of Gulf of Mexico habitats. The Center for Marine Conservation's existing Adopt-A-Shoreline Program for marine debris should be used as a model and perhaps coordinated with the new habitat degradation program. The Program should also be coordinated with ongoing "Adopt-A-Wetland" programs in the Gulf States, such as in Corpus Christi, TX, where youths are being taught the importance of wetlands conservation.
Lead: Center for Marine Conservation, in coordination with Gulf States, Gulf of Mexico Program Public Education & Outreach Operations, Habitat Degradation Committee, and Citizen's Advisory Committee.
Initiation Date: 1996
→ **10A**

In Closing...

We intend this document to be a beginning, not an end. Our hope is that this Action Agenda will serve as an inspiration and a call to action for the millions who live and work in the Gulf of Mexico region. Together, our coordinated actions can make a difference in protecting and restoring Gulf of Mexico habitats.

**The Gulf of Mexico Program
Habitat Degradation Committee**



- Adams, R.D., B.B. Barrett, J.H. Blackmon, B.W. Gane, and W.G. McIntire. 1976. *Barataria Basin: Geologic Processes and Framework*. Louisiana State University. Center for Wetland Resources. Baton Rouge, LA. Sea Grant Pub. No. LSU-T-76-006.
- Bahr, L.M., Jr. and W.P. Lanier. 1981. *The Ecology of Intertidal Oyster Reefs of the South Atlantic Coast: A Community Profile*. U.S. Fish and Wildlife Service. Office of Biological Services. Washington, D.C. USFWS/OBS-81/15.
- Baumann, R.H., and R.E. Turner. 1990. "Direct Impacts of Outer Continental Shelf Activities on Wetland Loss in the Central Gulf of Mexico." *Environ. Geo. Water Resour.* 15:189-198.
- Beasley, J.R. 1965. "Mudshell Exploitation and Production." Beasley letters, Ditto no. 86 a-e. University of Texas Memorial Museum.
- Bell, F.W. 1989. *Application of Wetland Valuation Theory to Florida Fisheries. Florida Sea Grant Program*. SGR 95. Florida Sea Grant College. The University of Florida. Gainesville, FL.
- Buff, V. and S. Turner. 1987. "The Gulf Initiative." *Coastal Zone* 1987.
- Broutman, M.A. and D.L. Leonard. 1988. *National Estuarine Inventory: The Quality of Shellfish Growing Waters in the Gulf of Mexico*. U.S. Department of Commerce. National Oceanic & Atmospheric Administration. Strategic Assessment Branch. Washington, D.C. (N/OMA31).
- Chabreck, R.H. 1982. "The Effect of Coastal Alteration on Marsh Plants." *In: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences and Options*. D.F. Boesch (ed.). U.S. Fish and Wildlife Service. Biological Services Program. Washington, D.C. USFWS/OBS-82/59,92-98.
- Comp, G.S. and W. Seaman, Jr. 1985. "Estuarine Habitat and Fishery Resources of Florida." *In: Florida Aquatic Habitat and Fishery Resources*. W. Seaman, Jr. (ed.). Florida Chapter of American Fisheries Society. Kissimmee, FL. ISBN-O-9616676-0-5.
- Conner, W.H. and W.J. Day, Jr., (eds.). 1987. *The Ecology of Barataria Basin, Louisiana: An Estuarine Profile*. U.S. Fish and Wildlife Service. National Wetlands Research Center. Washington, D.C. Biological Report 85 (7.13).
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Department of the Interior. U.S. Fish and Wildlife Service. Washington, D.C. USFWS/OBS-79/31.

- Dahl, T.E. 1991. *Wetland Resources of the United States* (map). U.S. Department of the Interior. Fish & Wildlife Service. National Wetlands Inventory. St. Petersburg, FL.
- Dame, R.F., T.G. Wolaver, and S.M. Libes. 1985. "The Summer Uptake and Release of Nitrogen by an Intertidal Oyster Reef." *Netherlands Jour. of Sea Research*. 19:265-268.
- Darnell, R.M. 1992. "Biology of the Estuaries and Inner Continental Shelf of the Northern Gulf of Mexico." *In: The Environmental and Economic Status of the Gulf of Mexico: Proceedings of the Conference on Environmental and Economic Status of the Gulf of Mexico*. Gulf of Mexico Program Office. Stennis Space Center, MS.
- Dunbar, J.B., L.D. Britsch, and E.B. Kemp, III. 1990. *Land Loss Rates: Louisiana Chenier Plain*. U.S. Army Corps of Engineers, Waterways Experiment Station, Tech. Dept. GL-90-2.
- Dunbar, J.B., L.D. Britsch, and E.B. Kemp, III. 1992. *Land Loss Rates--Louisiana Coastal Plain*. Tech. Rpt. GL-90-2. U.S. Army Corps of Engineers. Waterways Experiment Station. Vicksburg, MS.
- Durako, M.J., J.A. Browder, W.L. Kruczynski, C.B. Subrahmanyam, and R.E. Turner. 1985. "Salt Marsh Habitat and Fishery Resources of Florida." *In: Florida Aquatic Habitat and Fishery Resources*. Florida Chapter of American Fisheries Society. Kissimmee, FL.
- Eleuterius, L.N. Personal communication. Gulf Coast Research Laboratory, Ocean Springs, MS.
- Eleuterius, L.N. In Press. "Catastrophic Loss of Seagrasses in Mississippi Sound." *In: Proceedings of the Minerals Management Service Information Transfer Meeting*. New Orleans, LA. Dec., 1989.
- Eleuterius, L.N. and G.J. Miller. 1976. "Observations on Seagrasses and Seaweeds in Mississippi Sound Since Hurricane Camille." *J. Miss. Acad. Sci.* 21:58-63.
- Field, D.W., A.J. Reyer, P.V. Genovese, and B.D. Shearer. 1991. *Coastal Wetlands of the United States: An Accounting of a Valuable National Resource*. U.S. Department of Commerce. National Oceanic and Atmospheric Administration. National Ocean Service, Strategic Assessment Branch. Washington, DC.
- Gosselink, J.G. 1984. *The Ecology of Delta Marshes of Coastal Louisiana: A Community Profile*. U.S. Fish and Wildlife Service. Washington, D.C. USFWS/OBS-84/09.

- Gosselink, J.G., G.P. Shaffer, L.C. Lee, D.M. Burdick, D.L. Childers, N.C. Leibowitz, S.C. Hamilton, R. Boumans, D. Cushman, S. Fields, M. Koch, and J.M. Visser. 1990. "Landscape Conservation in a Forested Wetland Watershed: Can We Manage Cumulative Impacts." *Bioscience* 40(8): 588-600.
- Haddad, K.D. 1989. "Habitat Trends and Fisheries in Tampa and Sarasota Bays." *In: Tampa and Sarasota Bays: Issues, Resources, Status, and Management*. National Oceanic and Atmospheric Administration. Washington, D.C. NOAA Estuary-of-the-Month Seminar Series No. 11.
- Hopkinson, C.S. and J.W. Day, Jr. 1979. "Aquatic Productivity and Water Quality at the Upland-Estuary Interface in Barataria Basin, Louisiana." *In: Ecological Processes in Coastal and Marine Systems*. R.J. Livingston (ed.). Plenum Press, London, UK.
- Iverson, R.L. and H.F. Bittaker. 1986. "Seagrass Distribution and Abundance in Eastern Gulf of Mexico Coastal Waters." *Estuarine, Coastal Shelf Sci.* 22:577-602.
- Johnson, W.B. and J.G. Gosselink. 1982. "Wetlands Loss Directly Associated with Canal Dredging in the Louisiana Coastal Zone." *In: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options*. D.F. Boesch (ed.). Baton Rouge, LA. October 5-7, 1981. U.S. Fish and Wildlife Service, Biological Services Program. Washington, D.C. USFWS/OBS-82/59,60-72.
- Lewis, R.R. III. 1989. "Biology and Eutrophication of Tampa Bay." *In: Tampa and Sarasota Bays: Issues, Resources, Status, and Management*. National Oceanic and Atmospheric Administration. NOAA Estuary-of-the-Month Seminar Series No. 11.
- Lewis, R.R. III, J. Durako, M.D. Moffler, and R.C. Phillips. 1985a. "Seagrass Meadows of Tampa Bay--A Review." *In: Proceedings: Tampa Bay Area Scientific Information Symposium*. S.F. Treat, J.L. Simon, R.R. Lewis III and R.L. Whitman, Jr. (eds.). May, 1982. Florida Sea Grant Report No. 65.
- Lewis, R.R. III, R.G. Gilmore, Jr., D.W. Crewz, and W.E. Odum. 1985b. "Mangrove Habitat and Fishery Resources of Florida." *In: Florida Aquatic Habitat and Fishery Resources*. W. Seaman, Jr. (ed.). Florida Chapter of the American Fisheries Society. Kissimmee, FL.
- Liebowitz, S.G. and J.M. Hill. In press. "Land Loss Hotspots in Coastal Louisiana." *Ambio*.
- Lindall, W.N., Jr., and C.H. Saloman. 1977. "Alteration and Destruction of Estuaries Affecting Fishery Resources of the Gulf of Mexico." *Mar. Fish. Rev.* 39:1-7.

- Lindall, W.N., Jr., and G.W. Thayer. 1982. "Quantification of National Marine Fisheries Service Habitat Conservation Efforts in the Southeast Region of the United States." *Mar. Fish. Rev.* 44:18-22.
- Lindall, W.N., Jr., A. Mager, Jr., G.W. Thayer, and D.R. Ekberg. 1979. "Estuarine Habitat Mitigation Planning in the Southeast." *In: The Mitigation Symposium: A National Workshop on Mitigating Losses of Fish and Wildlife Habitats.* Ft. Collins, CO. July, 16-20, 1979. U.S. Department of Agriculture. Technical Report RM:65.
- Longley, W.L., and M. Wright. 1989. *Texas Barrier Island Characterization-Narrative Report.* U.S. Fish and Wildlife Service. Washington, D.C. NWRC Open File Rep. 89-05.
- Louisiana Geological Survey and U.S. Environmental Protection Agency. 1987. *Saving Louisiana's Coastal Wetlands: The Need for a Long-term Plan of Action.* USEPA-230-02-87-026. (RR#13148).
- MacDonald, I.R., S.E. Best, C.S. Lee, and A.A. Rost. 1992. *Biogeochemical Processes at Natural Oil Seeps in the Gulf of Mexico: Field Trials of a Small Area Benthic Imaging System (SABIS).* Presented at the First Thematic Conference on Remote Sensing for Marine and Coastal Environments. New Orleans, LA., June 15-17, 1992.
- McGarry MacAulay, G. Personal communication. Florida Department of Natural Resources. Marine Research Institute.
- Montagna, P.A. 1991. "Effects of the Laguna Madre, Texas Brown Tide on Benthos." *In: Whitledge, T.E. and W. M. Pulich, Jr., Report: Brown Tide Symposium and Workshop.* Final Report to Texas Parks and Wildlife Department, and USEPA Gulf of Mexico Program. Technical Report No. TR/91-002, Marine Science Institute, The University of Texas, Port Aransas, TX. pp. 21-22.
- Odum, W.E., C.C. McIvor, and T.J. Smith III. 1982. *The Ecology of the Mangroves of South Florida: A Community Profile.* U.S. Fish and Wildlife Service. Washington, D.C. USFWS/OBS-81/24.
- Penland, P.S., and R. Boyd. 1981. *Shoreline Changes in the Louisiana Barrier Coast. The Ocean--An International Workplace.* Oceans 81 Conference Record. Boston, MA. September 16-18, 1981. Vol. 1, 209- 219.
- Powell, G.L. 1989. *Texas Bays and Estuaries Program: A Cooperative State Program for the Study of Freshwater Inflow Needs.* Texas Water Development Board. Austin, TX.

- Pulich, W.M., Jr. and S. Rabalais. 1986. "Primary Production Potential of Blue-Green Algal Mats on Southern Texas Tidal Flats." *The Southwestern Naturalist* 31(1):39-47.
- Pulich, W.M., Jr. and R.S. Scalan. 1987. "Organic Carbon and Nitrogen Flow from Marine Cyanobacteria to Semiaquatic Insect Food Webs." *Contributions in Marine Science*. 30:27-37.
- Pulich, W.M., Jr. and W.A. White. 1990. *Decline of Submerged Vegetation in the Galveston Bay System: Chronology and Relationships to Physical Processes*. A Report to the Texas Parks and Wildlife Department. Austin, TX.
- Rabalais, N.N. 1992. *An Updated Summary of Status and Trends in Indicators of Nutrient Enrichment in the Gulf of Mexico*. Prepared for U.S. Environmental Protection Agency, Gulf of Mexico Program, Nutrient Enrichment Committee. Publication No. EPA/800-R-92-004. Louisiana Universities Marine Consortium. Chauvin, LA.
- Rabalais, N.N., R.E. Turner, W.J. Wiseman, Jr. and D.F. Boesch. 1991. "A Brief Summary of Hypoxia on the Northern Gulf of Mexico Continental Shelf: 1985-1988." Pages 35-47 in R.V. Tyson and T.H. Pearson (eds.), *Modern and Ancient Continental Shelf Anoxia*. Geological Society Special Publication No. 58. The Geological Society. London.
- Rezack, R., T.J. Bright, and D.W. McGrail. 1985. *Reefs and Banks of the Northwestern Gulf of Mexico*. 1st ed. John Wiley & Sons. New York, NY.
- Robblee, M.B., T.R. Barber, P.R. Carlson, Jr., M.J. Durako, J.W. Fourqurean, L.K. Muehstein, D. Porter, L.A. Yarbrough, R.T. Zieman, and J.C. Zieman. 1991. "Mass Mortality of the Tropical Seagrass *Thalassia testudinum* in Florida Bay (USA)." *Marine Ecology Progress Series*. Vol. 71: 297-299.
- Sather, J.H. and R.D. Smith. 1984. *An Overview of Major Wetland Functions and Values*. U.S. Fish and Wildlife Service. Washington, D.C. USFWS/OBS-84/18.
- Sea Grant College Program. 1989. "Galveston Bay." Texas A & M University. Galveston, TX. *GulfWatch*. 1(2):24.
- Sifneos, J.C., E.W. Cake, Jr., and M.E. Kentula. 1992. "Effect of Section 404 Permitting of Freshwater Wetlands in Louisiana, Alabama, and Mississippi." *Wetlands* 12(1): 28-36.
- Smith, W. E. 1989. *Mississippi Sound North Shoreline Changes in Alabama, 1955-1985*. Geological Survey of Alabama. Tuscaloosa, AL. Information Series 67.

