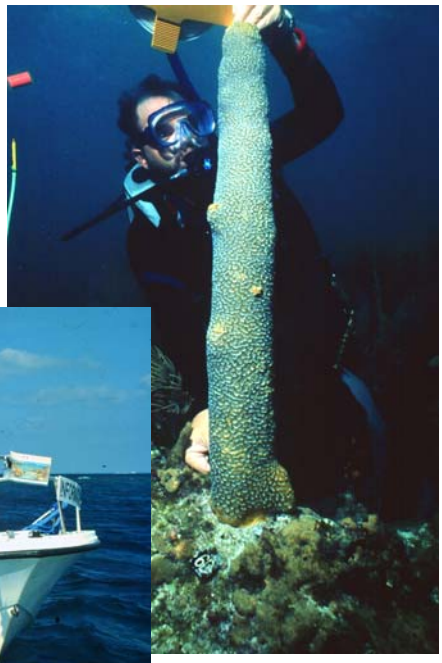
Florida Keys
National Marine Sanctuary
Draft Revised Management Plan



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U.S. Department of Commerce

National Oceanic and
Atmospheric Administration

National Ocean Service

National Marine Sanctuary Program

This document is the draft revised management plan for the Florida Keys National Marine Sanctuary. It replaces the management plan that was implemented in 1997 and will serve as the primary management document for the Sanctuary during the next five years.

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Note to Reader

In an effort to make this document more user-friendly, we have included references to the Florida Keys National Marine Sanctuary web site rather than including the entire text of many bulky attachments or appendices that are traditionally included in management plans. Readers who do not have access to the Internet may call the Sanctuary office at (305) 743-2437 to request copies of any documents that are on the Sanctuary's web site. For readers with Internet access, the Sanctuary's web site can be found at: http://floridakeys.noaa.gov.

ABOUT THIS DOCUMENT

This document is a report on the results of NOAA's five-year review of the strategies and activities detailed in the 1997 *Final Management Plan and Environmental Impact Statement* for the Florida Keys National Marine Sanctuary. It serves two primary purposes: 1) to update readers on the outcomes of successfully implemented strategies - in short, accomplishments that were merely plans on paper just five years ago; and, 2) to disseminate useful information about the Sanctuary and its management strategies, activities and products. The hope is that this information, which charts the next 5 years of Sanctuary management, will enhance the communication and cooperation so vital to protecting important national resources.

Sanctuary Characteristics

The Florida Keys National Marine Sanctuary extends approximately 220 nautical miles southwest from the southern tip of the Florida peninsula. The Sanctuary's marine ecosystem supports over 6,000 species of plants, fishes, and invertebrates, including the nation's only living coral reef that lies adjacent to the continent. The area includes one of the largest seagrass communities in this hemisphere. Attracted by this tropical diversity, tourists spend more than thirteen million visitor days in the Florida Keys each year. In addition, the region's natural and man-made resources provide livelihoods for approximately 80,000 residents.

The Sanctuary is 2,900 square nautical miles of coastal waters, including the recent addition of the Tortugas Ecological Reserve. The Sanctuary overlaps six state parks and three state aquatic preserves. Three national parks have separate jurisdictions, and share a boundary with the Sanctuary. In addition, the region has some of the most significant maritime heritage and historical resources of any coastal community in the nation.

The Sanctuary faces specific threats, including direct human impacts such as ship groundings, pollution, and overfishing. Threats to the Sanctuary also include indirect human impacts, which are harder to identify but seem to be reflected in coral declines and increases in macroalgae and turbidity. More information about the Sanctuary can be found in this document and at the Sanctuary's web site: http://floridakeys.noaa.gov.

Management Plan Organization

Within this document, the tools that the Sanctuary uses to achieve its goals, are presented under five management divisions: 1) Science; 2) Education, Outreach & Stewardship; 3) Enforcement & Resource Protection; 4) Resource Threat Reduction; and, 5) Administration, Community Relations, & Policy Coordination. Each management division contains two or more *action plans*, which are implemented through supporting *strategies* and *activities*. The strategies described in the 1997 *Management Plan* generally retain their designations in this document. As in the 1997 plan, two or more action plans may share a strategy where their goals and aims converge.

Accomplishments and Highlights

The Sanctuary's programs and projects have made significant progress since the original management plan was implemented 1997. An overview of these accomplishments is provided in the Introduction. In addition, each action plan contains bulleted lists of accomplishments since the 1997 management plan was adopted.

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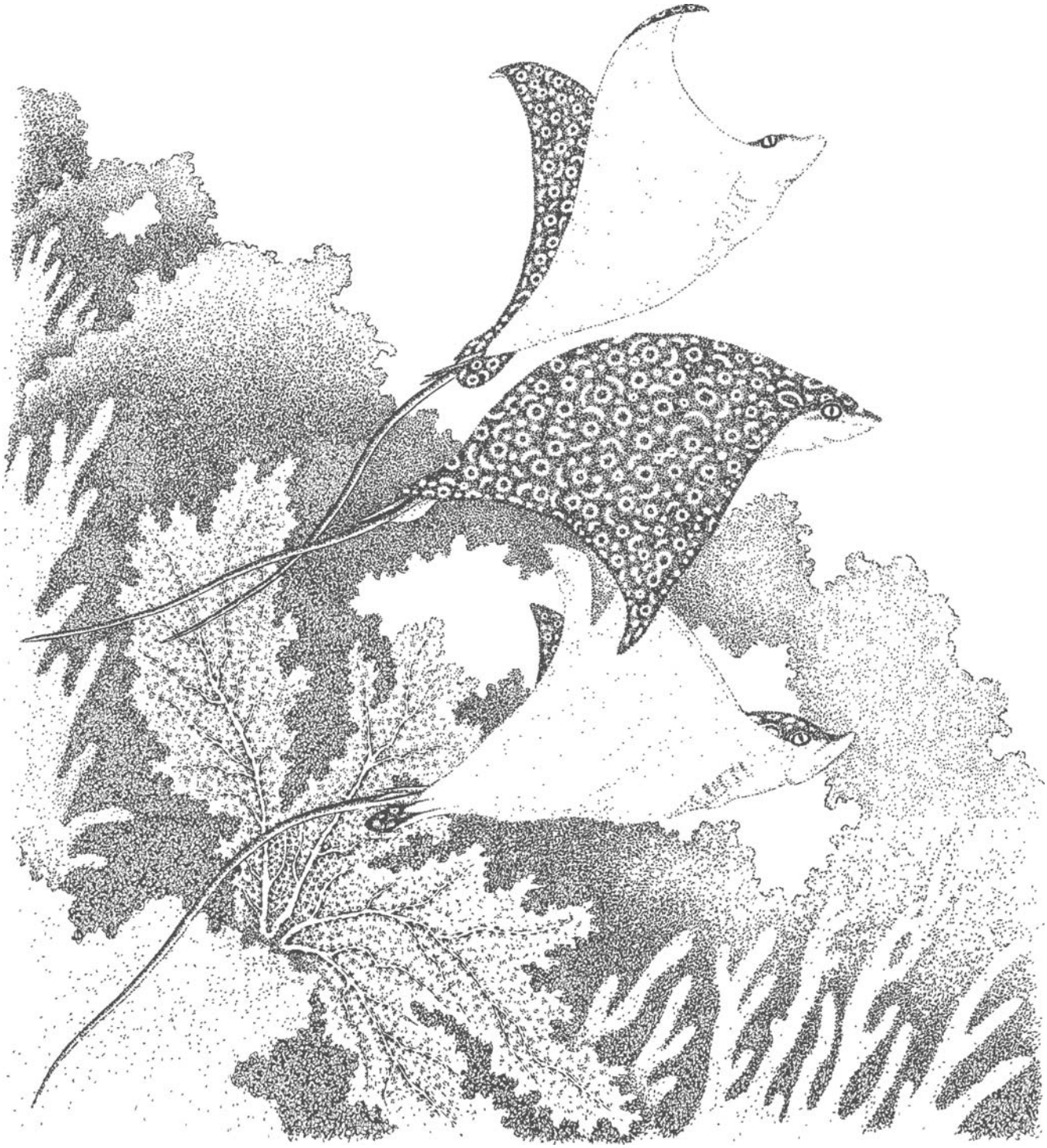
Acronyms

ASA	Abandoned Shipwreck Act
ATBAs	Areas to Be Avoided
AWT	Advanced Wastewater Treatment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DARP	Damage Assessment and Restoration Program
DMR	Department of Marine Resources (Monroe County)
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
F.S.	Florida Statues
FAC	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FDHR	Florida Division of Historical Resources
FDEP	Florida Department of Environmental Protection
FFWCC	Florida Fish and Wildlife Conservation Commission
FKNMS	Florida Keys National Marine Sanctuary
FKNMSPA	Florida Keys National Marine Sanctuary Protection Act
FPS	Florida Park Service
FWRI	Fish and Wildlife Research Institute
FWS	Fish and Wildlife Service
GIS	Geographic Information System
GPS	Global Positioning System
HAZMAT	Hazardous Materials
MBTA	Migratory Bird Treaty Act
MEERA	Marine Ecosystem Event Response and Assessment
MHR	Maritime Heritage Resources
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NEPA	National Environmental Protection Act
NGO	Non-governmental Organization
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NMS	National Marine Sanctuary
NMSA	National Marine Sanctuary Act
NMSP	National Marine Sanctuary Program
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
OSDS	On-Site Disposal System
PSSA	Particularly Sensitive Sea Area