- Stout, J.P. 1979. "Marshes in the Mobile Estuary: Status and Evaluation." *In: Symposium on the Natural Resources of the Mobile Bay Estuary, Alabama.* Mobile, AL. May 1979. H.A. Loyacano, Jr. and J.P. Smith (eds.). U.S. Army Corps of Engineers. Mobile District. Mobile, AL.
- Taylor, J.L., and C.H. Saloman. 1968. "Some Effects of Hydraulic Dredging and Coastal Development in Boca Ciega Bay, Florida." *U.S. Fish and Wildlife Service Fish. Bull.* 67(2):213-241.
- Texas Parks & Wildlife Department and Texas Colonial Waterbird Society. 1988. *Texas Colonial Waterbird Census Summary.* Texas Parks and Wildlife Department, Nongame and Endangered Species Program. Austin, TX.
- Thayer, G.W. and J.F. Ustach. 1981. "Gulf of Mexico Wetlands: Value, State of Knowledge and Research Needs." *In: Proceedings of a Symposium on Environmental Research Needs in the Gulf of Mexico.* Key Biscayne, FL. May, 1981. NOAA. Washington, D.C.
- Turner, R.E.. 1982. "Wetland Losses and Coastal Fisheries: An Enigmatic and Economically Significant Dependency." *In: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences and Options.* D.F. Boesch (ed.) U.S. Fish & Wildlife Service. Biological Services Program. Washington, D.C. USFWS/OBS-82/59.
- Turner, R.E. 1987. *Relationship Between Canal and Levee Density and Coastal Land Loss in Louisiana.* U.S. Fish and Wildlife Service. Washington, D.C. Biological Report 85(14):85.
- Turner, R.E. 1990. "Landscape Development and Coastal Wetland Losses in the Northern Gulf of Mexico." *Amer. Zool.* 33 pp.
- Turner, R.E. and D.F. Boesch. 1987. "Aquatic Animal Production and Wetland Relationships: Insights Gleaned Following Wetland Loss or Gain." Pages 25-39 *In: D. Hooks (ed.), Ecology and Management of Wetlands.* Croons Helms, Ltd. Beckenham, Kent, United Kingdom.
- Turner, R.E. and D.R. Cahoon. 1988. *Causes of Wetland Loss in the Coastal Central Gulf of Mexico, Volume II: Technical Narrative.* Minerals Management Service. New Orleans, LA.
- Turner, R.E., R. Costanza, and W. Sciafe. 1982. "Canals and Wetland Erosion Rates in Coastal Louisiana." *In: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options.* D.F. Boesch (ed.). U.S. Fish and Wildlife Service. Biological Services Program. Washington, D.C. USFWS/OBS-82/59.

- U.S. Department of Commerce. 1990a. *Current Fishery Statistics No. 8900: Fisheries of the United States, 1989*. National Oceanic and Atmospheric Administration. National Marine Fisheries Service. Fishery Statistics Division. Silver Spring, MD.
- U.S. Department of Commerce. 1990b. *A Special Earthweek Report: 50 Years of Population Change Along the Nation's Coasts 1960-2010*. National Oceanic and Atmospheric Administration, National Ocean Service. April 1990.
- U.S. Department of Commerce. 1991. *Coastal Wetlands of the United States: An Accounting of a Valuable National Resource*. Prepared by D.W. Field, A.J. Reyer, P.V. Genovese, and B.D. Shearer. National Oceanic & Atmospheric Administration, Strategic Assessment Branch. Rockville, MD.
- U.S. Department of Commerce. 1992. *Current Fishery Statistics No. 9100: Fisheries of the United States, 1991*. Fishery Statistics Division, National Marine Fisheries Service, NOAA, Silver Spring, MD.
- U.S. Department of the Interior. 1980. *Selected Vertebrate Endangered Species of the Sea Coast of the United States*. Fish and Wildlife Service. National Fish and Wildlife Service Laboratory. Washington, D.C. USFWS/OBS-80/01. Vol. 1 58 species accounts.
- U.S. Environmental Protection Agency. 1982. *Hydrographic, Water Quality, and Biological Studies of Freshwater Canal Systems in South Carolina, Mississippi, and Florida*. Environmental Services Division, Athens, GA.
- U.S. Environmental Protection Agency. 1988. *The Gulf Initiative: Protecting the Gulf of Mexico*. Gulf of Mexico Program Office. John C. Stennis Space Center, MS.
- U.S. Environmental Protection Agency. 1991. *Gulf Facts*. Gulf of Mexico Program Office. John C. Stennis Space Center, MS.
- Watzin, M.C., S. Tucker, and C. South. In preparation. *Mobile Bay Cumulative Impacts Study*. U.S. Fish and Wildlife Service. National Wetlands Research Center. Slidell, LA.
- Weyl, P.K. 1970. *Oceanography*. John Wiley & Sons. New York, NY.
- White, W.A., and T.R. Calnan. 1990. *Sedimentation and Historical Changes in Fluvial-Deltaic Wetlands along the Texas Gulf Coast with Emphasis on the Colorado and Trinity River Deltas*. Bureau of Economic Geology. The University of Texas. Austin, TX.

Bibliography

- Whitledge, T. and S.M. Rag (eds.). 1989. *Galveston Bay: Issues, Resources, Status, and Management*. NOAA Estuary-of-the-Month Seminar Series No. 13. Washington, D.C. 114.
- Wood, E.J.F., W.E. Odum, and J.C. Zieman. 1969. "Influences of Seagrasses on the Productivity of Coastal Lagoons." *In: Coastal Lagoons*. A.A. Castanares (ed.). Universidad Nacional Autonoma de Mexico. Ciudad Universitaria, Mexico, DF.
- Zieman, J.C. and R.T. Zieman. 1989. *The Ecology of the Seagrass Meadows of the West Coast of Florida: A Community Profile*. U.S. Fish and Wildlife Service. Washington, D.C. Biological Report. 85(7.25).

FEDERAL LEVEL

U.S. Environmental Protection Agency (USEPA)

- **Clean Water Act (CWA) as amended.** Waters of the U.S. protected by the Clean Water Act (CWA) include rivers, streams, estuaries, the territorial seas, and most ponds, lakes, and wetlands. In determining waters that are within the scope of the CWA, Congress intended to assert federal jurisdiction to the broadest extent permissible under the commerce clause of the Constitution. One factor that establishes a commerce connection is the use or potential use of waters for navigation. Other factors include (but are not limited to) use of a wetland (or other water) as habitat by migratory birds, including waterfowl, use by federally listed endangered species, or for recreation by interstate visitors.

Section 404. The U.S. Congress enacted the CWA to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." Section 404 regulates the discharge of dredged and fill material into waters of the U.S., and establishes a permit program to ensure that such discharges comply with environmental requirements.

Activities regulated by Section 404 include discharges of dredged and fill material commonly associated with activities such as port development, channel construction and maintenance, fills to create development sites, transportation improvements, and water resource projects (such as dams, jetties, and levees). Other kinds of activities, such as land clearing, are regulated as Section 404 discharges if they involve discharges of dredged or fill material (e.g., soil) into waters of the U.S. However, some activities which can adversely affect and even destroy wetlands, such as drainage and groundwater pumping, are often conducted without discharging dredged or fill material into waters of the U.S., and in those circumstances, are not regulated under Section 404.

USEPA has primary roles in several aspects of the Section 404 program including development of the environmental guidelines by which permit applications must be evaluated; review of proposed permits; prohibition of discharges with unacceptable adverse impacts; approval and oversight of state assumption of the program; establishment of jurisdictional scope of waters of the U.S.; and interpretation of Section 404 exemptions. As a jointly administered program, USACE and USEPA share responsibility for enforcing the Section 404 Program. In general, USACE enforces against non-compliance with permit conditions; USEPA generally focuses its resources towards discovering and enforcing against unpermitted (unauthorized) discharges. USEPA also has the authority to veto a USACE permit approval.

Under the authority of Section 404(c), USEPA may prohibit, withdraw, or restrict the discharge of dredged or fill material into waters of the U.S. if the discharge

would have unacceptable adverse effects on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreational areas. This authority may be used before, during, or after USACE action on a permit application. USEPA may also exercise this authority in the absence of a specified permit application or USACE regulatory action.

Anyone in violation of the Section 404 Program, either by conducting an unauthorized activity or by violating permit conditions, is subject to civil or criminal action or both. Section 309 gives USACE and USEPA the authority to impose penalties administratively, that is, without use of judicial procedures. USEPA has developed an Administrative Penalty Policy which outlines procedures for establishing fines. When judicial action is pursued, the violator may be required to restore the site and may be subject to payment of fines, imprisonment or both. Violators are frequently required to restore the site, often in addition to other penalties.

National Pollutant Discharge Elimination System (NPDES). The National Pollutant Discharge Elimination System (NPDES) controls the discharge of effluent from any point source into any surface waters, pursuant to effluent limitations published in federal regulations. It is relevant to wetlands and coastal waters where industrial discharge is a potential problem. Dischargers must apply for permits that delineate site-specific requirements concerning the frequency, quantity, and location of pollution discharges. Some permits also prescribe abatement schedules and requirements for monitoring and reporting the discharge. The NPDES Program also provides USEPA with the authority to regulate oil and gas industry discharges of produced waters (brine). All Gulf States, with the exception of Florida and Texas, have been delegated authority by USEPA to administer the NPDES program.

National Estuary Program (NEP). In 1987, Congress realized the special need to protect estuaries and established the National Estuary Program (NEP), under the CWA Amendments, to protect and improve water quality and enhance living resources. NEP jurisdiction applies not only to the mouth of a river or stream, but to "associated aquatic ecosystems and...tributaries draining into the estuary," up to the historic height of fish migration or tidal influence, whichever is higher.

USEPA, in managing NEP, is directed to identify nationally significant estuaries threatened by pollution, development, or overuse, and to promote the preparation of comprehensive management plans to ensure their ecological integrity. Specifically, NEP: 1) establishes working partnerships among federal, state, and local governments; 2) transfers scientific/management information and expertise to program participants; 3) increases public awareness of pollution problems; 4) promotes area-wide planning to control pollution and manage resources; and 5) oversees development and implementation of pollution reduction and control programs.

The five NEPs within the Gulf of Mexico region are Tampa Bay, Sarasota Bay, Galveston Bay, Corpus Christi Bay, and the Barataria-Terrebonne Estuarine Complex.

- **Safe Drinking Water Act of 1974, as amended (SDWA).** Under the Safe Drinking Water Act (SDWA), grants are available to states from USEPA to develop wellhead area protection plans for public groundwater drinking supply recharge areas. The grants can cover from 50 to 90 percent of the costs of establishing and running a protection program. If a wetland is hydrologically located such that any contaminants entering it are reasonably likely to reach a public water supply, the protection program may apply to activities in the wetland.
- **Wetlands Initiatives.** Executive Order 11990. Protection of Wetlands. Executive Order 11990, Protection of Wetlands, directs federal agencies to take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out their activities. The Executive Order sets forth several major requirements that federal agencies are required to comply with before undertaking any new construction in wetlands. They are as follows: 1) prior to undertaking an action in wetlands, determine whether a practical alternative to the action exists (if a practical alternative exists, the action should not be undertaken in wetlands); 2) if the action must be undertaken in wetlands, include practical measures to minimize harm to wetlands which may result from such use; 3) preserve and enhance the natural and beneficial values of the wetlands; and 4) involve the public early in the decision making process for any action involving new construction in wetlands.

The key requirement of the Executive Order is determining whether a practical alternative to locating an action in a wetland exists. The alternative could be: location outside of a wetland (alternative sites); other means that would accomplish the same purpose(s) as the proposed action (alternative actions); and no action. If there is no practical alternative to locating an action in wetlands, the Executive Order requires that the action include all practical measures to minimize harm to the wetlands, and preserve and enhance the natural and beneficial values of the wetlands.

National Wetlands Policy Forum. USEPA, in 1987, convened the National Wetlands Policy Forum to discuss major policy concerns about how the U.S. should protect and manage its wetlands. The Action Agenda developed by the Forum includes three general categories of recommendations: 1) protecting the resource, 2) improving the protection and management process, and 3) implementing the Forum's recommended program.

Wetlands Research Program (WRP). USEPA's Wetlands Research Program (WRP) was initiated in 1987, and is a matrix-managed program located at the

Environmental Research Laboratory at Corvallis, OR. A research strategy for FY92-96 has recently been finalized. Although the emphasis of this program has been largely on freshwater wetlands, some research has been performed on Gulf Coast systems, including the cumulative loss of bottomland hardwood wetlands (Gosselink *et al.*, 1990) and the effects of Section 404 permitting on freshwater wetlands in Louisiana, Alabama, and Mississippi (Sifneos *et al.*, 1992).

In FY92, the Environmental Research Laboratory at Gulf Breeze, FL, initiated a pilot project as part of WRP to begin research on coastal wetlands. A project has been funded to identify limits of incident light on growth, survival, and restoration of a common Gulf of Mexico seagrass species. Resources permitting, this research will be expanded to other species and will include an investigation of watershed management practices, which are vital to estuarine and nearshore wetland and seagrass communities.

- **National Environmental Policy Act of 1969 (NEPA).** The National Environmental Policy Act (NEPA) requires consideration of the adverse impacts on environmental resources caused by any federal action, including federally funded or permitted projects. It also requires examination of alternatives to minimize those impacts. Compliance with NEPA is an additional requirement to regulatory programs such as Section 404 of CWA when federal agencies or federal monies are involved in a proposed project. Environmental investigations carried out in accordance with NEPA are documented in an Environmental Assessment or an Environmental Impact Statement (EIS).
- **National Environmental Education Act of 1990 (NEEA).** The National Environmental Education Act (NEEA) is designed to increase public understanding of the natural environment and to advance and develop environmental education and training. NEEA builds upon the efforts that USEPA has undertaken and establishes formal communication and advisory links with educational institutions and other federal agencies. NEEA also requires partnership among federal government agencies, local education institutions, state agencies, not-for-profit educational and environmental organizations, and private sector interests.