SAV	Submerged Aquatic Vegetation
SCR	Submerged Cultural Resources
SEFSC	Southeast Fisheries Science Center
SFWMD	South Florida Water Management District
SPA	Sanctuary Preservation Area
SWIM	Surface Water Improvement and Management Act
SWM	Stormwater Management
TNC	The Nature Conservancy
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDOC	U.S. Department of Commerce
USDOI	U.S. Department of Interior
USDOS	U.S. Department of State
USDOT	U.S. Department of Transportation
USGS	U.S. Geological Survey
WMA	Wildlife Management Area

1.0 INTRODUCTION



1.1 The National Marine Sanctuary Program (NMSP)

The National Marine Sanctuary Program (NMSP) is a network of 13 marine protected areas (Figure 1.1), encompassing marine resources from Washington State to the Florida Keys, and Lake Huron to American Samoa. The National Oceanic and Atmospheric Administration's (NOAA) National Ocean Service (NOS) has managed the nation's marine sanctuaries since passage of the Marine Protection, Research and Sanctuaries Act of 1972. Title III of that Act is now called the National Marine Sanctuaries Act (NMSA), which is found in Appendix A.

Today, the national marine sanctuaries contain deep-ocean gardens, near-shore coral reefs, whale migration corridors, deep-sea canyons, and underwater archaeological sites. They range in size from one-quarter square mile in Fagatele Bay, American Samoa, to more than 5,300 square miles off Monterey Bay, California—one of the largest marine protected areas in the world. Together, these sanctuaries protect nearly 18,000 square miles of coastal and open ocean waters and habitats. While some activities are managed to protect resources, certain multiple uses, such as recreation, commercial fishing, and shipping are allowed to the extent that they are consistent with a sanctuary's resource protection mandates. Research, education, outreach, and enforcement activities are major components in each sanctuary's program of resource protection.

The NMSP is recognized around the world for its commitment to management of marine protected areas within which primary emphasis is placed on the protection of living marine resources and our nation's maritime heritage resources.

Figure 1.1. The National Marine Sanctuaries

The NMSP Vision:
People value marine sanctuaries as treasured places protected for future generations.

The NMSP Mission:
To serve as the trustee for the national system of marine protected areas to conserve, protect, and enhance their biodiversity, ecological integrity and cultural legacy.

1.2 The Florida Keys National Marine Sanctuary (FKNMS)

Historical Setting

Warning signs of the fragility and finite nature of the region's marine resources have been present in the Florida Keys for years. In 1957, a group of conservationists and scientists met at Everglades National Park to discuss the demise of the coral reef resources at the hands of those attracted by its beauty and uniqueness. The conference resulted in the 1960 creation of the world's first underwater park, John Pennekamp Coral Reef State Park. However, in the following decade, public outcry continued over pollution, overfishing, physical impacts, overuse, and user conflicts. The concerns continued to be voiced by environmentalists and scientists alike throughout the 1970s and into the 1990s.

As a result, additional management efforts were instituted to protect the Keys' coral reefs. In the Upper Keys, Key Largo National Marine Sanctuary was established in 1975 to protect 103 square nautical miles of coral reef habitat from north of Carysfort Lighthouse to south of Molasses Reef. In the Lower Keys, the 5.32 square nautical mile Looe Key National Marine Sanctuary was established in 1981.

Despite these efforts, oil drilling proposals and reports of deteriorating water quality occurred throughout the 1980s. At the same time, scientists were assessing coral bleaching and diseases, long-spined urchin die-offs, loss of living coral cover, a major seagrass die-off, and declining reef fish populations. Such threats prompted Congress to act. In 1988, Congress reauthorized the National Marine Sanctuary Program and ordered a feasibility study for possible expansion of Sanctuary sites in the Florida Keys - a directive that signaled that the health of the Keys ecosystem was of national concern.

The feasibility studies near Alligator Reef, Sombrero Key, and westward from American Shoal were overshadowed by several natural events and ship groundings that precipitated the designation of the Florida Keys National Marine Sanctuary (FKNMS). Three large ships ran aground on the coral reef during one 18-day period in the fall of 1989. Although people cite the ship groundings as the issue triggering Congressional action, it was, in fact, the cumulative degradation and the threat of oil drilling, along with the groundings. These multiple threats prompted Congressman Dante Fascell to introduce a bill into the House of Representatives in November of 1989. Congressman Fascell had long been an environmental supporter of South Florida and his action was very timely. Senator Bob Graham, also known for his support of environmental issues in Washington and as a Florida Governor, sponsored the bill in the Senate. Congress gave its bipartisan support, and on November 16, 1990, President George Bush signed the bill into law.

With designation of the Florida Keys National Marine Sanctuary in 1990, several protective measures were implemented immediately, such as prohibiting oil and hydrocarbon exploration, mining or otherwise altering the seabed, and restricting large shipping traffic. Additionally, protection to coral reef resources was extended by restricting anchoring on coral, touching coral, and collecting coral and live rock (a product of the aquarium trade). Discharges from within the Sanctuary and from areas outside the Sanctuary that could potentially enter and affect local resources were also restricted in an effort to comprehensively address water quality concerns.

Administration and Legislation

The Sanctuary uses an ecosystem approach to comprehensively address the variety of impacts, pressures, and threats to the Florida Keys marine ecosystem. It is only through this inclusive approach that the complex problems facing the coral reef community can be adequately addressed.

The goal of the Sanctuary is to protect the marine resources of the Florida Keys. It also aims to interpret the Florida Keys marine environment for the public and to facilitate human uses of the Sanctuary that are consistent with protection of this particular marine ecosystem. The Sanctuary is administered by NOAA and is jointly managed with the State of Florida under a co-trustee agreement. The Florida Governor and Cabinet, sitting as the Board of Trustees for the State of Florida, designated the Florida Department of Environmental Protection (FDEP) as the State's partner for Sanctuary management. Additionally, the Florida Fish and Wildlife Conservation Commission (FWC), created in 1999, enforces Sanctuary regulations in partnership with Sanctuary managers. FWC also houses the Fish and Wildlife Research Institute (FWRI), which conducts and coordinates scientific research and monitoring.

National Marine Sanctuaries are typically designated by the Secretary of Commerce through an administrative process established by the NMSA. However, recognizing the importance of the Florida Keys ecosystem and the degradation of the ecosystem due to direct and indirect physical impacts, Congress passed the Florida Keys National Marine Sanctuary and Protection Act (FKNMSPA) in 1990, (P.L. 101-605) (Appendix B) designating the Florida Keys National Marine Sanctuary. President George Bush signed the FKNMSPA into law on November 16, 1990.

The FKNMSPA requires the preparation of a comprehensive management plan and implementing regulations to protect Sanctuary resources. This draft *Revised Management Plan* responds to the FKNMSPA's requirements. The implementing regulations, effective as of 1 July 1997, are found at 15CFR922 and in Appendix C. The designation document for the FKNMS is found in Appendix D.

Sanctuary Boundaries

The Sanctuary's enabling legislation designated 2,800-square-nautical miles of coastal waters off the Florida Keys as the Florida Keys National Marine Sanctuary. The Sanctuary's boundary was amended in March 2001 when the Tortugas Ecological Reserve was designated, significantly increasing the marine resources requiring protection.

Currently, the boundary encompasses approximately 2,900 square nautical miles (9,800 square kilometers) of coastal and ocean waters and submerged land (Figure 1.2). The boundary extends southward on the Atlantic Ocean side of the Keys, from the northeastern-most point of the Biscayne National Park along the approximate 300-foot isobath for over 220 nautical miles to the Dry Tortugas National Park. The boundary extends more than 10 nautical miles to the west of the Park boundary, where it turns north and east. The northern boundary of the Sanctuary extends to the east where it intersects the boundary of the Everglades National Park. The Sanctuary waters on the north side of the Keys encompass a large area of the Gulf of Mexico and western Florida Bay. The boundary follows the Everglades National Park boundary and continues along the western shore of Manatee Bay, Barnes Sound, and Card Sound. The boundary then follows the southern boundary of Biscayne