NEEA provides for the following mandates and authorizations: establishes an Office of Environmental Education (OEE) within USEPA, establishes and operates an Environmental Education & Training Program, authorizes USEPA to enter into grants and contracts, requires USEPA to facilitate internships for college students with agencies of the federal government, requires USEPA to provide national awards recognizing outstanding contributions in environmental education, establishes an Environmental Education Advisory Council and Task Force, establishes a National Environmental Education Foundation, and authorizes funds to carry out the Act.

- **Marine Protection, Research & Sanctuaries Act of 1972 (MPRSA).** The Marine Protection, Research & Sanctuaries Act (MPRSA) primarily regulates the dumping of wastes into the oceans and provides funding for ocean research programs and ocean habitat sanctuaries. The Ocean Dumping Ban Act, prohibits the dumping of any industrial waste or sewage sludge into the ocean after 1992. A research program grants USEPA and NOAA money to study ocean pollution. The National Marine Sanctuaries Program sets aside threatened or fragile areas of ocean-based habitat as protected park-like environments for preservation and educational purposes. The sanctuaries are maintained by NOAA, which works closely with the nearest state and with USFWS.
- **Federal Insecticide, Fungicide & Rodenticide Act (FIFRA).** The Federal Insecticide, Fungicide & Rodenticide Act (FIFRA), as amended by the Federal Environmental Pesticide Control Act (FEPCA) of 1982, and the FIFRA Amendments of 1975, 1978, 1980, and 1988, governs the licensing or registration of pesticide products. FIFRA also governs storage and disposal of banned pesticides, indemnities, and enforcement. All pesticide products, with some exceptions, must be registered by USEPA before they can be sold within the U.S. FIFRA gives USEPA the authority and responsibility for registering pesticides for specified uses, provided that those uses do not pose an unreasonable risk to human health or the environment. It is a violation of the law for any person to use a pesticide in a manner inconsistent with its label. USEPA may also suspend or cancel a registration of a pesticide if information indicates that use of the pesticide would pose unreasonable risks. Pesticide registration decisions are primarily based on USEPA's evaluation of test data provided by pesticide applicants. USEPA can require up to 70 different kinds of specific tests. This testing is needed to determine whether a pesticide has the potential to cause adverse effects on humans, wildlife, fish, and plants, including endangered species. USEPA also evaluates data on environmental fate (*i.e.*, how chemicals react in the environment).

U.S. Department of Defense (USDOD)

U.S. Army Corps of Engineers (USACE)

The U.S. Army Corps of Engineers (USACE) has responsibility in its water resources projects for flood control, hydropower production, navigation, water supply storage, recreation, and fish and wildlife resources. Pursuant to the Federal Water Pollution Control Act Amendments of 1972 (Clean Water Act of 1977), as amended, USACE also has responsibility for conducting a regulatory program that considers all functions and values of wetlands and negative impacts and cumulative or regional effects of individual or multiple projects in wetlands. Through its project planning, construction, operations and maintenance (primarily of navigation and flood

control projects), regulation, and accompanying activities in wetlands, USACE is directly involved in wetlands protection and management.

In 1990, Lieutenant General H.J. Hatch of USACE issued two memoranda: "Strategic Direction for Environmental Engineering" which provides an overall philosophy that will guide current and future changes in the environmental aspects of the USACE civil and military programs, and "Statement of New Environmental Approaches" which provides a more specific framework in which USACE will pursue Civil Works water resources development programs. These memoranda reflect the changing philosophy of USACE, and this new philosophy will change the way USACE traditionally conducts business and work for other agencies.

"The anticipation and prevention of environmental damage will continue to require that the ecological dimensions of a project, a policy, or a federal action be considered at the same time as the economic, social, and engineering consideration; however, the weight we give to environmental consequences will increase. Proposed development or action will attempt first to avoid adverse impacts, then minimize or reduce them, and finally compensate for unavoidable effects over the life cycle of the project or action. Simply put, the environmental aspects of all we do must have *equal* standing among other aspects--not simply a "consideration," but part of the "go-no-go" test along with economics and engineering. Now is the time to use our engineering, scientific, and management capacity to advance our nation's environmental goals. We recognize that sustaining the environment is a necessary part of building and securing this nation."

USACE districts perform coastal habitat restoration projects under the authority of Section 1135 of the Water Resources Development Act of 1986 and in cooperation with other federal agencies under the Coastal America Program, National Estuary Program, and Cooperative Agreement with NMFS for Coastal Habitat Restoration.

Major environmental enhancement opportunities in the Gulf of Mexico exist for USACE as part of its program to maintain navigation channels. The Jacksonville, Mobile, New Orleans, and Galveston districts dredge an average of over 15.3 million m³ (20 million yd³) of clean material annually. This dredged material ranges from beach quality sand to silty material most suitable for rebuilding coastal marshes. Beneficial uses of dredged material is an integral part of the USACE civil works program. However, if costs for beneficial uses of dredged material exceed the least costly environmentally acceptable option, then additional costs must be shared with a non-federal partner. Examples of some beneficial uses of dredged material in the Gulf of Mexico are:

- ☐ Gaillard Island at Mobile
- ☐ Thin layer demonstration project at Gulfport and Mobile
- ☐ National Underwater Berm Demonstration Study at Mobile

- ☐ Louisiana coastal marsh restoration projects
- ☐ Gulf Intracoastal Waterway Projects
- **Waterways Experiment Station (WES).** The Waterways Experiment Station (WES) is the major research facility for USACE and is composed of the following labs: Hydraulics, Geophysical, Structures, Coastal Engineering, and Environmental. WES is responsible for most of USACE's environmental research. Primary customers include federal and state agencies and the military. WES also works jointly with conservation groups. Several of WES's activities relate to the Gulf Coast Initiative, including the Wetland Regulatory Assistance Program through which WES provides assistance to USACE districts in wetland delineation and evaluation. Dredging Research & Assistance Programs deal, in part, with beneficial uses of dredged material (to include wetland and terrestrial habitat development). The Aquatic Plant Research & Assistance Program is targeted at developing techniques for keeping aquatic vegetation at desirable levels.

WES administers the USACE Wetlands Research Program (WRP) which is targeted at refining techniques for wetlands delineation, wetlands evaluation, wetlands restoration and development, and wetlands management. The purpose of WRP is to use scientific and engineering disciplines of USACE in coordination and cooperation with other agencies and offices, to provide environmentally sound, cost-effective techniques to manage the nation's wetlands. To accomplish this, WRP encompasses a number of activities, as follows:

- ☐ Conducting an active interagency coordination and cooperation effort relative to the accomplishment of WRP broad purposes, including cooperative projects.
- ☐ Providing a mechanism for technology and information transfer from WRP to USACE offices, other agencies, and the general public, through a variety of traditional and innovative channels.
- ☐ Examining the basic processes that result in wetlands functions and relating these processes and functions to USACE activities.
- ☐ Refining existing technology for delineating and evaluating wetlands in order to provide methods sensitive to regional differences in wetlands soils, vegetation, and hydrology.
- ☐ Examining existing wetlands restoration, protection, and establishment sites and evaluating success of techniques used.
- ☐ Demonstrating and/or evaluating wetlands restoration, protection, and establishment techniques and further refining those techniques for other wetlands projects within USACE activities.

- ☐ Developing engineering and scientific guidelines and technologies for designing, constructing, and managing wetlands.
- ☐ Developing methods to address man-caused impacts on specific wetlands functions and critical wetlands types.
- ☐ Developing standards for data management systems (DMS) for use in wetlands accounting and developing standards for collecting and interrelating remotely sensed and "on-the-ground" data.
- ☐ Refining existing mapping techniques to better serve USACE wetlands needs and improving existing DMS technology to address large-scale projects.
- ☐ Demonstrating and/or evaluating reduction of nonpoint source pollution using wetlands in USACE projects.
- ☐ Demonstrating and/or evaluating wetlands habitat development and management on USACE reservoirs and USACE project lands in cooperation with federal and state agencies and their wetlands and conservation programs.
- ☐ Developing wetlands protection measures for preservation of existing wetlands.
- ☐ Developing guidelines and field manuals for regional delineation and evaluation, wetlands restoration and creation, and stewardship and management.

Examples of Gulf Coast work by WES include:

- ☐ Evaluating and monitoring of four wetland engineering projects in coastal Louisiana (Tiger Pass, Fina la Terre, several splay sites, and several siphon sites).
- ☐ Comparison of the performance of a wetland mitigation site on the Mississippi coast to an adjacent natural wetland.
- ☐ Two wetland protection/shoreline stabilization/beneficial uses of dredged material sites in the intercoastal waterway of Texas (West Bay and Aransas).
- ☐ Coordination with and technical assistance to the Galveston Bay interagency working group in identifying beneficial uses of dredged material from the expansion of the Houston Ship Channel.

- ❑ Providing technical assistance to the USACE Jacksonville District on wetland projects and waterbird nesting islands in Tampa/Hillsborough Bay.
- ❑ Continuing long-term monitoring on a number of wetland sites constructed in the 1970s using dredged material in Florida, Alabama, Mississippi, Louisiana, and Texas. Monitoring parameters include success or failure, endangered species use, wildlife abundance and diversity, changes in soils, and other physical and environmental characteristics and stability.

Two of the WRP Work Units are interfacing directly with the Gulf Coast Initiative. WES has a Work Unit that, through an interagency working group, will develop standards for monitoring and success criteria for wetlands. Through partnering with the Gulf Coast Initiative, WES will use the information from that Work Unit to develop regional wetlands monitoring and success criteria for the northern Gulf Coast region. In addition, through this partnering, WES will develop a brochure for wetland restoration, protection, and creation criteria for the northern Gulf Coast. This is a spin-off of a more general Work Unit on wetland restoration, protection, and creation.

WES uses its capabilities in the environmental, hydraulics, geotechnical sciences, and coastal engineering fields to conduct computerized ecosystem modeling for its customers. WES has a Cray Supercomputer that is used in the analysis of large data bases and complex models. That equipment may prove useful to the Gulf Coast Initiative.

- **Clean Water Act (CWA), as amended.** USACE has a primary responsibility for the Section 404 permit program and is authorized, after notice and opportunity for a public hearing, to issue permits for the discharge of dredged or fill material. USACE also has responsibility for monitoring and enforcement of compliance with Section 404 permit conditions. States can assume a portion of the permitting program from the federal government (for some waters only), but there has been limited interest by the states.

USEPA works with USACE during the permit decision process whenever possible to ensure unacceptable adverse impact are avoided, and most concerns are resolved through this interagency consultation. USACE and USEPA have developed a process through a Memorandum of Agreement (MOA) to quickly resolve any differences over permit decisions. USFWS and NMFS have similar agreements with USACE.

The individual permit process under Section 404 is sometimes intensive and controversial. Section 230.80 of the Section 404(b)(1) Guidelines provides for a planning process that can result in a more predictable decision making process. In this planning process, the Advance Identification (ADID) process, information is developed that can be used by the regulated and general public to plan and consider potential projects.

The products that result from the ADID process include, at a minimum, designation of areas as generally suitable or unsuitable for use as a discharge site. Additional actions quite often result, such as some anticipatory method of protecting the most valuable areas. For example, ADID's may result in state or local land use or regulatory restrictions, or use of USEPA's Section 404(c) authority to restrict or prohibit discharges to a defined area. USACE may issue general permits for certain activities in portions of the area designated as suitable for disposal.

USACE's evaluation of a Section 404 permit application is a two part test which involves determining whether the project complies with the Section 404(b)(1) Guidelines and a public interest review. A permit must be denied if the project fails to comply with the Guidelines or is found to be contrary to the public interest. USACE's public interest review is a balancing test in which the public and private benefits of a project are weighed against its adverse impacts to the environment. As part of this evaluation, USACE conducts an environmental assessment under NEPA to determine whether the project has significant environmental impacts. Section 404(b)(1) Guidelines, published by USEPA in conjunction with USACE, contain substantive environmental criteria used in evaluating discharges of dredged or fill material and establish key policies for the Section 404 Program.

Section 401. In addition to the evaluation conducted by USACE under the Guidelines and their public interest review, Section 401 of the CWA must be complied with before a permit can be issued. Section 401 requires that the state in which an activity occurs must certify that the activity complies with the state's water quality standards or waive its right to so certify by not taking action within a specified time. Similarly, coastal states must concur that the activity meets the requirements of the coastal zone management program (CZMP) of the state or waive their right to concur by not taking action within a specified time. CZMPs are developed by states under the Coastal Zone Management Act of 1972 (CZMA).

- **Coastal Wetlands Planning, Protection & Restoration Act (CWPPRA).** The Coastal Wetlands Planning, Protection & Restoration Act (CWPPRA) establishes a mechanism to plan and fund implementation of wetland protection and restoration projects in coastal Louisiana. Planning and implementation activities are managed by a six-person/federal-state task force. In addition, CWPPRA calls for development of a Conservation Plan for the State of Louisiana and provides funds for matching grants to assist other coastal states in implementing wetland conservation projects (*i.e.*, projects to acquire, restore, manage, and enhance real property interest in coastal lands and waters). Five years of recurring funding provides up to \$50 million/year, 70 percent for Louisiana with 75/25 percent federal/state cost sharing. Extension of authority and funding is possible, but is contingent on progress. Other pertinent

provisions of CWPPRA include the National Coastal Wetlands Grant Program (Section 305) and additional funding for the North American Wetlands Conservation Act [Section 306(c)].

- **Rivers & Harbors Act of 1899.** The Rivers & Harbors Act regulates all construction in or modification of traditionally navigable waters. In many respects, its provisions are similar to those of Section 404 of the CWA. For example, Section 10 of the Rivers & Harbors Act requires permits issued by USACE for any dredging, filling, or obstruction of navigable waters. Sections 9, 11, and 13 are also relevant to some activities in wetlands and near coastal waters. When a project requires applications for permits under both the CWA and the River & Harbors Act, USACE often conducts the two permit reviews concurrently.

Despite its similarity to Section 404, the River & Harbors Act differs from Section 404 in two important ways. First, the activities it covers are much broader than those regulated under Section 404. Second, its jurisdiction extends only to the mean high water line. As a result, this Act offers the federal government greater regulatory authority within certain areas, but does not apply to all areas regulated under Section 404.

U.S. Department of Agriculture (USDA)

Soil Conservation Service (SCS)

The Soil Conservation Service (SCS) is USDA's primary technical agency in the areas of soil and water conservation and in water quality. SCS focuses its assistance primarily on non-federal land, but assistance may also be given on public lands upon request from the administering agency. SCS works primarily with private landowners in planning and applying measures to reduce soil erosion, conserve water, protect and improve water quality, and protect other renewable natural resources, such as plants and wildlife. The guiding principle is the use and conservation treatment of the land and water in harmony with its capabilities and needs.

SCS has an office in almost every county in the U.S. where it works closely with local subdivisions of state government called Soil and Water Conservation Districts. The Conservation Districts are governed by local citizens and typically have legislative mandates to plan and implement comprehensive soil and water conservation programs within their boundaries. These boundaries often coincide with county lines.

SCS's basic authorities were created by PL (74)-46, PL (83)-566, and PL (78)-534. Program authorities were added under various Farm Bills including those enacted

in 1961 (Resource Conservation & Development Program, 1985 (Swampbuster, Sodbuster, Conservation Compliance & Conservation Reserve Program), and 1990 (Wetlands Reserve Program and others). Under the Swampbuster provisions, SCS assists landowners to identify and protect wetlands. Severe economic consequences, including loss of USDA program benefits, can result for agricultural producers who convert wetlands to make possible the production of agricultural commodities. SCS also provides technical assistance in implementing the wetland conservation programs under the Food Security Act of 1985.

SCS performs soil surveys and operates a system of some 27 Plant Material Centers for selecting, developing, testing, and releasing plants for use in conservation programs.

SCS works with private landowners and others to preserve, protect, and restore wetlands and to develop wildlife and fisheries habitat.

- **Food Security Act of 1985 (FSA).** The Food Security Act (FSA) was amended in 1990 to the Food, Agriculture, Conservation & Trade Act (Swampbuster). A major change in the Swampbuster provision of this Act is the illegality of converting a wetland to land capable of producing an agricultural commodity. Under the 1985 Act, an agricultural commodity would have had to actually been planted to constitute a violation of the provision; however, the 1990 amendments make it illegal to convert a wetland regardless of whether a commodity crop is planted. The Swampbuster provision of the FSA discourages the conversion of wetlands to farmland by making any person who violates the Act's provisions ineligible for most federal farm benefits. These benefits include price-support payments, farm storage facility loans, crop insurance, disaster payments, and insured and guaranteed loans.

A second provision of this Act is the Conservation Reserve Program (CRP). This program is designed to remove highly erodible croplands from production. Landowners wishing to enter any of their land in the CRP sign ten-year agreements with the Department of Agriculture. Participants receive annual payments, as well as 50 percent federal cost-sharing for the establishment of vegetative cover. While CRP was not initially designed for wetlands protection, wetlands have been added to the program; nationwide, approximately 203,000 hectares (500,000 acres) of wetlands had been enrolled by 1989.

In addition to the Conservation Reserve Program, the 1990 Act established the Wetland Reserve Program (WRP). A target enrollment of one million acres by the end of 1995 has been set by Congress. During the first year (1992), nine pilot states, including Louisiana and Mississippi, have been chosen to participate and will be limited to enrolling a national limit of 20,300 hectares (50,000 acres). Areas of farmed wetlands and the prior converted cropland are the principal wetland types expected to be placed into the program. Landowners will receive payments based on the length of easements they accept, either long-term (30

years) or perpetual. All lands accepted into WRP will have to be maintained according to a wetland restoration plan for the life of the easement. It is expected that WRP will have a significant and positive effect on the nation's wetland resources.

Another provision of this Act that may aid in the protection of wetlands is the Farm Debt Restructure and Conservation Set-Aside. This provision allows the Secretary of Agriculture to grant partial debt relief to Farmers Home Administration (FmHA) borrowers in exchange for 50 year conservation easements on selected acres.

A related provision pertains to the resale of land in the FmHA inventory. The inventory consists of lands whose owners defaulted on their loans to FmHA. Section 1314 of the Act allows the Secretary to grant or sell easements, deed restrictions, or development rights of inventory lands to local governments or non-profit organizations, prior to resale of the properties to other parties. Actual implementation of this provision has not yet occurred. However, since there are currently approximately 687,990 hectares (1.7 million acres) of property (a number expected to expand significantly in the FmHA inventory), this provision could have sizable impact.

Agricultural Stabilization & Conservation Service (ASCS)

The Agricultural Stabilization and Conservation Service (ASCS) administers the following programs: Agricultural Conservation Program, Conservation Reserve Program, Wetland Reserve Program, and others. In addition, ASCS administers various agricultural commodity production programs designed to balance production of specific agricultural commodities (including cotton, rice, corn, wheat, peanuts, tobacco, and others) with demand for those commodities. Commodity program decisions can dramatically affect land use. ASCS has an office in essentially every county in the U.S. SCS and ASCS work closely on implementation of conservation programs.

Farmers Home Administration (FmHA)

The Farmers Home Administration (FmHA) administers various financial assistance programs for rural residents and small communities. Their programs include loans for land acquisition, farm operations, construction of homes in rural areas and small towns, rural water and sewerage projects, and small watershed project sponsors.

U.S. Forest Service (USFS)

The U.S. Forest Service (USFS) administers large units of land called "National Forests" in most of the fifty states, as well as "National Grasslands" in some of the western states. USFS is directly responsible for management of natural resources in

the Endangered Species Act plays an important role in the recovery and conservation of these species and their imperiled coastal ecosystems.

- **Wetland Acquisition Programs.** USFWS administers a number of Wetland Acquisition Programs. The Migratory Bird Hunting and Conservation Stamp Act of 1934 requires all waterfowl hunters to buy "duck stamps," the proceeds of which are used by USFWS to acquire migratory waterfowl habitat. The Small Wetlands Acquisition Program, also administered by USFWS, offers a landowner the opportunity to sell a wetland and surrounding upland area outright, or to enter into a perpetual easement agreement that places a restriction on the wetland. Lease and purchase prices under this program reflect current market conditions. Additional monies for the purchase of wetlands are available through USFWS's Land & Water Conservation Fund.

Emergency Wetlands Resources Act of 1986. This Act expands and enhances the sources of funds for wetlands acquisition. The law also directs the Secretary of the Interior to develop, in consultation with USEPA and other federal and state agencies, a National Wetlands Priority Conservation Plan that identifies the type of wetlands and wetland interests to be given priority for federal and state acquisition.

- **National Wetlands Inventory.** This USFWS program provides wetland maps at various scales. Digital maps are also available. Maps depicting wetland losses along the U.S. Gulf of Mexico coastline will be available during 1994.
- **National Wetlands Research Center.** The National Wetlands Research Center is headquartered in Lafayette, LA, with field stations in Vicksburg, MS, and Corpus Christi and Padre Island, TX. Research focuses on migratory birds, spatial analysis, and wetlands ecology. Migratory bird research emphasizes wintering waterfowl and neotropical migrants, as well as shorebirds and colonial nesting birds. Research includes the inventory and monitoring of migratory bird populations, population modeling, habitat and ecosystem requirements, estimates of time-specific survival rates, and development of management data bases and models.

Spatial analysis studies include research (GIS, remote sensing, and spatial decision support systems for wetland management, oil pollution, and contaminant effects), inventorying and monitoring (land use trends, Coastal Barrier Resources Act Inventory update, Gap analysis, hazardous waste, and contaminant surveys), and technical assistance (remote sensing and GIS training and support and advance spatial analysis techniques). Wetland ecology studies include the potential effects of global climate change on sediment accretion rates in coastal wetlands and on structure and function of submerged aquatic vegetation; impacts of hurricane disturbance on coastal emergent wetlands and bottomland hardwood forests; efficacy of current marsh management practices; tolerance of wetland plant communities to environmental stressors; effects of

disturbance on successional trends in wetlands; and ecosystem modeling of hydrologic effects on wetland structure.

The Center is involved in the Coastal Wetlands Planning, Protection & Restoration Act, the Oil Pollution Act, and various other task forces.

- **Coastal Barriers Resources Act (CBRA) of 1982, as amended by the Coastal Barrier Improvement Act of 1990.** The Coastal Barriers Resources Act (CBRA) bans federal assistance for new development within units of the Coastal Barrier Resources System, including a ban on federal flood insurance. Certain exceptions are allowed after consultation with USFWS. These include maintenance of infrastructure in place prior to the unit being placed in the system, fish and wildlife and conservation activities, and research and national security activities. CBRA became effective in 1982, with a substantial expansion of the system in the 1990 amendments. It has proven effective in substantially reducing development of coastal barriers and impacts on associated wetland resources.

National Park Service (NPS)

- **Statewide Comprehensive Outdoor Recreation Plan (SCORP).** SCORP identifies state wildlife protection and recreation area needs and establishes priorities for proposed acquisition and development projects.
- **Land & Water Conservation Fund (LWCF).** LWCF was established in the early 1960s to allocate money to the states for acquisition and development projects. The majority of the Fund is distributed among four federal conservation and land use agencies--NPS, USFWS, USFS, and BLM--for specified projects. The remainder of the Fund is distributed directly to the states in the form of matching grants. Forty percent of the total available for state grants is divided evenly among the 50 states; the remaining 60 percent is allocated in proportion to state population. States qualify for LWCF by completing a SCORP at least once every five years. States with SCORP's approved by NPS may use their LWCF money to help fund their most urgent conservation projects.
- **Wild & Scenic Rivers Act of 1968.** The goal of the Wild & Scenic Rivers Act is to protect outstanding natural free-flowing rivers from damming and other forms of development. NPS is responsible for managing all designated river segments, except those managed by states, USFS, or BLM. The Act also encourages river protection by authorizing the Secretary of the Interior to provide technical assistance to state and local governments and to private interests in support of the law's objectives. Many state programs have benefited from this assistance.

U.S. Department of Commerce (USDOC)**National Oceanic & Atmospheric Administration (NOAA)**

The National Oceanic & Atmospheric Administration (NOAA) is a lead federal agency in the development and dissemination of scientific information and products for the nation's estuarine and coastal ocean waters. NOAA provides a wide range of observational, assessment, research, and predictive services for estuarine and coastal ocean regions. In the Gulf of Mexico, NOAA maintains coastal and marine research facilities, National Estuarine Research Reserves, and National Marine Sanctuaries, oversees approved Coastal Zone Management Plans in coastal states, and has direct ties to universities and colleges through the National Sea Grant College Program. NOAA has developed an impressive array of programs to address not only national-scale estuarine issues, but also specific problems affecting individual estuarine and coastal ocean systems.

- **Office of Chief Scientist.** The Office of Chief Scientist is responsible for establishing NOAA scientific policy and providing guidance to NOAA managers on scientific and technology issues. The Office serves as the focal point within the federal government to administer the National Climate Program; the National Ocean Pollution Planning Act of 1978, as amended; and the Acid Precipitation Research Program. The Office manages NOAA's technology transfer program and provides national overview and leadership for NOAA's estuarine programs. It is responsible for coordinating all NOAA activities involving NEPA, ecological and environmental conservation matters, and serves as the focal point for NEPA compliance and implementation.
- **National Ocean Service (NOS).** The National Ocean Service (NOS) supports a variety of estuarine activities related to the broad mission of NOAA. Many of these efforts are associated with the historical mission related to navigation in estuarine and coastal waters. NOS has a major program in tide and tidal current prediction and in nautical charting, including maintenance of U.S. coastal charts. NOS provides information for marine boundary determinations and generates records of long-term sea level change.

NOS also manages specific programs directed at estuarine assessment. Within the Ocean Assessments Division (OAD), the Strategic Assessment Branch (SAB) carries out assessments of multiple resource uses. Products include a National Estuarine Inventory & Atlas and the National Coastal Pollution Discharge Inventory (NCPDI). Located with OAD, the Hazardous Materials Response Branch provides scientific support for hazardous material spills, *e.g.*, oil spills, using numerical modeling and environmental sensitivity analyses.

NOS has a number of programs directed at coastal and estuarine management. Within the Office of Ocean & Coastal Resources Management (OCRM), the States Assistance Program promotes prudent use of the U.S. coastal zone; the Interstate

Grants Program provides monies to coordinate interstate coastal zone planning; and the National Estuarine Reserve Research Program manages estuarine reserves. In OCRM, the National Estuarine Reserve Research Program supports research reserves that serve as natural field laboratories for research and education.

- **National Weather Service (NWS).** The National Weather Service (NWS) has three programs directed toward coastal and estuarine waters. The Hurricane Guidance Program, the Tsunami Warning Program, and the Marine Weather Warning Forecast Program provide timely forecasts and warnings for coastal and estuarine waters. Other activities related to coastal and estuarine waters are the marine forecasts and advisories routinely issued by NWS forecast offices. In addition, the National Meteorological Center carries out operational storm surge modeling to announce warnings during the passage of hurricanes. These models have also been used to determine hurricane vulnerability in estuarine areas.
- **National Environmental Satellite, Data & Information Service (NESDIS).** The National Environmental Satellite, Data & Information Service (NESDIS) conducts several coastal and estuarine related activities. The Assessment & Information Services Center (AISC) conducts studies on satellite remote-sensing application and the use of numerical model data for circulation and bathymetry application and for simulation of sediment transport. The National Environmental Data Referral Service (NEDRES) is a computerized, online data base inventory that facilitates environmental data identification for ocean and coastal regions.

Although NESDIS conducts studies related to the remote sensing of estuaries by satellites and aircraft, the majority of NESDIS's estuarine work is done under its data and information program within the National Oceanographic Data Center (NODC) and AISC. NODC manages an archive of estuarine data, responds to queries, and produces several specialized data catalogues for specific coastal and oceanic regions. NOAA CoastWatch synthesizes NESDIS data and additional data and scientific analyses by the NMFS to map coastal habitats and monitor conditions in estuaries and coastal waters.

- **Office of Oceanic & Atmospheric Research (OAR).** The Office of Oceanic & Atmospheric Research (OAR) conducts research directed toward understanding and predicting coastal and estuarine processes. Estuarine programs are conducted in OAR through four of NOAA's Environmental Research Laboratories (ERLs) and the National Sea Grant College Program. The National Sea Grant College Program conducts estuarine studies at sites across the country, including the Mississippi/Atchafalaya River complex. Studies are funded by competitive grants awarded to academic investigators working with Sea Grant Programs in the state or region. Sea Grant environmental studies involve research related to nutrient dynamics and primary production, trophic dynamics

and primary production, habitat structure and function, pollutant fate and transport, and circulation modeling. Research in fisheries also composes a large segment of the estuarine work. In this area, interests include environmental control of reproduction and recruitment in estuarine stocks, improved management of estuarine fisheries, and relationships of habitat to fisheries production. Smaller efforts in Sea Grant estuarine research range from studies of coastal processes to economic and policy studies.