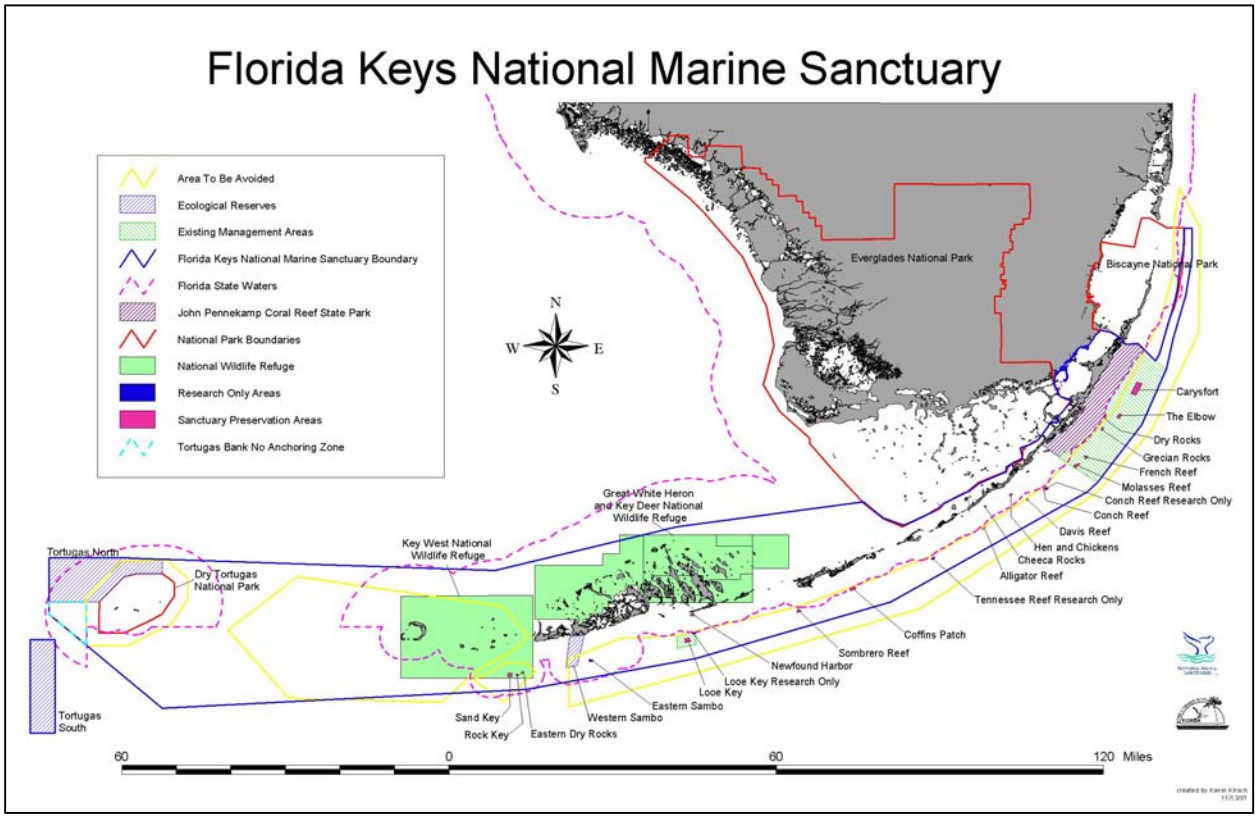
National Park and up its eastern boundary along the reef tract at a depth of approximately 60 feet until its northeastern-most point.

A separate, non-contiguous, 60 square nautical mile area off the westernmost portion of the Sanctuary is called the Tortugas Ecological Reserve South. The area's shallowest feature is Riley's Hump.

The Sanctuary boundary overlaps two previously existing National Marine Sanctuaries (Key Largo and Looe Key); four U.S. Fish and Wildlife Service (USFWS) refuges; six state parks, including John Pennekamp Coral Reef State Park; three state aquatic preserves; and other jurisdictions. Everglades National Park, Biscayne National Park and Dry Tortugas National Park are excluded from Sanctuary waters, but each shares a boundary with the Sanctuary.

The shoreward boundary of the Sanctuary is the mean high-water mark, except around the Dry Tortugas where it is the boundary of Dry Tortugas National Park. The Sanctuary boundary encompasses nearly the entire reef tract, all of the mangrove islands of the Keys, and a good portion of the region's seagrass meadows.

Figure 1.2. The Florida Keys National Marine Sanctuary Boundaries



Socio-Economic Context

The environment and the economy are inextricably linked in the Florida Keys, making management and protection of existing resources and reducing impacts critical if the economy is to be sustained. Tourism is the number one industry in the Florida Keys, with over $1.2 billion dollars being spent annually by over 3 million visitors. The majority of visitors participate in activities such as snorkeling, SCUBA diving, recreational fishing, viewing wildlife and studying nature. Recreational and commercial fishing are the next most important sectors of the local economy, annually contributing an estimated $500 million and $57 million respectively (http://marineeconomics.noaa.gov).

Because of the recreational and commercial importance of the marine resources of the Florida Keys, protecting these Sanctuary resources is valuable not only for the environment but also for the economy. The special marine resources of the region, which led to the area's designation as a National Marine Sanctuary, contribute to the high quality of life for residents and visitors. Without these unique marine resources, the quality of life and the economy of the Keys would decline.

1.3 The Management Plan Review Process

What is management plan review?
In 1992, when Congress reauthorized the NMSA, it required all National Marine Sanctuaries to review their management plans every five years in order to monitor and evaluate the progress of the national mission to protect national resources. The Florida Governor and Cabinet, as trustees for the State, also mandated a five-year review of the Florida Keys National Marine Sanctuary Management Plan in their January 28, 1997 resolution.

The Sanctuary's management plan review creates a road map for future actions based on past experience and outcomes. The review reevaluates the goals and objectives, management techniques, strategies, and actions identified in the existing management plan. It provides the opportunity to take a close and comprehensive look at outcomes and plan for future management of the Sanctuary.

The 1997 Florida Keys National Marine Sanctuary Management Plan
After the initial six-year FKNMS planning process, a comprehensive management plan for the Sanctuary was implemented in July 1997. The management plan focused on ten action plans which were largely non-regulatory in nature and involved educating citizens and visitors, using volunteers to build stewardship for local marine resources, appropriately marking channels and waterways, installing and maintaining mooring buoys for vessel use, surveying maritime heritage resources, and protecting water quality. In addition to action plans, the 1997 management plan designated five types of marine zones to reduce pressures in heavily used areas, protect critical habitats and species, and reduce user conflicts. The efficacy of the marine zones is monitored Sanctuary-wide under the Research and Monitoring Action Plan.

The implementing regulations for the FKNMS became effective July 1, 1997. The 1997 management plan was published in three volumes: Volume I is the Sanctuary management plan itself (which this document updates); Volume II describes the process used to develop the draft management alternatives, including environmental and socioeconomic impact analyses of the alternatives, and the environmental impact statement; Volume III contains appendices, including the texts of Federal and State legislation that designate and implement the Sanctuary. All three volumes of the 1997 management plan are available on the Sanctuary web site (http://floridakeys.noaa.gov/) and from the Sanctuary's Marathon office. Volume II is not being revised as part of this review. After public input, government review and final adoption of this five-year review and revised Management Plan, this document will replace Volumes I and III.

How does management plan review work?
Review of the 1997 management plan began in early 2001 with a meeting in Tallahassee, Florida, among Federal and state partners responsible for Sanctuary management and various FKNMS and NMSP staff. The review included the Sanctuary Advisory Council (SAC) and the general public in every step of the process.

In the late spring and summer of 2001, FKNMS staff, working closely with the SAC, held scoping meetings and re-convened working groups that had been created during development of the 1997 plan. The scoping meetings were held in Marathon, Key Largo, and Key West, and gave the public the opportunity to meet with SAC members, Sanctuary managers, and FKNMS staff. The meetings

included round-table discussions on every action plan, and participants had the opportunity to move freely between the various topics being discussed at each table.
The scoping period for the revised management plan lasted from June 8 through July 20, 2001. Approximately 30 comments were received - a sharp contrast to the more than 6000 public comments received during the comment period for the 1997 plan. In addition, the working groups held more than three dozen meetings between June and September 2001 to discuss, evaluate, revise and update action plans. SAC members and FKNMS staff who had served on the working groups presented the proposed revisions to the Sanctuary Advisory Council at three meetings in October 2001. The full advisory council recommended minor changes and approved each action plan in this document. The Advisory Council membership and Working Group membership lists are included in Appendix E.

The Role of Sanctuary Management as Facilitators
A Sanctuary management plan is designed to identify the best and most practical strategies to achieve common goals, while getting the most out of public investment. Achieving this aim cannot be accomplished solely through the authorities and resources of an individual Sanctuary management authority. It requires a broad partnership of programs, authorities, and resources, coordinated to meet the needs of both the sanctuary site and the broader region of which it is a part.

Consequently, the management plan review process first focuses on finding the most effective strategies to accomplish common goals. These strategies are the product of a process that brings together constituents, institutions, and interested parties in directed working groups to address specified problem areas. How these strategies are to be implemented—with whose authorities, investments, and personnel—is determined subsequently to developing the best strategies. While the Sanctuary program commits to carrying out specific strategies as budgets allow, in many cases implementation becomes the responsibility of other institutions such as state, Federal, or local partners, that have either the authorities, the appropriate program, and/or the resources required.

In this process, the sanctuary management plan becomes a framework in which the role of all partners is codified. The Sanctuary assumes the role of facilitator and integrator of a far larger body of activities and outcomes than are within the immediate authorities, programs, and resources of the site. This facilitation role provides the mechanism for continued implementation, evaluation, and adaptation of the partnership activities documented by the plan, ensuring its continuity and overall success.

1.4 Accomplishments

There have been many accomplishments in the sanctuary beginning with the authority established under the Florida Keys National Marine Sanctuary and Protection
Act of 1990 and the implementation of the management plan in 1997. An overview of the Sanctuary's accomplishments is given here, and more details are provided within each Action Plan.