- **Coastal Ocean Program (COP).** The Coastal Ocean Program (COP) provides leadership and support to the overall national effort to provide a cleaner and safer environment, sustainable and wholesome fisheries, and coastal communities whose citizens are forewarned about storms, flooding, and erosion. COP is carried out in concert with other ongoing federal, state, and local programs and is designed to promote effective environmental decision-making by supplementing current retrospective analyses with timely forecasts and prediction. The ability to predict environmental change allows problem prevention through proactive regional approaches, rather than reacting to well-rooted problems. The goals of the COP include:

- ☐ *Prediction of Coastal Ocean Degradation and Pollution*--To predict changes in the quality of the coastal environment and its living marine resources to help prevent further habitat degradation and to recommend mitigative measures.
- ☐ *Conservation and Management of Living Marine Resources*--To predict the influence of fishing, habitat degradation (pollution and alteration), and natural forces on living marine resources to ensure optimal productivity today and for the future.
- ☐ *Protection of Lives and Property in Coastal Areas*--To predict the occurrence of natural physical hazards, for both short-term warnings and long-term planning, to prevent or minimize adverse effects of storms and erosion on coastal communities.

COP's National Status & Trends (NS&T) program provides monitoring, research, modeling, and assessment directed towards prevention of coastal ocean degradation and pollution. Gulf of Mexico activities include:

- ☐ Expanding the existing NS&T program to encompass new sites, - measurements, and organisms, including edible tissue; evaluation of historical pollution trends; and determinations of biological responses to pollutants in Tampa and Galveston Bays;
- ☐ Studying seagrass and tidal wetland estuarine habitat to examine their ability to function under natural conditions and to support important marine life;

- ☐ Mapping tidal wetlands to determine their rates of change or disappearance, and formation of a critical basis for implementing the President's "no net loss" wetlands policy;
 - ☐ Exploring the effect of nutrient enrichment associated with human activities on primary production and water quality of the nation's coastal oceans, including examination of the implications of enhanced production to the global marine carbon cycle in the Mississippi River plume and the adjacent Louisiana continental shelf areas, and;
 - ☐ Expanding information delivery through enhancement of NOAA's geographic information systems, (GeoCoast and COMPAS).
- **Habitat Strategic Plan.** NOAA has recently developed the Habitat Strategic Plan, the agency's long-range strategy for coordinated and concerted action to address the deterioration of the nation's coastal, estuarine, and riverine habitats and populations of living marine resources dependent upon such habitats. NOAA's legislative responsibilities and capabilities in habitat protection, wetlands ecology, resource conservation, toxicology, ocean system dynamics, fishery management, biological processes, and coastal habitat management provide a solid foundation for addressing these issues through an inter-disciplinary approach. NOAA has invested over \$100 million per year in programs and activities that focus on habitat-related problems and issues along the U.S. coasts and throughout the EEZ, including protectorates and trust territories in the Pacific Ocean and Caribbean Sea.

The Habitat Strategic Plan provides detailed, agency-wide guidance for addressing the priority issues affecting habitat important to living marine resources throughout the nation's coastal waters. This document complements "NOAA's Investment in Coastal Environmental Quality," which is being published separately, but focuses specifically on living marine resources' habitats. NOAA's role in this effort is: 1) to develop the scientific understanding of how human activities affect natural ecosystem functioning and 2) to assess and predict the effects of specific land and water development proposals on coastal environments and their living marine resources. NOAA's goal for habitat protection is to "protect, conserve, and restore the quantity and quality of habitats of living marine resources to maintain populations of commercial, recreational, and ecologically important species at optimal sustainable levels."

- **Coastal Zone Management Act of 1972 (CZMA).** The Coastal Zone Management Act (CZMA) was designed to help coastal states develop their own plans to manage and protect their coastal zone resources, including those affected by offshore energy development projects. The Act provides financial and technical assistance during the planning and administration of programs that meet minimum federal standards. Approval of state plans is the responsibility of the Secretary of Commerce, acting through NOAA.

The implementation of many of these plans requires active involvement of local communities. In accordance with the federal CZMA's "consistency" provisions, states with approved plans have the authority to veto federal permits for activities in wetlands or coastal waters that are inconsistent with the state's coastal zone management plan. These states receive various grants for construction and land acquisition projects and permitting efforts. Under the Estuarine Research Reserve System, CZMA also provides matching grants to states for the acquisition of estuarine areas for research and education.

Of particular interest to estuarine management is Section 309 of CZMA, which allows NOAA to make grants to states to coordinate interstate coastal management activities, as occurs frequently in large estuaries under the jurisdiction of two or more states.

Coastal Zone Act Reauthorization Amendments of 1990 (CZARA). Section 6217 of the Coastal Zone Act Reauthorization Amendments (CZARA) requires states to establish coastal nonpoint programs, which must be approved by both NOAA and USEPA. Once approved, the coastal nonpoint programs will be implemented through changes to the state nonpoint source pollution program approved by USEPA under Section 319 of the CWA and through changes to the state coastal zone management program approved by NOAA under Section 306 of the CZMA. Beginning in fiscal year 1996, states that fail to submit an approvable coastal nonpoint program to NOAA and USEPA face statutory reductions in federal funds awarded under both Section 306 of the CZMA and Section 319 of the CWA.

The central purpose of Section 6217 is to strengthen the links between federal and state coastal zone management and water quality programs in order to enhance state and local efforts to manage land use activities that degrade coastal waters and coastal habitats. This is to be accomplished primarily through the implementation of 1) management measures in conformity with guidance published by USEPA under Section 6217(g) of the CZARA and 2) additional state-developed management measures as necessary to achieve and maintain applicable water quality standards.

The Section 6217 program guidance identifies and explains provisions state coastal nonpoint programs must include in order to be approved by USEPA and NOAA. Four of the many requirements for state programs are: 1) identify critical coastal areas adjacent to coastal waters which are impaired or threatened by nonpoint source pollution; 2) implement additional management measures for land uses or critical coastal areas as necessary to achieve and maintain water quality standards; 3) establish mechanisms to improve coordination among state and local agencies responsible for land use programs and permitting, water quality permitting and enforcement, habitat protection, and public health and safety; and 4) modify coastal zone boundaries as the state determines is necessary

to implement NOAA's recommendations under Section 6217(e) of the CZARA. (This section requires NOAA and USEPA to determine whether the landward coastal zone of each coastal state extends far enough inland to control significant upland sources of nonpoint source pollution.)

National Marine Fisheries Service (NMFS)

The National Marine Fisheries Service (NMFS) has a strong interest in estuaries. Much of this interest stems from its responsibility under the Magnuson Fishery Conservation & Management Act (MFCMA), which provides for fishery conservation and management within the U.S.'s 200-mile Exclusive Economic Zone. MFCMA provides the statutory authority for the Gulf of Mexico Fishery Management Council which regulates the harvest of specified marine fishery resources through implementation of fishery management plans. Since most species under NOAA's management authority spend some portion of their life cycle in estuaries, NMFS is concerned about the ability of estuarine habitats to sustain these resources. Habitat conservation activities are carried out through NMFS regional and field offices and fisheries centers. The NMFS Habitat Conservation Program carries out related management and research activities including impact analyses and development of recommendations to reduce degradation or loss of estuarine habitats due to development and other factors. The recently created NMFS Restoration Center is also expected to play a significant role in habitat restoration efforts nationwide and in the Gulf of Mexico.

- **Magnuson Fishery Conservation & Management Act of 1976 (MFCMA).** The Magnuson Fishery Conservation & Management Act (MFCMA) extended the nation's marine management jurisdiction from 4.8-321.8 km (3-200 miles) offshore and mandated accelerated development of the fishing industry. It also created eight regional Fishery Management Councils (FMCs) for the purpose of preparing Fishery Management Plans (FMPs) for selected species and appointed NMFS Regional Directors as the primary federal representative on each Council. Other Council members include state fish and wildlife directors and private citizen appointees who are designated by state governors and the Secretary of Commerce. These appointees must be individuals who are knowledgeable and experienced in commercial and recreational fishery conservation and management. The Councils are advised through input from technical committees.

The 1986 Amendments require that habitat information be included in FMPs and that the effects of habitat change be addressed in plan development. A second provision of the Amendments authorizes the regional FMCs to recommend habitat protection measures for ongoing and proposed federal and state activities. This provision also requires that federal agencies must provide a detailed written response to Council recommendations within 45 days. By special agreement between NMFS and the Gulf of Mexico Fishery Management

Council, NMFS reports to regulatory agencies may also represent or convey the views and recommendations of the Council.

- **Federal Aid in Wildlife Restoration.** The Federal Aid in Wildlife Restoration (Pittman-Robertson Act) provides federal assistance to states for projects pertaining to the restoration, conservation, management, and enhancement of wild birds and mammals, or the provision of public use of and benefits from these resources. Through this Act, grants are provided to states for up to 75 percent of the cost of projects for the acquisition, restoration, and maintenance of wildlife areas, including wetlands. Funds are derived from the federal excise tax on hunting equipment.
- **Federal Aid in Sport Fish Restoration Act of 1950 (Dingell-Johnson Act).** The Federal Aid in Sport Fish Restoration Act (Dingell-Johnson/Wallop-Breaux Act) provides federal assistance to states for projects pertaining to the restoration, conservation, management, and enhancement of sport fish, or the provision for public use and benefits from these resources. The Act provides up to 75 percent for applicable projects. The Wallop-Breaux Amendment in 1984 expanded the tax base to include essentially all items of fishing tackle and motor boat fuel taxes and provided for expenditures on boat safety.

Federal Emergency Management Agency (FEMA)

- **National Flood Insurance Program (NFIP).** For property owners to be eligible for federally subsidized flood insurance, their communities must adopt floodplain management regulations that will minimize future flood damage. Adoption is typically accomplished by incorporating the regulations into the local zoning ordinances and building codes. NFIP's restrictions on floodplain development may, in effect, protect wetlands adjacent to the flood-prone waterway. Communities joining NFIP are rewarded with the incentive of substantial flood insurance coverage, whereas communities that do not participate are indirectly penalized by decreased funding for acquisition and construction purposes.

Interagency Coordination

Coastal America

Coastal America lays the groundwork for an unprecedented level of cooperation among the federal agencies with principal responsibility for the stewardship of coastal living resources: USACE, USEPA, USFWS, USGS, MMS, NOAA, NPS, and USDOT. The President's Council on Environmental Quality will coordinate this multi-agency effort to solve environmental problems along the nation's shoreline.

This initiative is the first step toward forging a strong, long-term alliance among the public and private sectors, to address coastal problems by sharing information, pooling field expertise, and combining management skill and resources. Coastal America proposes activities designed to produce demonstrable environmental results in the short-term, coupled with long-term environmental improvements. Coastal America will also work to ensure optimum use of existing resources devoted to coastal protection and management.

Through a series of relatively small efforts, Coastal America will provide models for successful action and demonstrate new approaches to resolving coastal living resources concerns. Projects will be designed to address specific coastal problems in seven geographic regions, including the Gulf of Mexico. Examples of regional activities that could be conducted include: establishing priorities for habitat protection, enhancement, and restoration, and developing region-wide education programs.

Within each region, site-specific problems will also be addressed on a watershed basis. Examples of watershed projects could include: restoring a wetland, protecting coastal streams from storm water runoff, cleaning contaminated sediment sites, and sponsoring public education efforts.

At the national level, Coastal America will enhance federal, state, and local abilities to manage and protect coastal resources. Examples of these activities include a nationwide approach for tracking coastal management actions to provide for accountability and a national focus on public education and outreach to facilitate public awareness, support, and involvement.

STATE LEVEL

Alabama

Regulatory Agencies & Programs

The Alabama Coastal Area Management Program (ACAMP) is administered through the Alabama Department of Economic & Community Affairs (ADECA) and the Alabama Department of Environmental Management (ADEM). ADECA is the federal coastal zone management grant recipient in the state with responsibilities for program planning, while ADEM is responsible for the regulatory functions of ACAMP. ADEM's coastal program regulations are found in Division 8 of its Administrative Code.

Through the Division 8 Regulations, ADEM regulates all activities in the coastal area involving wetlands and submerged grassbeds. The basic premise is that these resources cannot be filled or dredged unless the project has a compelling public interest or is water dependent. If a permit is issued for filling or dredging wetlands, the loss must be mitigated by creation of wetlands at a rate of 1.5:1 or 2.0:1 on an area basis. A mitigation plan with details of site preparation, planting, and monitoring is developed through negotiation with the applicant and consultation with other state and federal agencies.

In addition to wetlands, beach and dune habitats are protected under the Division 8 Regulations through control of construction and other activities on the Gulf beaches in Alabama's coastal area. This is accomplished via an established construction control line, which was developed to protect the primary dune system and the beaches seaward of the primary dune from activities which would adversely impact these systems and the vegetation associated with them.

Wetland filling is also regulated by ADEM through its 401 water quality certification of USACE Section 404 permits for wetland fill. Permits in the two coastal counties (Mobile and Baldwin) and Washington County are reviewed and certified by ADEM coastal program staff, while permits in all other counties in Alabama are reviewed and certified by the Mining & Nonpoint Source Section of ADEM's Water Division.

Alabama received a grant from USEPA--Region 4 in 1992, to develop a Wetlands Conservation & Management Initiative. The goal of this initiative is to improve the effectiveness and efficiency of governmental agencies and the private sector to protect and restore wetlands in Alabama. This will be accomplished through the identification and evaluation of existing wetlands protection programs and filling in any gaps that may exist. The initiative will include a study of Alabama's current wetland evaluation and classification resources, such as permit monitoring, mapping, and geographic information systems. Committees have been formed to

investigate mapping and delineation, functional assessment, and education and outreach.

Another state agency with involvement and a regulatory interest in Alabama's coastal habitats is the Alabama Department of Conservation & Natural Resources (ADCNR). The Marine Resources Division is responsible for management of the state's marine fishery resources, and the State Lands Division is responsible for all state lands, including all state owned water bottoms.

Statutes

Act 82-612	Environmental Management Act
Act 81-563	Prohibition of vehicles on beaches and dunes.
Act 73-971	Prohibition of picking of wild sea oats.