1. Area To Be Avoided. The "Area To Be Avoided" (ATBA) designation has resulted in a significant decrease in the number of major ship groundings on the coral reefs. As Figure 1.3 illustrates, prior to 1990 there was a major ship grounding involving vessels greater than 50 m in length, nearly every year, while only two have occurred since the creation of the ATBA. The International Maritime Organization agreed that the ATBA should be given additional strength as a Particularly Sensitive Sea Area (PSSA) in 2002 (see Accomplishment 5 below). The ATBA regulations are at 15 CFR Part 922, Subpart P, Appendix VII. Figure 1.4 shows the ATBA and the Sanctuary boundary.

Figure 1.3. Reef groundings of vessels greater than 50m before & after ATBA designation.

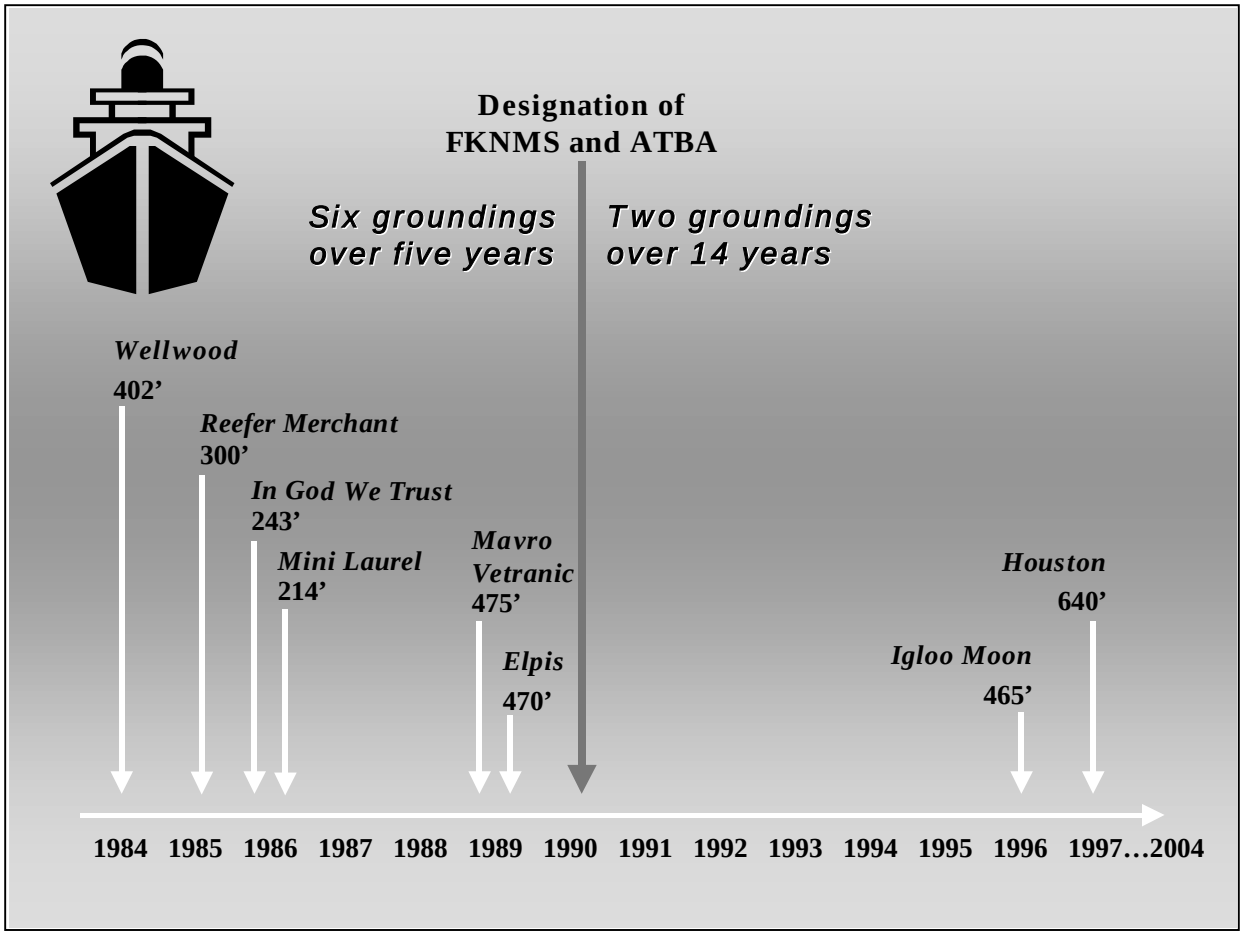
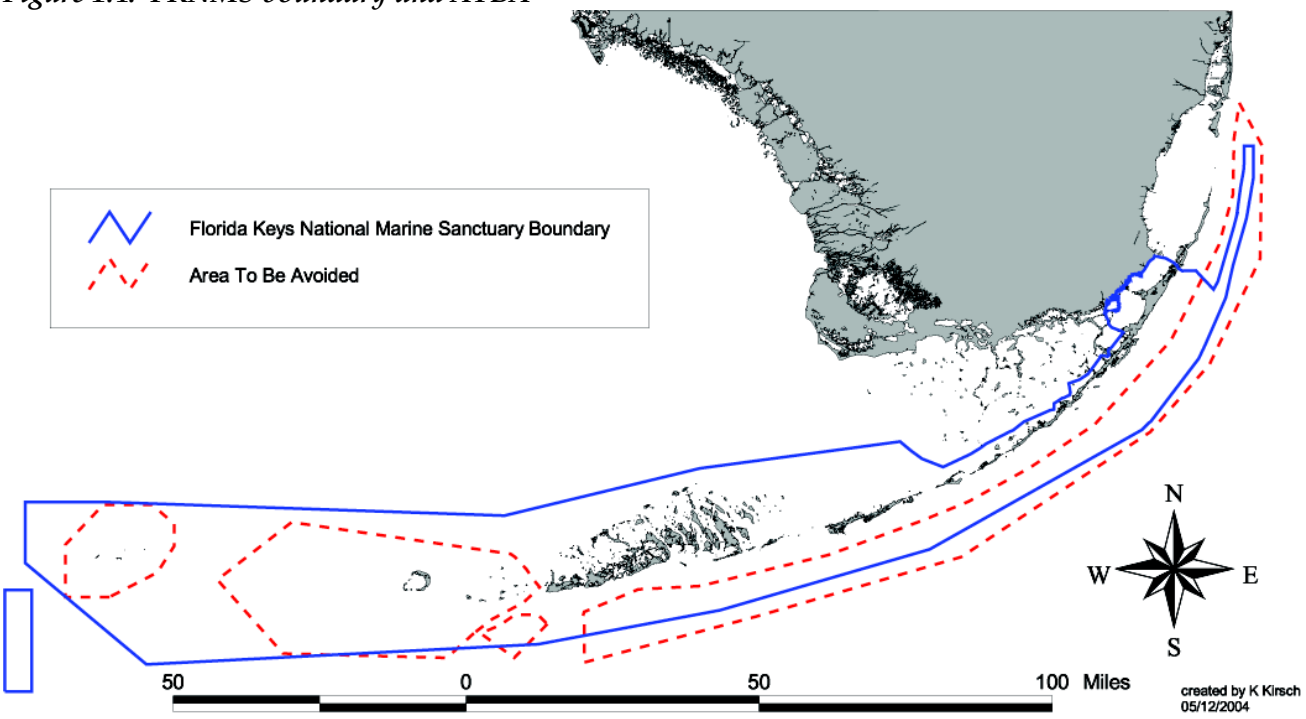


Figure 1.4. FKNMS boundary and ATBA



2. Oil Drilling and Hard Mineral Mining Ban. A ban on these activities was established when the Sanctuary was created, and has prevented these activities from occurring in the Sanctuary.

3. The Water Quality Protection Program. This program has produced the first Water Quality Protection Program for a national marine sanctuary and has fully implemented 26 of 49 high-priority activities, many of which are carried out in cooperation with other action plans.

4. The Comprehensive Everglades Restoration Plan. The Sanctuary continues to participate in the Comprehensive Everglades Restoration Plan. Sanctuary staff have been active on this project since 1993, including chairing a working group for the South Florida Ecosystem Restoration Task Force and staffing its science and education committees. The Sanctuary's participation seeks to protect the ecosystem's water quality by eliminating catastrophic releases of freshwater into Florida Bay following rain events.

5. Designation of the Florida Keys as a Particularly Sensitive Sea Area. In November 2002, the United Nations International Maritime Organization approved designation of the Florida Keys as a PSSA. The designation is not accompanied by additional rules and regulations, but seeks to elevate public awareness of the threat of oil spills and hazardous materials to sensitive marine environments and will ensure that the previously mentioned ATBA is noted not only on U.S. charts but also on nautical charts worldwide.

6. Long-term and continuing progress in the Research and Monitoring and Zoning action plans. Research and Monitoring has produced significant scientific data, hypothesis testing, mapping, trend documentation, and wide dissemination of these findings. Especially notable is the Keys-wide benthic map which provides valuable information for Sanctuary managers. In addition to the new protected zone in the Tortugas Ecological Reserve, the Sanctuary's zoning programs continue to provide invaluable data that crosses simple category boundaries.

7. Education, Public Outreach, Sanctuary Stewardship, and Volunteerism. Through these inter-related efforts, information is flowing from scientists to managers and then to educators, who reach the next generation. More than 120,000 volunteer hours, a $1.8 million value, have were donated to the Sanctuary between 1996 and 2000. Even more valuable than the dollar worth of the program is the stewardship created through volunteerism, which uniquely contributes to the long-term effectiveness of the Sanctuary.

8. Enforcement and Regulations. Both the city of Key West and the State of Florida have declared Florida Keys waters under their jurisdictions as "no-discharge" zones. Additional accomplishments in implementing the Enforcement and Regulatory Action Plans are largely a tribute to the cooperative efforts among the State, the Florida Fish and Wildlife Conservation Commission, the Florida Park Service, the U.S. Coast Guard and NOAA. Notable among these is the cross-deputization of state-certified law enforcement officers, which allows them to enforce some Federal laws, including fisheries regulations.

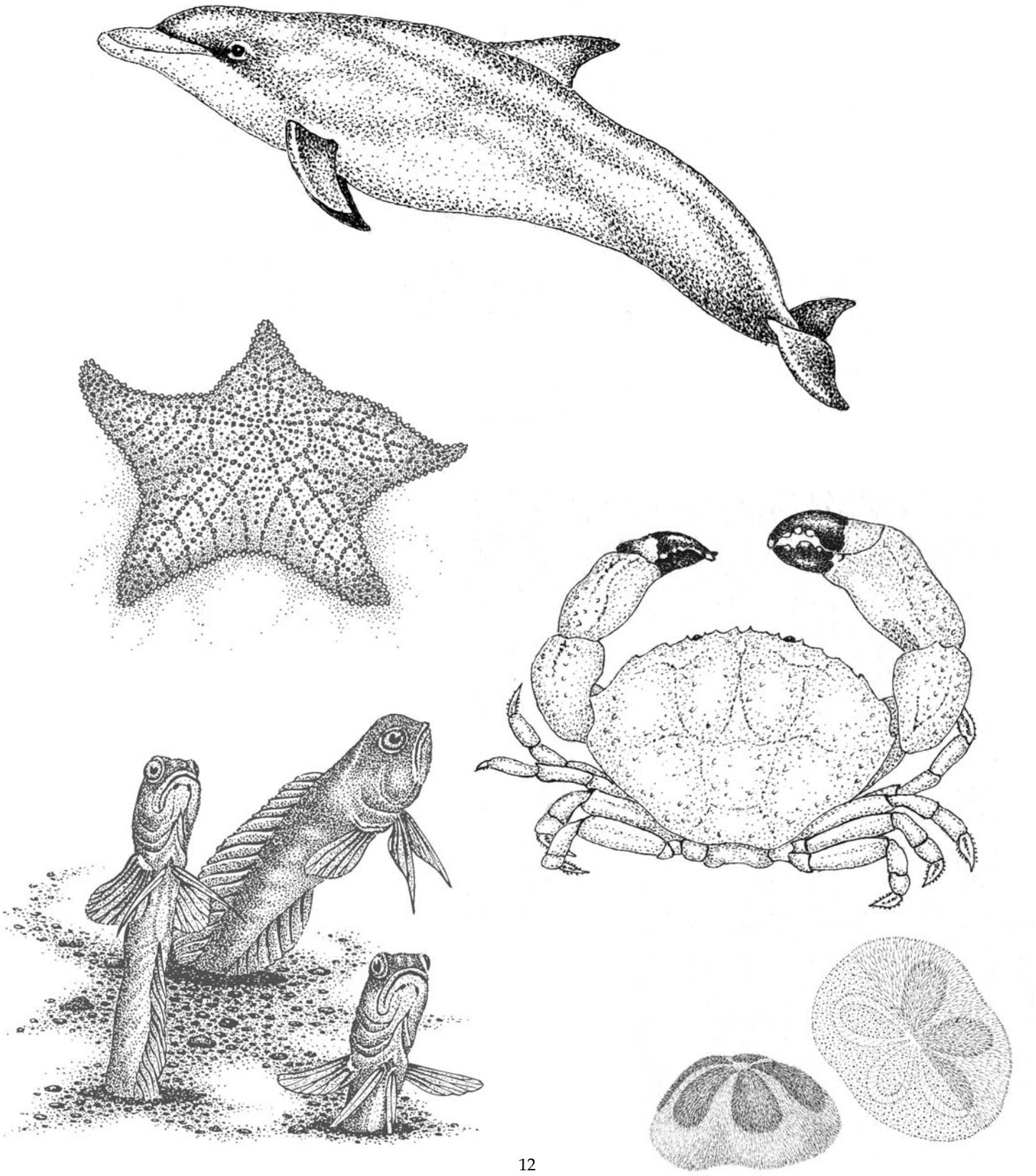
9. Damage Assessment and Restoration. The Damage Assessment and Restoration Action Plan is new to this document but is based on accumulated data and lessons learned since 1982. The cross-disciplinary strategies will prove useful in reducing the number of vessel groundings in Sanctuary waters as well as restoring Sanctuary resources damaged by vessels.

10. Maritime Heritage Resources. The Maritime Heritage Resources Action Plan includes a close partnership of the State, NOAA, and the Florida Advisory Council on Historic Preservation described in a 1998 programmatic agreement for resource management (see Appendix F). More recently, the 2002 discovery of a previously unknown wreck within the Sanctuary has brought about a community-endorsed research and interpretation plan for the site. Overall, the Action Plan represents excellent progress in balancing resource protection, investigation and interpretation.

11. Mooring Buoys and Waterway Management (formerly Channel Marking). The Mooring Buoy and Waterway Management Action Plans have implemented simple but effective strategies for reducing vessel damage to the coral reef and to seagrass beds. The long-term success of these programs—mooring buoy strategies have been used in local Sanctuary waters since 1981 when they were introduced at the Key Largo National Marine Sanctuary—has largely been due to a unique interface of education, outreach, enforcement, and research and monitoring activities.

12. Operations. Since 1997, the Sanctuary has integrated the administrative functions of two former sanctuaries—at Key Largo and Looe Key—into a single headquarters umbrella with two regional offices. This integration streamlined delivery of human resources, community relations, and policy development. It also resulted in a series of accomplishments, ranging from an updated electronic financial reporting system to the 130-episode television series, *Waterways*.

2.0 THE SANCTUARY ENVIRONMENT: A SUBTROPICAL ECOSYSTEM



2.1 Introduction

Adjacent to the Keys' land mass is a complex marine ecosystem that supports a variety of spectacular, unique, and nationally significant seagrass meadows, mangrove islands, and extensive living coral reefs. This ecosystem is the marine equivalent of a tropical rain forest in that it supports high levels of biological diversity, is fragile and easily susceptible to damage from human activities, and possesses great value to humans if properly conserved. The ecosystem supports over 6,000 species of plants, fishes, and invertebrates, including the nation's only coral reef that lies adjacent to the continent, and one of the largest seagrass communities in this hemisphere.

2.2 Living Marine Resources

The Florida Keys ecosystem contains one of North America's most diverse assemblages of flora and fauna. The Florida peninsula and Florida Keys serve as a partial barrier between the temperate waters of the Gulf of Mexico and the tropical to subtropical waters of the Atlantic Ocean, resulting in a unique distribution of marine organisms.

The coral reef tract, arching in a southwesterly direction for 220 miles, comprises one of the largest communities of its type in the world. It is the only emergent coral reef system off the continental U.S. All but the northernmost extent of the reef tract lies within the sanctuary.

The reef tract is a bank-barrier system comprised of an almost continuous reef community. One of its most noticeable features is its seaward-facing spur-and-groove formation. Over 6000 patch reefs, circular to oval in shape, lie in nearshore to offshore areas.

The ecosystem also supports one of the world's largest seagrass beds, among the richest, most productive, and most important submerged coastal communities. Seagrasses provide food and habitat for commercially and recreationally important species of fish and invertebrates. Without the seagrass community, the coral reef community would likely collapse.

Mangroves form an important component of the ecosystem, fringing most of the more than 1600 islands and 1800 miles of shoreline. Mangroves provide important ecological functions such as habitat for juvenile fishes and invertebrates, sediment traps, and surface area for attached organisms such as oysters, sponges, and algae.

The Florida Keys coral reef ecosystem is highly biologically diverse, and includes:

- 520 species of fish, including over 260 species of reef fish
- 367 species of algae
- 5 species of seagrasses
- 117 species of sponges
- 89 species of polychaete worms
- 128 species of echinoderms
- 2 species of fire coral
- 55 species of soft corals
- 63 species of stony corals

Coral Reefs and Coral Health

The reefs of Florida have undergone change for millennia due to sea-level changes, storms, and other natural occurrences. More recently, human impacts have directly and indirectly damaged the reef structure and reef communities, and as a result corals are under stress.