Florida

Regulatory Agencies & Programs

Florida's Coastal Management Program, with the Department of Community Affairs (DCA) in the lead role, integrates 26 state laws administered by 17 different agencies. The program was approved by the Florida Legislature in 1978, and Florida received delegation of the federal program under the CZMA.

The Coastal Resources Interagency Management Committee, consisting of the Secretaries or Executive Directors of the state agencies with major responsibilities in coastal management, coordinates review of major and complex issues that affect the coast--such as review of the siting of federal offshore disposal areas, ocean and shoreline management policy, and special area protection--and is a forum for resolving interagency disputes that affect coastal resources. In 1989, the Florida Legislature established the Interagency Management Committee by law.

- **Florida Department of Environmental Regulation (DER).** The Florida Department of Environmental Regulation (DER) has regulatory jurisdiction over waters of the state, to their landward extent, determined by the presence of certain types of wetland vegetation. DER is charged by state law to protect water quality. To help preserve these valuable areas, permits are required for many activities in inland and coastal waters and wetlands. Some of the activities that require permits include: dredging or filling wetlands; constructing piers, docks, seawalls, and other structures in open waters and wetlands; constructing artificial reefs; and restoring eroded beaches.

To encourage the preservation of wetlands, promote water conservation, and assure a consistent approach to water management practices, DER adopted a state water policy. The policy provides guidelines to officials when making water management decisions. The policy has a number of guidelines for wetland protection which instruct water management agencies to: encourage preservation of natural water management systems; discourage channelization of natural rivers and streams; encourage non-structural solutions to water management; and protect water storage and water quality functions of wetlands, floodplains and aquifer recharge areas through acquisition and other means.

- **Florida Game & Freshwater Fish Commission (GFC).** The major functions of the Florida Game & Freshwater Fish Commission (GFC) are the protection and management of wild animals and freshwater aquatic life through biological programs and a strong law enforcement program. Although the majority of this agency's responsibility and authorization is related to freshwater and inland areas, GFC provides comments to DER on wetland permitting issues and is involved in some coastal issues. GFC also conducts some freshwater wetlands research.
- **Florida Department of Natural Resources (DNR).** The Florida Department of Natural Resources (DNR) is charged with the administration, supervision, development, and conservation of Florida's natural resources, including management of state-owned lands. Six divisions of DNR have responsibility for coastal habitat issues: Division of Beaches & Shores, Division of Law Enforcement or Florida Marine Patrol, Division of Marine Resources, Division of Parks & Recreation, Division of Resource Management, and Division of State Lands.
- **Florida Department of Community Affairs (DCA).** Although the Department of Community Affairs (DCA) does not have direct regulatory authority, considerable influence on coastal development and planning is exerted by their overview function in several areas. DCA can appeal local government decisions in the following areas if the plans or development proposals do not meet state planning guidelines: local comprehensive plans; developments of regional impact; and areas of critical state concern.

Initiatives & Statutes

- **Apalachicola Bay Protection Act.** Under the Apalachicola Bay Protection Act, the 1985 Legislature required state and local planning for the area. This, combined with money for badly needed sewage treatment, helps protect the public health and marine resources of Apalachicola Bay.
- **Estuarine Management.** The following watershed management projects are producing environmental results with support through DER, using federal coastal management funds:

- ☐ An interstate team is studying the transport of nutrients into and through Perdido Bay.
- ☐ A Geographic Information System has been established by the Florida Department of Natural Resources for the Little Manatee River Watershed in Manatee County. This system will be used as a basis for revising land use ordinances for the estuarine areas of the Florida Gulf Coast and, in Manatee County, for planning recommendations and coordinating with the Tampa Bay Surface Water Improvement and Management Plan, and for addressing coastal issues along the Gulf.
- **Oil Spill Sensitivity Atlas.** DNR has initiated an update and GIS automation of the Oil Spill Sensitivity Atlas for oil spill contingency planning, response, and damage assessment.
- **Federal Consistency.** Reviews of federal actions and activities by Florida's coastal agencies resulted in the withdrawal or revision of some offshore oil and gas exploration in the Gulf of Mexico and suspension of the Navy's use of tributyltin antifouling points (and state legislation banning the use of some of these paints). Review of federal activities kept the federal government from selling an environmentally sensitive part of Grayton Dunes; instead, the property was offered to the state and is now a part of the state park.
- **Coastal Zone Management.** Representative coastal management projects producing environmental results with support through DER, DCA, and DNR using Federal Coastal Management and Sport Fish Restoration funds, and State of Florida Saltwater Fishing License and Coastal Protection Trust Funds include the following: mapping and study of declining seagrasses, city planning for beach access, and surveying for historical or cultural resources. Thirty to 40 percent of the money is used for local and regional projects, while the remainder is used by the state agencies in the coastal program.
- **Wetlands Protection Act.** The Wetlands Protection Act, passed in 1984, provides comprehensive wetlands protection. It improved the ability of DER to protect wetlands and the fish and wildlife that live in them. The legislation also strengthened and expanded the criteria by which DER evaluates wetland resource permit applications, gives DER statutory authority to consider the cumulative effect of many small projects in a water body, gives DER additional rule-making authority to adopt more stringent rules in specially protected areas, requires reclamation of areas disturbed by peat mining, and establishes a wetland tracking system. The law delegates the regulation of agricultural activities to the water management districts.
- **Surface Water Improvement & Management Act (SWIM).** The Surface Water Improvement & Management Act (SWIM) established a program to restore

waterbodies damaged by man's interference and protect those that are still in good condition. SWIM delegates this authority to Florida's five water management districts. The four goals of SWIM focus on water quality, natural systems, land use, and watershed management. SWIM's main task is to keep Florida's water bodies clean enough for wildlife and recreation, primarily by controlling and treating storm water runoff. SWIM works to restore and protect all natural systems. SWIM helps local governments make land use decisions by providing information on the long-term effects development can have on water bodies. Because water is a regional resource, SWIM considers the effects of land use and development over wide areas and makes decisions for the good of the water resource itself, instead of for individual communities, landowners, or other special interests.

With help from the public and local governments, each of Florida's five water management districts made a list of its surface waters which most needed attention. These lists include some of the most polluted waters and some of the most beautiful and unspoiled springs, rivers, bays, and lakes. Those water bodies in the Gulf of Mexico region include: Tampa Bay, Crystal River/Kings Bay, Charlotte Harbor, Lake Tarpon, and Lake Thonotosassa.

- **Aquatic Preserves.** To protect Florida's distinctive natural features for the enjoyment of future generations, the Florida Legislature created aquatic preserves. Aquatic preserves are submerged lands of exceptional beauty which are to be maintained in their natural or existing conditions. The first aquatic preserve was established in Estero Bay in 1966, the result of an increased environmental awareness among Florida citizens in the early 1960s. By 1975, the Florida Aquatic Preserve Act was passed, and the existing preserves were brought under a standard set of management criteria. All but three of the 40 preserves are located on the coast in the shallow waters of estuaries and the continental shelf; of the three freshwater preserves, two are located on rivers and one is a lake. The management objectives for the preserves are to maintain and improve existing resources, such as seagrasses, mangroves, aquatic plants, birds, and fish.
- **Preservation 2000.** The Florida Preservation 2000 Act legislative findings state "imminent development of Florida's remaining natural acres and continuing increases in land values necessitate an aggressive program of public land acquisition during the next decade to preserve the quality of life that attracts so many people to Florida." The only permanent solution to the protection of critical natural areas is land acquisition; thus, in 1990, Florida created Preservation 2000, a long-term program to provide this solution. In conjunction with the efforts of 14 county conservation programs, the ten-year Preservation 2000 program provides for \$300 million in annual funds for land acquisition through the year 2000. By all measures, Preservation 2000 is the most ambitious land protection program ever created and will provide funding for most of Florida's natural land acquisition needs.

Louisiana

Regulatory Agencies & Programs

The State & Local Coastal Resources Management Act (SLCRMA) La. R.S. 49:21, was passed by the Louisiana Legislature in 1978 and received federal approval in October 1980. Presently the program is being administered by the Coastal Management Division (CMD) within the Department of Natural Resources (DNR) Office of Coastal Restoration & Management.

CMD is charged with implementing the Louisiana Coastal Resources Program (LCRP). LCRP attempts to protect, develop, and restore or enhance the resources of the state's coastal zone. Its broad intent is to encourage multiple uses of resources and adequate economic growth, while minimizing adverse effects of one resource upon another without imposing undue restrictions on any user.

CMD's regulatory responsibilities include administering the Coastal Use Permit (CUP) Program, the Consistency Program, and the Enforcement Program.

CUP is the basic regulatory tool of CMD and is required for certain projects in the coastal zone, including, but not limited to dredge and fill work, bulkhead construction, shoreline maintenance, and other development projects. CMD has processed about 15,500 CUP applications since the inception of the program.

The Consistency Program determines whether the activities of all federal and some state governmental agencies are consistent with LCRP. Particular attention is given to environmental, economic, and cultural concerns. Most federal agencies conduct their own consistency determination and, if projects are found to be inconsistent with state regulations, they are not pursued. Examples of projects requiring a consistency determination are hurricane protection levees; USACE maintenance, dredging, locks, and drainage structures; navigation projects; freshwater diversions; and beach restoration projects.

The Enforcement & Monitoring Program ensures that any unauthorized projects in the coastal zone are investigated and action is taken. The Program also monitors activities permitted by CUP for compliance with permit conditions. The Program also gives the secretary of DNR the authority to enforce either legal or administrative procedures including fines, cease and desist orders, and restorative or mitigation work. The field investigative staff regularly monitors the entire coastal area for unauthorized activities and for non-compliance with permit conditions.

Statutes

- **State Act 6 (1989).** The 1989 Louisiana Legislature passed Act 6 which requires the State of Louisiana to annually develop a Coastal Wetlands Conservation & Restoration Plan from both a short and long-range perspective. The initiative for passing Act 6 was provided when it passed a voter referendum by approximately 75 percent. The Coastal Restoration Division of DNR has the responsibility for implementing this plan which is designed to restore, preserve, and enhance Louisiana's coastal wetlands.

The plan is the result of over 25 years of research and involves many innovative techniques designed to work with nature. The plan is an evolving one and includes a large number of individual projects which are designed to meet specific needs. Current restoration techniques include freshwater diversion, sediment diversion, marsh management, sediment capturing, shallow bay terracing, and structural shoreline erosion abatement devices.

On the local level, parish programs have been approved in Jefferson, Orleans, St. Bernard, Cameron, St. James, Lafourche, and Calcasieu. Elements included in local coastal programs include:

- ☐ Assessment of an area's environment, natural resources, and socioeconomic and demographic profiles;
 - ☐ Plan for the proper management of these resources and their interaction with other state and federal programs;
 - ☐ Zoning plan for the area;
 - ☐ Description of the proposed permit program; and
 - ☐ Breakdown of the parish's environmental management units (EMU's), including a description and analysis of each.
- **State Act 1040 (1990).** This Act requires compensatory mitigation for future permitted activities in the coastal zone and calls for establishment of a mitigation banking system by the DNR Secretary (proposed rules presently under development).
 - **State Act 633 (1991).** This Act requires development and implementation of a coastal environmental protection trust fund and provides for a coastal environment protection plan (not limited to wetlands) that would receive 50 percent of revenues from OCS impact assistance monies derived from offshore Louisiana, if such funding is authorized by the federal government.
 - **State Act 637 (1991).** This Act mandates development of a long-term management strategies plan for each existing or proposed navigation channel in Louisiana. Dredged spoil is to be used for beneficial purposes and channel banks are to be maintained to minimize secondary wetland losses. Funding is under negotiation.

Programs & Initiatives

Many habitat conservation programs are currently being implemented in Louisiana that have both direct and indirect wetland restoration applications. Listed below are many of the wetland conservation programs administered by agencies within both state and federal government. Annual funding for many of these programs is often determined by the Legislature and/or Congress on a year-to-year basis.

- **Barataria-Terrebonne National Estuary Program.** In 1989, the Barataria-Terrebonne Estuarine Complex was nominated for the National Estuary Program. In 1990, the Barataria-Terrebonne National Estuary Program was approved by USEPA including the following provisions: 1) a five year 75/25 percent federal/state matching program; 2) broad planning requirements via a management conference; and 3) development of a Comprehensive Conservation & Management Plan (CCMP) for the basins.
- **Coastal Restoration Policy Committee.** A cabinet level Coastal Restoration Policy Committee was established by the Governor in 1988. This committee was charged with developing a plan to identify measures to preserve, enhance, create, or restore vegetated wetlands in the coastal zone. A report, with short and long-term recommendations, was completed and adopted in August, 1988.
- **Coastal Plan.** A FY90/91 coastal plan and a FY 91/92 annual state coastal wetland conservation and restoration plan were approved by the Louisiana Legislature and implementation has commenced.
- **Wetlands Creation Program.** The USACE New Orleans District Operations Division instituted a program to create wetlands from dredge spoil from routine ongoing channel maintenance.
- **Restoration of Coastal Wetlands.** Under Section 1135 (Water Resources Development Act of 1986) the USACE New Orleans District has instituted specific projects restoring coastal wetlands. Examples include Wine Island Shoals and Queen Bess Island projects (75/25 percent federal-state cost sharing required).
- **Nonpoint Source Pollution Program.** The Governor's Office is coordinating the Louisiana coastal nonpoint source pollution program (to be jointly managed by LADEQ and DNR), including the potential for wetland enhancement. State management measures are to be developed within 30 months after final guidance was issued by USEPA in May, 1992. The program is to be jointly administered by USEPA and NOAA and will dovetail with existing state nonpoint programs previously required under Section 319 of the CWA. The existing state Nonpoint Source Program, administered by LADEQ, involves interagency coordination via the Nonpoint Source Interagency Committee. The program addresses all sources of nonpoint pollution through voluntary

implementation of BMPs, monitoring BMPs for effectiveness, and educational activities.

Mississippi

Regulatory Agencies & Programs

- **Mississippi Coastal Program.** The Mississippi Coastal Program was approved by the Commission on Wildlife Conservation on August 22, 1980, and has been updated throughout its implementation. This program is built around goals for guiding decisions affecting the development of Mississippi's coastal resources. These goals include, but are not limited to the following:
 - ☐ Providing for reasonable industrial expansion in the coastal area and insuring the efficient utilization of waterfront industrial sites so that suitable sites are conserved for water dependent industry.
 - ☐ Favoring the preservation of the coastal wetlands and ecosystems, except where a specific alteration of a specific coastal wetlands would serve a higher public interest in compliance with the public purposes of the public trust in which the coastal wetlands are held.
 - ☐ Encouraging the preservation of natural scenic qualities in the coastal area.
 - ☐ Considering the national interest involved in planning for and in the siting of facilities in the coastal area.