In the Florida Keys, a decrease in coral cover and species diversity and an alarming increase in coral diseases and coral bleaching have been recorded in the Coral Reef/Hard-bottom Monitoring Project conducted by Florida's Fish and Wildlife Research Institute (FWRI). The project records biodiversity, coral condition (including diseases and bleaching), and coral cover at stations located in various habitat types. Since 1996, over 66 percent of the monitored sites have exhibited losses in stony coral

diversity, although some positive trends were noted in the 1999-2000 survey period. Significant gains and losses of several stony coral species have occurred both between years and over the entire sampling period, indicating fluctuations in coral species richness but no loss of species Sanctuary-wide.

In addition, FWRI monitoring has shown a declining trend in stony coral cover from 1996 to 2000, with the greatest relative change occurring in the Upper Keys. A reprieve from this decline has recently been observed and may be attributable to the lack of significant events such as bleaching, tropical storms, or hurricanes. As with species diversity, scientists find that coral cover is highly variable by both habitat type and region.

Recruitment (settlement of new individuals) of stony corals is an important factor in overall community dynamics. Two monitoring programs that are evaluating coral recruitment trends find that differences exist in coral recruitment among habitat types and regions. Juvenile corals in the lower Keys suffered significant mortality in 1998 due to a direct strike from Hurricane Georges.

Coral diseases increasingly threaten the overall health and vitality of reef systems in the Sanctuary. While over ten coral diseases are believed to exist at this time, only three pathogens have been positively identified. The monitoring project has documented increases in the number of research stations that contain diseased coral, the number of coral species with disease, and the number of diseases themselves. Regional differences in disease incidence have also been documented, with the highest concentration observed in the Key West and Lower Keys region.

Over the past 20 years, coral bleaching events in the Sanctuary have increased in frequency and duration. Massive coral bleaching was first recorded in the Lower Keys in 1983 along the outer reef tract, where shallow fore-reef habitats were the most affected areas. Bleaching expanded and intensified with events in 1987 and 1990, and culminated with massive coral bleaching in 1997 and 1998 that targeted inshore and offshore reefs throughout the Keys. Coral bleaching is undoubtedly responsible for some of the dramatic declines in stony coral cover observed Sanctuary-wide in the last five years. Similar observations of bleaching have been made regionally and internationally since 1987, and it is widely recognized that 1997 and 1998 were the worst coral bleaching years on record, causing significant loss of corals worldwide.

Algae, Seagrasses, and Other Benthic Organisms

Monitoring of benthic, or bottom, communities by the National Undersea Research Center at the University of North Carolina at Wilmington has documented that algae of various species dominate bottom habitats at all sites throughout the Sanctuary. Sponges and soft corals cover a much smaller percentage of the sea floor (from about 10 percent to 20 percent). Like algae, they are highly variable, depending on the region being surveyed and the time of year.

Seagrasses are comprehensively monitored by Florida International University as part of the Sanctuary's Water Quality Protection Program. Data indicate approximately 12,800 square kilometers of seagrass beds lie within and adjacent to the Sanctuary. Some variability in seagrass cover and abundance has been identified, although populations seem relatively stable. Continued monitoring will be invaluable for detecting human impacts on the seagrass communities.

Reef Fish

Monitoring fish populations occurred for many years before the Sanctuary's designation and continues to this day. From 1979 through 1998, a total of 263 fish species representing 54 families were observed. Over half of all fish observed were from just ten species. Relatively few fish of legal size have been seen, which is consistent with several studies that indicate reef fish in the Florida Keys are highly overexploited.

Despite population declines throughout much of the Sanctuary, fish numbers in fully protected zones (Sanctuary Preservation Areas, Ecological Reserves, and Special-use and Research-only areas) are increasing to some degree. Years of data from one monitoring program show that the number of individuals of three exploited species are higher in protected zones than in fished sites. Researchers have also seen an overall increase in the average abundance of three snapper species at several sites after the sites were protected.

Mobile Invertebrates

FWRI monitors mobile invertebrates, such as spiny lobster and queen conch. Spiny lobsters continue to be more abundant in the fully protected Sanctuary Preservation Areas and Ecological Reserves than outside these areas. Researchers have found their average size is larger and catch rates (number of lobsters per trap) are higher than in reference areas during both the open and closed fishing seasons.

Queen conch populations have remained low for the last decade despite a prohibition on their collection since 1985. Attempts to supplement wild populations with laboratory reared stock and experiments aimed at improving their reproduction are designed to ameliorate the long-term decline in queen conch populations in the region.

Sea urchins are also in very low abundances, especially the long-spined urchin, suggesting poor recovery of this species since its massive Caribbean-wide die-off in 1983. Two research efforts underway are exploring means by which populations of this key species may be restored.

2.3 Non-living Marine Resources

Maritime Heritage Resources

The waters of the Florida Keys have some of the most significant maritime heritage and historical resources of any coastal community in the nation. Because of its unique geographical position on the European and American trade routes, shipwrecks in the Keys contain a record of the 500-year history of the Americas. Key West has been the crossroads of the Caribbean, and the sea has remained the common thread through the region's cultural and historic sites. The relative inaccessibility of underwater cultural sites has ensured that many delicate artifacts remain undisturbed. The importance of the region's maritime heritage resources is great, and the possibility exists for discovering some of the earliest archaeological sites in North America. A detailed description of the cultural and historical resources of the Florida Keys is contained in the "Description of the Affected Environment," of the Environmental Impact Statement (see Volume II of the Florida Keys Management Plan at http://floridakeys.noaa.gov).

Water Quality

Many water-quality parameters have been monitored Sanctuary wide by Florida International University's Southeast Environmental Research Center since 1995 as part of the Water Quality Protection Program. Thus far, results indicate that some elements (dissolved oxygen, total organic nitrogen, and total organic carbon) are present in higher concentrations in surface waters, while other indicators (salinity, turbidity, nitrite, nitrate, ammonium, and total phosphorus) are higher in bottom waters.

Geographic differences in water quality include higher nutrient concentrations in the Middle and Lower Keys and lower nutrient concentrations in the Upper Keys and Dry Tortugas. Also, declining inshore-to-offshore trends across Hawk Channel have been noted for some parameters (nitrate, ammonium, silicate, total organic carbon and nitrogen, and turbidity).

Probably the most interesting findings thus far show increases over time in total phosphorus for the Dry Tortugas, Marquesas Keys, Lower Keys, and portions of the Middle and Upper Keys, and increases in nitrate in the Southwest Florida Shelf, Dry Tortugas, Marquesas Keys, and the Lower and Upper Keys. In contrast, total organic nitrogen decreased somewhat, mostly in the Southwest Florida Shelf, the Sluiceway, and the Lower and Upper Keys. These trends may be driven by regional circulation patterns arising from the Loop Current and Florida Current, and have changed as the period of record has increased.

Stationary instruments along the reef tract continuously monitor seawater parameters and ocean states. The data are analyzed by Florida Institute of Oceanography's SEAKEYS program and periodically transmitted to satellites and made available on the Internet. Additionally, water temperature data are recorded every two hours from a series of thermographs that the Sanctuary has maintained for the past ten years.

2.4 Threats to the Ecosystem

The deterioration of the marine ecosystem in South Florida is no longer a matter of debate. Visitors, residents and scientists alike have noted the precipitous decline in the health of the coral reef ecosystem. The threats causing these visible signs of decline are numerous and often complex, ranging from direct human impacts to global climate changes.

Direct human impacts include vessel groundings, anchor damage, destructive fishing, and damage to corals as a result of divers and snorkelers standing on them. Boat propellers and large ships have damaged over 30,000 acres of seagrasses and more than 20 acres of coral reef habitat in the Sanctuary.

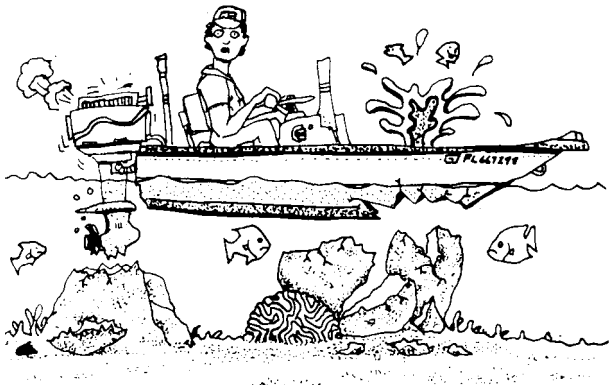
Most pressures stem from the 5 million annual visitors and 80,000 year-round residents. Their high levels of use in the Sanctuary have significant direct and indirect effects on the ecosystem. Sanctuary visitors primarily seek water-related recreation, including fishing, diving, snorkeling, and boating.

Although less immediate than direct physical damage to the corals, other stressors also significantly affect the Florida Keys ecosystem. Overfishing has dramatically altered fish and other animal populations on the coral reef, contributing to an imbalance in ecological relationships that are critical to sustaining a diversity of organisms. Eutrophication (an outcome of excess nutrients in the water, such as fertilizers) of nearshore waters is a documented problem. Wastewater and stormwater treatment and solid-waste disposal facilities are highly inadequate, directly affecting nearshore water quality. Some solutions to water quality problems are being implemented, but given the scope of the problem, more action is required.

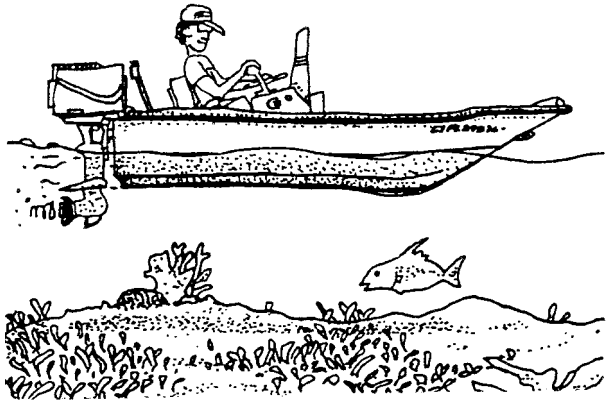
In Florida Bay, reduced freshwater flow has increased plankton blooms, sponge and seagrass die-offs, and fish kills. Since Florida Bay and nearshore waters provide important nursery and juvenile habitat for a variety of reef species, the declines in these areas affect the overall health and structure of offshore coral reefs. Therefore, regional strategies to address the quantity, quality, timing, and distribution of freshwater flows into the South Florida ecosystem and Florida Bay through the Comprehensive Everglades Restoration Plan are critical.

In addition, seasonal and yearly seawater temperature fluctuations, increasing solar radiation, and atmospheric changes all affect the ecosystem. The impacts are seen in coral disease and bleaching, which have increased in frequency, duration and range, coinciding with the ten warmest years on record. Under normal conditions, corals and reef organisms would be expected to tolerate and recover from sporadic events such as temperature variation. However, additional human-induced stresses are likely affecting the ability of these organisms to adequately recover from climate fluctuations.

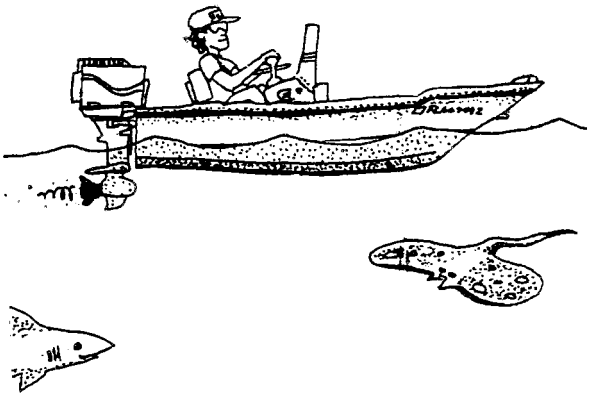
3.0 ACTION PLANS



BROWN, BROWN, RUN AGROUND



GREEN, GREEN, NICE AND CLEAN



BLUE, BLUE, SAIL ON THROUGH

What Are Action Plans?

Action plans are the means by which the Sanctuary identifies and organizes the wide variety of management tools it employs to manage and protect its marine resources. "Road maps" for management, action plans articulate the programs and projects used to address the resource issues identified in the Sanctuary and to fulfill the purposes and policies of the NMSA. Each action plan is composed of *strategies* sharing common management objectives and *activities*, which are the specific actions the Sanctuary and its partners will take to implement the strategies.

What Are The Action Plans In This Document?

The following chapters are the action plans that guide every aspect of sanctuary management. Readers should note that the *1997 Final Management Plan* for the Sanctuary included ten action plans, presented in alphabetical order to address management needs related to:

- Channel/Reef Marking
- Education and Outreach
- Enforcement
- Mooring Buoys
- Regulatory
- Research and Monitoring
- Submerged Cultural Resources
- Water Quality
- Volunteer
- Zoning

In this revised management plan, four new action plans have been added: Science Management and Administration Action Plan, Damage Assessment and Restoration Action Plan, Operations Action Plan, and, Evaluation Action Plan. The Submerged Cultural Resources Action Plan has been changed to the Maritime Heritage Resources Action Plan, while the Channel/Reef Marking Action Plan has been renamed to more accurately reflect the intent, which is "Waterway Management", and the word "Marine" has been added to the Zoning Action Plan to clarify the title.

Management Divisions

In this revised management plan, the individual action plans have been grouped into five management divisions. This was done to both improve the organization of the plan as well as to highlight the management goals for each of the plans. The individual action plans for the Sanctuary are organized in the following divisions:

Sanctuary Science

- Science Management and Administration Action Plan
- Research and Monitoring Action Plan

Education, Outreach and Stewardship

- Education and Outreach Action Pan
- Volunteer Action Plan

Enforcement and Resource Protection

- Regulatory Action Plan
- Enforcement Action Plan
- Damage Assessment and Restoration Action Plan
- Maritime Heritage Resources Action Plan

Resource Threat Reduction

- Marine Zoning Action Plan
- Mooring Buoy Action Plan
- Waterway Management Action Plan
- Water Quality Action Plan

Administration, Community Relations and Policy Coordination

- Operations Action Plan
- Evaluation Action Plan

Implementing Action Plans

The FKNMS defines a place where many governmental and non-governmental organizations work in partnership to achieve the Sanctuary's goals: protect resources and their conservation, recreational, ecological, historical, research, educational, or aesthetic values through comprehensive long-term management. This management plan describes these collective efforts, and its implementation relies on resources and efforts from a variety of partners. Table 3.1 describes the extent to which each of the action plans and strategies within this revised management plan can be implemented under three funding scenarios. Funding from both NOAA and other partners, (e.g. EPA, Monroe County, etc.) is considered in ranking the level of implementation.

Table 3.1 Action Strategy Implementation Over Five Years Under Three Funding Scenarios

Implementation* with NOAA Funding ● - High ⦿ - Medium ○ - Low	Implementation* with Partner Funding ◆ - High ◈ - Medium ◇ - Low	**Scenario 1: Level Funding**	**Scenario 2: 5% per year increase**	**Scenario 3: 10% per year increase**
Sanctuary Science				
Science Management and Administration Action Plan				
Strategy B.11 – Issuance of Sanctuary Research Permits		●	●	●
Strategy W.29 – Dissemination of Findings		⦿	⦿	●
Strategy W.32 – Maintaining a Technical Advisory Committee		●	●	●
Strategy W.34 – Regional Science Partnerships and Reviews		⦿	⦿	●
Strategy W.35 – Data Management		◈	◈	◆
Research and Monitoring Action Plan				

* Implementation ranking considers the priority of each strategy as well as the percentage of activities that could be initiated, maintained, and/or completed under differing funding scenarios.

	Strategy W.33 – Ecological Research and Monitoring	⦿◈	⦿◈	●◆
	Strategy Z.6 – Marine Zone Monitoring	⦿	⦿	●
	Strategy W.36 – Conducting Socioeconomic Research	●	●	●
	Strategy F.3 – Researching Queen Conch Population Enhancement Methods	●◆	●◆	●◆
	Strategy F.7 – Researching Impacts from Artificial Reefs	⦿◈	⦿◈	●◆
	Strategy F.6 – Fisheries Sampling	⦿◈	⦿◈	●◆
	Strategy F.11 – Evaluating Fishing Gear/Method Impacts	○◇	○◇	⦿◈
	Strategy F.15 – Assessing Sponge Fishery Impacts	⦿◈	⦿◈	●◆
	Strategy W.18 – Conducting Pesticide Research	○◇	○◇	⦿◈
	Strategy W.22 – Assessing Wastewater Pollutants Impacts	●◆	●◆	●◆
	Strategy W.23 – Researching Other Pollutants and Water Quality Issues	⦿◈	⦿◈	●◆
	Strategy W.24 – Researching Florida Bay Influences	⦿◈	⦿◈	●◆
	Strategy W.21 – Developing Predictive Models	⦿◈	⦿◈	●◆
Education, Outreach and Stewardship				
	Outreach and Education Action Plan			
	Strategy E.4 – Developing Training, Workshops and School Programs	○	⦿	⦿
	Strategy E.6 – Continuing the Education Working Group	●	●	●
	Strategy E.10 – Establishing Public Forums	⦿	⦿	●
	Strategy E.11 – Participating in Special Events	⦿	⦿	●
	Strategy E.1 – Printed Product Development and Distribution	○	○	⦿
	Strategy E.2 – Continued Distribution of Audio-Visual Materials	⦿	●	●
	Strategy E.3 – Continue Development of Signs, Displays, Exhibits, and Visitor Centers	⦿	⦿	⦿
	Strategy E.5 – Applying Various Technologies	⦿	⦿	⦿
	Strategy E.12 – Professional Development of Outreach and Education Staff	○	○	⦿
	Volunteer Action Plan			
	Strategy V.1 – Maintaining Volunteer Programs	⦿	⦿	⦿
	Strategy V.2 – Working with Other Organization/Agency Volunteer Programs	○	○	○
	Strategy V.3 – Providing Support for Volunteer Activities	○	○	⦿
Enforcement and Research Protection				
	Regulatory Action Plan			
	Strategy R.1 – Maintaining the Existing Permit Program	⦿	⦿	●
	Strategy R.2 – Regulatory Review	⦿	⦿	●
	Enforcement Action Plan			
	Strategy B.6 – Acquiring Additional Enforcement Personnel	●	●	●
	Damage Assessment and Restoration Action Plan			
	Strategy B.18 – Injury Prevention	○	○	⦿
	Strategy B.19 – Implementing DARP Notification and Response Protocols	○	○	⦿
	Strategy B.20 – Damage Assessment and Documentation	⦿◇	⦿◇	●◇
	Strategy B.21 – Case Management	◆	◆	◆
	Strategy B.22 – Habitat Restoration	◈	◈	◆
	Strategy B.23 – Data Management	○	⦿	⦿
	Maritime Heritage Resources Action Plan			