The Mississippi Coastal Program makes funds available for the preservation or restoration of wetlands and access areas. Local governments play a lead role in any such project.

The agencies responsible for this program are the Bureau of Marine Resources (BMR), the Office of Pollution Control (OPC), the Bureau of Land & Water Resources, and the Department of Archives & History. These four agencies are responsible for monitoring state and federal decisions that affect the coastal area and for insuring that such decisions are made in accordance with program councils.

- **Bureau of Marine Resources (BMR).** The Mississippi Bureau of Marine Resources (BMR) is the lead agency responsible for the overall administration of the coastal program. BMR regulates projects and activities under the Wetlands Protection Law and saltwater fisheries statutes. There are three types of activities regulated under BMR's jurisdiction. These are activities physically located in coastal wetlands (ie., piers, bulkheads), those not located in the coastal wetlands

but affecting them by indirect means (ie., construction), and the erection of structures on sites suitable for water dependent industry.

Development is directly regulated to minimize adverse impacts. This is done by addressing special management areas (SMA). SMAs detail all regulations affecting an area and specifically state what will and will not happen in an area. This helps to ensure that development will occur in a predictable manner.

Coastal Preserves Program. The Coastal Preserves Program represents an effort by BMR, in conjunction with various federal, state, and non-profit organizations, to develop a comprehensive program for managing sensitive coastal habitats in Mississippi. The Mississippi Coastal Preserves Program is an extension of the Coastal Preserves Program concept developed in Texas and supported by the Gulf of Mexico Program.

BMR's Department of Wildlife, Fisheries & Parks announced the dedication of various tracks of sensitive coastal habitats as part of the "Coastal Preserves Program" on April 17, 1992. The Graveline Bayou Coastal Preserve and the Grand Bay Coastal Preserve were recognized as sensitive coastal habitats along the Mississippi Gulf Coast and will now be provided with a level of management and protection to insure the long-term ecological health of these areas.

Graveline Bayou is a small estuary along the Northern shore of the Mississippi Sound that serves as a nursery for commercial and recreationally important fisheries. Approximately 243 hectares (600 acres) of wetlands will be transferred from The Nature Conservancy (TNC) to BMR in one of the first actions of the Coastal Preserves Program. Grand Bay Coastal Preserve is a wetlands area on the eastern border of Mississippi that includes one of the largest undisturbed pine savannahs in the southeastern U.S. USFWS is in the process of developing the Grand Bay National Wildlife Refuge in this area, and BMR, in conjunction with USFWS and TNC, will develop a comprehensive management strategy involving over 4,047 hectares (10,000 acres) of wetlands habitat adjacent to the refuge.

USFWS and TNC are also taking an active role in the Mississippi Coastal Preserves Program. BMR has been awarded a \$100,000 grant under the National Wetlands Conservation Grant Program; TNC will assist the state in providing matching funds for the grant. Finally, BMR is using grant funds from the federal CZMP to fund an assessment process which is being conducted by the Department of Wildlife, Fisheries & Parks--Natural Heritage Program.

Statutes

- CWA/401b Water Quality Certification
- Mississippi Coastal Wetlands Protection Law of 1973

Projects/Special Initiatives

Projects and special initiatives in Mississippi include the Coastal Mississippi Wetlands Initiative, Audubon Society Citizens Guide for Saving Wetlands, and Section 309 Assessment.

Texas

Regulatory Agencies & Programs

The Texas Legislature has distributed authority for coastal resource management among a number of state agencies. This system has evolved historically with no formal coordination mechanism to ensure a consistent management approach.

- **Texas General Land Office (GLO).** The Texas General Land Office (GLO), in conjunction with the School Land Board, manages the state's coastal public lands. GLO is developing a coastal management plan for Texas beaches and state-owned submerged lands from mean high tide in the bays and estuaries to 16.65 km (10.35 miles) offshore in the Gulf of Mexico. On June 7, 1991, the Texas State Legislature passed bills directing the GLO and Texas Parks & Wildlife Department (TPWD) to develop a Wetlands Conservation Plan for state-owned coastal lands and a Coastal Management Plan to address coastal erosion, beach access, dune protection, and planning and coordination of these activities. The Governor of Texas has given notice to USDOC that Texas will submit a coastal management plan for approval under the federal CZMA.

The Commissioner of GLO may issue permits for geological, geophysical, and other investigations within the tidewater limits of the state. The Commissioner may also grant easements or leases for rights-of-way across state lands for pipelines and other transmission lines. In addition, the Commissioner is responsible for technical assistance and compliance under the Dune Protection Act and implementation of the Texas Coastal Preserve Program with TPWD.

- **Texas Parks & Wildlife Department (TPWD).** The Texas Parks & Wildlife Department (TPWD) through its Resource Protection Division evaluates state and federal projects, permits, and other actions affecting fish and wildlife resources, including endangered species. TPWD also operates the state parks system and wildlife management areas. A permit must be obtained from TPWD for the disturbance or dredging of sand, shell, or marl in public waters not authorized by other state or federal agencies. Public waters are defined as all the salt and fresh waters underlying the beds of navigable streams under the jurisdiction of the Parks & Wildlife Commission.

- **Texas Natural Resource Conservation Commission (TNRCC).** The Texas Natural Resource Conservation Commission (TNRCC) (formerly the Texas Water Commission) has the responsibility to protect surface and groundwater quality. TNRCC also issues Section 401 certifications. In addition to this responsibility, TNRCC oversees surface water rights administration, dam safety management, the National Flood Insurance Program and flood control improvement project administration, injection well program administration, waste minimization initiatives, and water district supervision.
- **Soil & Water Conservation Board.** The Texas State Soil & Water Conservation Board has the responsibility to plan, implement, and manage programs and practices for abating agricultural and silvicultural nonpoint pollution. The State Board also administers a voluntary conservation program with and through 211 local soil and water conservation districts which encompass over 99 percent of the surface acres of Texas. With a voluntary program, conservation practices are being applied by over 215,000 cooperating landowners on more than 48.6 million hectares (120 million acres).
- **School Land Board.** The School Land Board, in conjunction with GLO, manages the state's coastal public lands. The Board may grant leases to certain governmental bodies for public purposes; leases for mineral exploration and development; easements to littoral landowners; channel easements to surface or mineral interest holders; leases to educational, scientific, or conservation interests; and permits for limited use of previously unauthorized structures.
- **Texas Railroad Commission.** The Texas Railroad Commission has extensive authority in the oil and gas industry and in pollution prevention and abatement. The Commission also regulates intrastate natural gas pipelines and issues drill permits for oil and gas wells. The Commission issues wastewater permits for produced water discharge. In addition, the Commission regulates surface mining for lignite, uranium, and iron ore to make sure that the resources are properly developed and the environment protected.
- **Texas Department of Transportation.** The Department is responsible for road construction and planning. The Department administers federal funds for mass transit and may plan, purchase, construct, lease, and contract for public transportation systems in the state. The Department constructs and maintains bridges and ferries, serves as the state sponsor of the Gulf Intracoastal Waterway, and can acquire easements and rights-of-way from GLO for channel expansion, relocation, or alteration.
- **Texas Antiquities Committee.** The Texas Antiquities Committee, created by the Texas Antiquities Code, is responsible for preserving and protecting the state's historical and archaeological resources. The Committee requires permits for activities involving salvage or study of state archaeological landmarks, including historical sites and artifacts of interest such as sunken ships, buried treasure, and

art works. The Committee issues eight types of permits covering virtually every aspect of historical and archaeological investigation, including reconnaissance, testing, excavation, and destruction.

- **Texas Attorney General's Office.** The Texas Attorney General's Office is not a regulatory agency, but it has a role in resource management as the state's enforcement agency for the Open Beaches Act and other coastal legislation. The office protects the public's beach access rights and can bring suit on behalf of other state agencies to enforce state laws.
- **Bureau of Economic Geology.** The Bureau of Economic Geology at The University of Texas is responsible for much of the mapping of coastal resources, energy, minerals, land, geology, and biology. It also monitors erosion along the Texas Gulf Coast.
- **Governor's Office of Budget & Planning.** The Governor's Office of Budget and Planning prepares recommendations for the budget and is responsible for administration of state review and comment procedures for all federal or federally funded projects.

Statutes

- **Open Beaches Act.** The Open Beaches Act (Sections 61.001-61.025 of the Texas Natural Resources Code), passed by the Texas Legislature in 1959, guaranteed the public's right of free and unrestricted access to the "public beach," which extends from the line of mean low tide to the line of permanent vegetation of the shoreline bordering the Gulf of Mexico. The Act makes it unlawful to prevent or impede access to or use of the public beach by erecting barriers or by posting signs declaring a beach closed to the public.

Programs & Initiatives

- **Freshwater Inflow.** Studies by the Texas Water Development Board (TWDB) between 1967 and 1979 recommended specific inflow amounts for each of the seven major estuaries. In 1985, further legislation authorized TWDB, TPWD, and TNRCC to document the historical patterns of abundance and species composition of estuarine animals, their habitats, and inflow conditions supporting ecosystem productivity. Annual and seasonal inflow requirements, to be derived by 1996 for each estuary, will be based on multi-objective optimization modeling in conjunction with bay circulation and mass transport modeling.

ACAMP	Alabama Coastal Area Management Program
ADCNR	Alabama Department of Conservation & Natural Resources
ADECA	Alabama Department of Economic & Community Affairs
ADEM	Alabama Department of Environmental Management
ADID	Advance Identification
AISC	Assessment & Information Services Center
AL	Alabama
ASCS	Agricultural Stabilization & Conservation Service
ATSDR	Agency for Toxic Substances & Disease Registry
BLM	Bureau of Land Management
BMP	Best Management Practice
BMR	Bureau of Marine Resources--Mississippi
CAC	Citizens Advisory Committee--Gulf of Mexico Program
CBRA	Coastal Barriers Resources Act
CCMP	Comprehensive Conservation & Management Plan
CMD	Coastal Management Division--Louisiana
COP	Coastal Ocean Program
CRP	Conservation Reserve Program
CUP	Coastal Use Permit Program
CWA	Clean Water Act
CWPPRA	Coastal Wetlands Planning, Protection & Restoration Act
CZARA	Coastal Zone Act Reauthorization Amendments
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Plan (or Program)
DCA	Department of Community Affairs--Florida
DER	Department of Environmental Regulation--Florida
DMS	Data Management Systems
DNR	Department of Natural Resources--Florida/Louisiana
EEZ	Exclusive Economic Zone
EIS	Environmental Impact Statement
EPIC	Environmental Protection Information Center
ERL	Environmental Research Laboratory
FACTA	Food, Agriculture, Conservation & Trade Act
FEMA	Federal Emergency Management Agency
FEPCA	Federal Environmental Pesticide Control Act
FIFRA	Federal Insecticide, Fungicide & Rodenticide Act
FL	Florida
FMC	Fishery Management Council
FmHA	Farmers Home Administration
FMP	Fishery Management Plan
FSA	Food Security Act
GFC	Game & Freshwater Fish Commission--Florida
GLO	General Land Office--Texas
GIS	Geographic Information System
GMP	Gulf of Mexico Program
LA	Louisiana

LADEQ	Louisiana Department of Environmental Quality
LCRP	Louisiana Coastal Resources Program
LGS	Louisiana Geological Survey
LWCF	Land & Water Conservation Fund
MC	Management Committee--Gulf of Mexico Program
MFCMA	Magnuson Fishery Conservation & Management Act
MPRSA	Marine Protection, Research & Sanctuaries Act
MMS	Minerals Management Service
MOA	Memorandum of Agreement
MS	Mississippi
NASA	National Aeronautics & Space Administration
NCPDI	National Coastal Pollution Discharge Inventory
NEEA	National Environmental Education Act
NEDRES	National Environmental Data Referral Service
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NESDIS	National Environmental Satellite, Data & Information Service
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic & Atmospheric Administration
NODC	National Oceanographic Data Center
NOS	National Ocean Service
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NS&T	National Status & Trends
NWS	National Weather Service
OAD	Ocean Assessment Division
OAR	Office of Oceanic & Atmospheric Research
OCRM	Office of Ocean & Coastal Resources Management
OCS	Outer Continental Shelf
OEE	Office of Environmental Education
OPC	Office of Pollution Control--Mississippi
PRB	Policy Review Board--Gulf of Mexico Program
SAB	Strategic Assessment Branch
SAV	Submerged Aquatic Vegetation
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SCS	Soil Conservation Service
SDWA	Safe Drinking Water Act
SLCRMA	Louisiana State & Local Coastal Resources Management Act
SMA	Special Management Area
SWIM	Surface Water Improvement & Management Act
TAC	Technical Advisory Committee--Gulf of Mexico Program
TNC	The Nature Conservancy
TNRCC	Texas Natural Resource Conservation Commission
TPWD	Texas Parks & Wildlife Department
TWDB	Texas Water Development Board

TX	Texas
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USDOC	U.S. Department of Commerce
USDOD	U.S. Department of Defense
USDOE	U.S. Department of Energy
USDOI	U.S. Department of the Interior
USDOT	U.S. Department of Transportation
USEPA	U. S. Environmental Protection Agency
USFDA	U.S. Food & Drug Administration
USFS	U.S. Forest Service
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
WES	Waterways Experiment Station
WRP	Wildlife Reserve Program
WRP	Wetlands Research Program

abyssal plain	Plain created by sediment fill in the deepest portion of the ocean basin and defined by a gradient of <1:1000.
baleen whale	Whale with elastic horn-like material forming plates in the upper jaw which are used for filtering krill, plankton, and other small organisms from large quantities of sea water.
barrier island	A long, narrow, sandy coastal island that is above high tide and parallel to the shore; commonly has dunes, vegetated zones, and swampy terrain.
benthic zone	All of the water covered ocean bottom from low tide level to deepest trench.
berm	Low, horizontal or landward sloping terrace on the backshore of a beach that is formed from material thrown up and deposited by storm waves. Also, an elongated, filled area.
biodiversity	The variety of species of organisms inhabiting a specific environment.
bloom	The explosive growth of one or more plankton species probably in response to an influx of nutrients and warm, calm conditions. High phytoplankton biomass can reduce light penetration and cause oxygen depletion.
brackish marsh	Marine/estuarine marsh subjected to freshwater inflow; salinity can range between 0.5 o/oo and 30 o/oo.
brown tide	Toxic condition created by an intense bloom of the microalgae <i>chrysophyte</i> ; usually occurs in calm waters with a low turnover rate and high nutrient input, such as Laguna Madre, TX.
chemosynthetic	Synthesis of organic substances such as food nutrients using the energy of chemical reactions; usually restricted to environments without oxygen.
clearcut	Process of removing all trees and undergrowth from a parcel of land.
coliform	A group of bacteria whose presence is used as an indicator of contamination by human or animal wastes.
compensatory mitigation	The requirement to perform a service to offset unavoidable damages.
continental shelf	The water covered part of the continent from mean low tide level to the shelf break at about 200 m (656 ft) depth; characterized by surface slope average of >1:1000.
continental slope	Transitional area between shelf edge and the abyss which is marked by a gradient change from >1:1000 to >1:100.
dead zone	A water covered area in which the water's dissolved oxygen content is less than 2 mg/l.

diapir	Dome formed in overlying rocks by the squeezing of plastic core material, such as slate, which is pushed upward by the pressure of overlying sediments; Jefferson and Avery Islands.
dune	A low ridge or hill of loose, wind blown material capable of being moved from place to place but retaining its characteristic shape.
eat-out	Massive destruction of vegetation by animals (e.g., nutria/muskrat) or birds (e.g., geese/gulls).
ecosystem	An ecological unit consisting of the environment with its living elements, plus the non-living factors that exist in and affect it.
edaphic species	Species of plants and animals influenced by physical or chemical conditions of the soil or substrate.
epibenthic species	Plants and animals that live on the bottom; bottom dwellers.
epifauna	Animals living upon rather than below the surface of the seafloor; the term is also used for fauna attached to rocks, plants, pilings, boat hulls, etc., in shallow water and along the shore.
epiphyte	Plant which lives attached to another plant or an inanimate object.
estuary	A partially enclosed coastal body of water where fresh water mixes with seawater and where tidal effects are evident.
eutrophication	Process by which a body of water comes to be characterized by high levels of plant nutrients especially if artificially enriched.
Exclusive Economic Zone (EEZ)	Arbitrarily chosen areas (shoreline to 200 mi) reserved for national exploitation; outer limit conforms to the seaward edge of the OCS rather than a physiographic boundary.
fresh marsh	Herbaceous wetland in which salinity is usually <0.5 o/oo.
Gulf Coast Homeporting Plan	Department of the Navy proposal to station several Caribbean Fleet ships each at Pensacola, FL, Mobile, AL, Pascagoula, MS, Lake Charles, LA, and Corpus Christi, TX.
habitat	Those elements of an environment that sustain organisms and communities.
halophyte	Plants tolerant of high salinity levels.
herbaceous plants	Annual or perennial green vascular plants of low stature which are leaf-like in appearance or texture.
herbicide	Poison formulated to selectively kill certain types of plants; may become environmentally destructive to animals when concentrated in the food chain.
hermatypic coral	Reef building coral with associated symbiotic algae that requires light for growth.

hydrology	The study of the physical properties of water movement, circulation, and distribution.
hypersaline	1) Water with salinity >40 o/oo due to land-derived salts. 2) Salinity greater than the lowest salinity at which halite can be precipitated; about 350 o/oo at one atmosphere and 20° C.
hypoxia	Stress caused by deficiency in the amount of oxygen reaching bodily tissue.
infauna	Organisms living within rather than on the sediments of waterbodies.
interstitial salinity	Salinity of the water filling the pore spaces of sediments.
intertidal	Zone between high and low tide levels.
littoral zone	Depth zone between high tide and low tide.
low energy environment	Water covered area characterized by lack of wave or current action which permits settling of suspended fine-grained sediments.
mangrove swamp	A subtropical, low-energy, aqueous environment, overgrown by mangrove trees and noted for high productivity of organic matter.
mean sea level	The average height of the sea surface for all tidal stages over a 19 year period as determined by hourly observations.
mean tide level	Surface marking the average of observed heights of high water and low water averaged over a nodal period (about 19 years).
mesocosm	A representative portion of an ecosystem which can be experimentally manipulated.
mudflat	Level area of silts and clays, barren of vegetation, which is alternately covered and uncovered by the tide.
nepheloid layer	A layer of water, up to 1000 m (3,281 ft) thick, over the shelf edge or in the deep ocean basin, that contains a suspended sediment load sufficient to reflect light.
oceanic realm	Term used to describe oceans and their physical, chemical, biological, and geological properties.
Outer Continental Shelf (OCS)	Federally mandated, submerged portion of continent which usually starts about 4.8 km (3 mi) from shoreline and extends about 322 km (200 mi) seaward; under federal jurisdiction.
pelagic zone	All the ocean waters including the neritic (inshore) and oceanic (open ocean) zones; vertically, the pelagic zone is divided into the upper lighted zone and the lower dark zone.
pesticide	Poison formulated to selectively kill insects or other organisms; becomes environmentally destructive when retained in the food chain.

photosynthesis	Process in which energy of light and chlorophyll are used to manufacture carbohydrates from carbon dioxide and water. Maximum depth about equivalent to shelf break [200 m (656 ft)].
polychaete	Marine worm of Class <i>Polychaeta</i> , Phylum <i>Annelida</i> . Many live in temporary or permanent tubes or burrows.
red tide	Discolored seawater caused by explosive growth of one of several species of dinoflagellates capable of poisoning fish or producing anaerobic conditions. Rapid growth apparently caused by phosphorus enrichment.
salt marsh	Meadow of intertidal, rooted vegetation which is alternately inundated and drained by tides.
saltern	Areas generally barren of vegetation or vegetated by species tolerant of hypersaline conditions. Formed by a concentration of salts by evaporation; generally occur at upper limits of tidal marshes.
serpulid	Any annelid (worm) of the family <i>Serpulidae</i> that characteristically builds contorted calcareous tubes which may coalesce into small reefs.
shelf break	Boundary between continental shelf (gradient >1:1000) and continental slope (gradient >1:100).
Sigsbee Abyssal Plain	Abyssal plain in the Gulf of Mexico basin at a depth below 3,600 m (11,812 ft) and gradient of >1:2000.
straight pipe	Term used for the dumping of untreated sewage directly into waterbodies.
submerged aquatic vegetation (SAV)	Dense communities of vascular plants beneath the water surface in saline environments.
subsidence	Downward settling of the earth's surface with little or no horizontal movement usually caused by compaction, dehydration, or crustal warping.
subtidal	Seaward of low tide level; always water covered.
supralittoral	Shore area above the high tide level.
turbidity	Reduced clarity of water due to presence of suspended matter.
wave base	Depth at which waves no longer stir sediments; wave base is about 10 m (32.8 ft) in the Gulf of Mexico.
wetland	Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

The Habitat Degradation Committee**Co-Chairs:**

Larry Goldman	U.S. Fish & Wildlife Service
Eugene Turner	Louisiana State University

Members:

Steve Branstetter	Gulf & South Atlantic Fisheries Development Foundation, Inc.
Carl Brown	U.S. Army Corps of Engineers
Tom Calnan	Texas General Land Office
William Cibula	National Aeronautics & Space Administration
Art Dyas	Southeastern Natural Resources--CAC
Johnny French	U.S. Fish & Wildlife Service
Gary Gaston	University of Mississippi
Bill Good	Louisiana Department of Natural Resources
Kenneth Haddad	Florida Department of Natural Resources
Kenneth Heck	Dauphin Island Sea Lab
Rex Herron	National Marine Fisheries Service
Clyde Hoeft	U.S. Fish & Wildlife Service
Bill Kruczynski*	U.S. Environmental Protection Agency--Region 4
Bennett Landreneau	Soil Conservation Service
Larry Lewis	Brown & Mitchell
Robin Lewis	Lewis Environmental Services, Inc.
Andreas Mager Jr.	National Marine Fisheries Service
Paul Montagna	University of Texas
Rudy Nyc	U.S. Army Corps of Engineers
Leland Roberts	Texas Parks & Wildlife Department
Robert Rogers	Minerals Management Service
Stephanie Sanzone	U.S. Environmental Protection Agency
Peter Sheridan	National Marine Fisheries Service
Brent Smith	U.S. Department of Energy
Robert Stewart Jr.	U.S. Fish & Wildlife Service
Ronald Ventola	U.S. Army Corps of Engineers

*Previous Co-Chair

Steering Committee:

Len Bahr	Office of the Governor--Louisiana
Larry Goldman	U.S. Fish & Wildlife Service
Kenneth Haddad	Florida Department of Natural Resources
Bill Kruczynski	U.S. Environmental Protection Agency--Region 4
Larry Lewis	Brown & Mitchell
Paul Montagna	University of Texas
Leland Roberts	Texas Parks & Wildlife Department
Eugene Turner	Louisiana State University
John Weber	U.S. Army Corps of Engineers

Participants in the Action Agenda Workshop & Development Process

Dan Allen	Chevron
Len Bahr	Office of the Governor of Louisiana
Alan Ballard	U.S. Environmental Protection Agency--GMP
Carl Brown	U.S. Army Corps of Engineers
Sally Davenport	Texas General Land Office
Donna Devlin	Center for Marine Conservation
Fred Dunham	Louisiana Department of Wildlife & Fisheries
Linda Dye	Florida Department of Natural Resources
Ernie Estevez	Mote Marine Laboratory
Mike Evans	Citizens Advisory Committee
Larry Goldman	U.S. Fish & Wildlife Service
Bill Good	Louisiana Department of Natural Resources
Bryon Griffith	U.S. Environmental Protection Agency--GMP
Lore Hantske	Texas General Land Office
Kenneth Heck	Dauphin Island Sea Lab
Rex Herron	National Marine Fisheries Service
Ron Herring	Mississippi Power Company
Bill Holland	U.S. Environmental Protection Agency--GMP
Richard Hoogland	Gulf of Mexico Fishery Management Council
Susan Jackson	U.S. Environmental Protection Agency
Fred Kopfler	U.S. Environmental Protection Agency--GMP
Bill Kruczynski	U.S. Environmental Protection Agency--Region 4
John Lambeth	Citizens Advisory Committee
Bennett Landreneau	Soil Conservation Service
Mary Landin	U.S. Army Corps of Engineers
Larry Lewis	Brown & Mitchell
Robin Lewis	Lewis Environmental Services, Inc.
Doug Lipka	U.S. Environmental Protection Agency--GMP
Paul Montagna	University of Texas
Rudy Nyc	U.S. Army Corps of Engineers
Chris Onuf	U.S. Fish & Wildlife Service
David Pashley	The Nature Conservancy
Alex Plaisance, Jr.	Louisiana Landowners Association
Warren Pulich	Texas Parks & Wildlife Department
Leland Roberts	Texas Parks & Wildlife Department
Robert Rogers	Minerals Management Service
Blake Roper	Alabama Department of Environmental Management
Peter Sheridan	National Marine Fisheries Service
Eugene Turner	Louisiana State University
Virginia VanSickle-Burkett	U.S. Fish & Wildlife Service
Lloyd Wise	U.S. Environmental Protection Agency--Region 4
John Weber	U.S. Army Corps of Engineers
Bernie Yokel	Florida Audubon Society

Written Comments on Draft Documents Received From the Following:

Dan Allen	Chevron
Len Bahr	Office of the Governor of Louisiana
Alan Ballard	U.S. Environmental Protection Agency--Gulf of Mexico Program
Jimmy Bates	U.S. Army Corps of Engineers
Thomas Baugh	U.S. Fish & Wildlife Service
Ken Blan	Soil Conservation Service--Gulf of Mexico Program
Carl Brown	U.S. Army Corps of Engineers
Eugene Buglewicz	U.S. Army Corps of Engineers
John Burt	Soil Conservation Service
John Carlton	Alabama Department of Environmental Management
James Cato	Florida Sea Grant College
Dave Chambers	U.S. Environmental Protection Agency
Tom Czapla	U.S. Fish & Wildlife Service
Ernie Estevez	Mote Marine Laboratory
Conrad Fjetland	U.S. Fish & Wildlife Service
Johnny French	U.S. Fish & Wildlife Service
David Fruge	U.S. Fish & Wildlife Service
Larry Goldman	U.S. Fish & Wildlife Service
Kenneth Haddad	Florida Department of Natural Resources
James Hanchey	U.S. Army Corps of Engineers
Rex Herron	National Marine Fisheries Service--Gulf of Mexico Program
George Horvath	U.S. Environmental Protection Agency--Region 6
Alan Jones	Texas Water Commission
Andrew Kemmerer	National Marine Fisheries Service
Bill Kruczynski	U.S. Environmental Protection Agency--Region 4
Larry Lewis	Brown & Mitchell
Andreas Mager Jr.	National Marine Fisheries Service
Garry Mauro	Texas General Land Office
Larry McKinney	Texas Parks & Wildlife Department
Brandt Mannchen	Sierra Club
Susan MacMullin	U.S. Environmental Protection Agency
Kai Midboe	Louisiana Department of Environmental Quality
Paul Montagna	University of Texas
Warren Olds	U.S. Fish & Wildlife Service
Maureen O'Neill	U.S. Environmental Protection Agency--Region 4
Chris Onuf	U.S. Fish & Wildlife Service
J. Rogers Percy	Minerals Management Service
Laura Radde	U.S. Environmental Protection Agency--Region 6
Leland Roberts	Texas Parks & Wildlife Department
Robert Rogers	Minerals Management Service
Dugan Sabins	Louisiana Department of Environmental Quality
A.J. Salem	U.S. Army Corps of Engineers
Peter Sheridan	National Marine Fisheries Service
Brent Smith	U.S. Department of Energy

Written Comments on Draft Documents Received From the Following (continued):

Dave Smith	U.S. Fish & Wildlife Service--Gulf of Mexico Program
Barbara Todd	Pinellas County Board of County Commissioners--CAC
Eugene Turner	Louisiana State University
Michael Wagner	U.S. Environmental Protection Agency--Region 6
John Weber	U.S. Army Corps of Engineers
Phil Wieczynski	U.S. Coast Guard