		Strategy MHR.1 – MHR Permitting	●◈	●◈	●◈
		Strategy MHR.2 – Establishing an MHR Inventory	○◈	○◈	⦿◈
		Strategy MHR.3 – MHR Research and Education	○◇	○◇	⦿◈
		Strategy MHR.4 – Ensuring Permit Compliance through Enforcement	●◈	●◈	●◈
		Strategy MHR.5 – Ensuring Interagency Coordination	●◈	●◈	●◈
Resource Threat Reduction					
	Marine Zoning Action Plan				
		Strategy Z.1 – Wildlife Management Areas	○	⦿	●
		Strategy Z.2 – Ecological Reserves	⦿	●	●
		Strategy Z.3 – Sanctuary Preservation Areas	○	⦿	●
		Strategy Z.4 – Existing Management Areas	●	●	●
		Strategy Z.5 – Special-use Areas	○	⦿	●
	Mooring Buoy Action Plan				
		Strategy B.15 – Mooring Buoy Management	●	●	●
	Waterway Management Action Plan				
		Strategy B.1 – Boat Access	◆	◆	◆
		Strategy B.4 – Waterway Management/Marking	◈	◈	◆
	Water Quality Action Plan				
		Strategy W.19 – Florida Bay Freshwater Flow	●◆	●◆	●◆
		Strategy W.3 – Addressing Wastewater Management Systems	◇	◇	◈
		Strategy W.5 – Developing and Implementing Water Quality Standards	◇	◇	◇
		Strategy W.7 – Resource Monitoring of Surface Discharges	◆	◆	◆
		Strategy W.11 – Stormwater Retrofitting	◇	◇	◈
		Strategy W.14 – Instituting Best Management Practices	◈	◈	◆
		Strategy B.7 – Pollution Discharges	⦿◈	⦿◈	●◆
		Strategy L.1 – Elimination of Wastewater Discharge from Vessels	⦿◈	⦿◈	●◆
		Strategy L.3 – Marina Operations	◈	◈	◆
		Strategy L.7 – Assessing Solid Waste Disposal Problem Sites	◇	◇	◈
		Strategy W.15 – HAZMAT Response	○◇	○◇	⦿◈
		Strategy W.16 – Spill Reporting	○◇	○◇	⦿◈
		Strategy L.10 – HAZMAT Handling	◇	◇	◈
		Strategy W.17 – Refining the Mosquito Spraying Program	◇	◇	◈
		Strategy W.10 – Addressing Canal Water Quality	◇	◇	◈
Administration					
	Operations Action Plan				
		Strategy OP.1 – Addressing Administrative Policy Issues	⦿	⦿	⦿
		Strategy OP.2 – Addressing Resource Policy Issues	⦿	⦿	⦿
		Strategy OP.3 – Addressing Legal Issues	⦿	⦿	●
	Evaluation Action Plan				
		Strategy EV.1 – Measuring Sanctuary Performance Over Time	●	●	●

3.1 SANCTUARY SCIENCE

The Sanctuary Science management division consists of two action plans: Science Management and Administration, and Research and Monitoring. An effective science program requires management and administration that focuses on coordinating research and monitoring projects, communicating findings of the program, and engaging in other regional science efforts. This coordination role is substantial with participation from a number of government, academic and non-governmental scientists. Permitting is a component of this action plan, along with other critical aspects of administering an effective science program.

The monitoring component of the Research and Monitoring Action Plan has established a baseline of information on spatial patterns and temporal trends in natural resources and other components of the ecosystem. To improve our understanding of patterns and trends, research elucidates:

- Cause-and-effect relationships of specific ecological interactions;
- Processes that shape ecosystem structure and function; and,
- How management actions or other factors modify ecosystem processes.

Research and monitoring projects investigate fundamental processes and specific topics in support of science-based management. The resulting scientific findings are used to:

- Evaluate the effectiveness of the Sanctuary and its management actions;
- Distinguish between the effects of human activities and natural variability;
- Develop hypotheses about causal relationships that can then be investigated; and,
- Validate models that guide management actions.

3.1.1 SCIENCE MANAGEMENT & ADMINISTRATION ACTION PLAN

Introduction

Scientific research and monitoring in the FKNMS involves dozens of projects conducted by a wide range of academic institutions, state and federal agencies, and other organizations. It is essential to maintain overall coordination and management of this complex set of activities and the information it generates to achieve science-based management of Sanctuary resources and to effectively communicate findings of the science program to interested parties. In addition, many scientific studies do not comply with Sanctuary regulations, often in the form of temporarily placing sampling apparatus on the sea floor, and require permits to proceed.

Sanctuary managers regularly require technical advice on best-management practices of natural resources and other issues, and obtain this advice from a Technical Advisory Committee (TAC) comprised mainly of scientists conducting projects in the FKNMS. This advice has been of great value, for example when Sanctuary managers developed a comprehensive science plan (Research and Monitoring Action Plan).

There are several major efforts in South Florida that are highly relevant to Sanctuary management such as the South Florida Ecosystem Restoration Task Force and the Florida Bay and Adjacent Marine Systems Science Program, which require participation by Sanctuary staff. The Florida Reef Tract is a nationally significant ecosystem that lies at the southernmost margin of the greater South Florida ecosystem. "Upstream" management actions may impact Sanctuary resources, and FKNMS staff are responsible for including such considerations at a host of meetings and discussions.

Goals and Objectives

The goal of the Science Management and Administration Action Plan is to define the elements of a coordinated science program that meets management objectives, informs the public about the state of Sanctuary resources, and provides relevant information for regional efforts such as Everglades restoration.

The objectives of this action plan are to:

- Facilitate and manage scientific and educational projects that entail prohibited activities;
- Broadly disseminate findings of the science program and use this information in regional science efforts;
- Utilize the technical expertise of the regional scientific community in Sanctuary decision-making; and
- Define the elements of a distributed data management strategy.

Implementation

The Science Management and Administration Action Plan will be implemented by the FKNMS, EPA, FWC, and FDEP.

Accomplishments

There have been substantive accomplishments in scientific coordination, data collection and dissemination of findings since the 1997 management plan. Examples include:

- An independent Science Advisory Panel, convened in December 2000, to review the science program and make recommendations about future directions.
- *Florida Keys National Marine Sanctuary Comprehensive Science Plan*, addressing the science panel's recommendations and identifying research and monitoring priorities in support of specific management objectives.
- A 2004 conference, *Connectivity: Science, People, and Policy in the FKNMS*, to engage the public about recent scientific findings regarding resource condition and linkages between natural resources, socio-economic use, and management challenges.
- A symposium at NOAA headquarters in 2001, conducted to present findings of the monitoring programs and associated projects to a broad audience of managers, scientists, and other interested parties.
- Annual reports on findings of the Science Program including the Water Quality Protection and Marine Zone Monitoring Programs.
- Presentations at conferences and workshops.
- Publications in peer-reviewed journals, books, and conference proceedings.

Strategies

There are five strategies in this Action Plan:

- B.11 Issuance of Sanctuary Research Permits
- W.29 Dissemination of Findings
- W.32 Maintaining a Technical Advisory Committee
- W.34 Regional Science Partnerships and Reviews
- W.35 Data Management

Each of these strategies is detailed below. Table 3.2 provides estimated costs for implementation of each strategy over the next five years.

Table 3.2 Estimated Costs of the Science Management and Administration Action Plan

Science Management and Administration Action Plan Strategies	Estimated Annual Cost (in thousands)*					Total Estimated 5 Year Cost
	YR 1	YR 2	YR 3	YR 4	YR 5	
B.11: Issuance of Sanctuary Research Permits	20	20	20	20	25	*105*
W.29: Dissemination of Findings	15	15	15	15	20	*80*
W.32: Maintaining a Technical Advisory Committee	10	10	10	10	15	*55*
W.34: Regional Science Partnerships and Reviews	60	60	65	65	70	*320*
W.35: Data Management	60	60	65	65	70	*320*
Total Estimated Annual Cost	*165*	*165*	*175*	*175*	*200*	880

* Contributions from outside funding sources also anticipated.

STRATEGY B.11 ISSUANCE OF SANCTUARY RESEARCH PERMITS

Strategy Summary
This strategy allows researchers to conduct prohibited activities if these activities further highly beneficial research and monitoring in the Sanctuary. Research activities that are not prohibited are maintained in a voluntary research registry. Permits are monitored and their provisions enforced (see also Strategy R.1 in the Regulatory Action Plan, 15 CFR 922.166, and the Sanctuary web site: http://floridakeys.noaa.gov/research_monitoring/permits.html).

Activities (1)

(1) Continue Research Permitting Program. Sanctuary staff continues to manage, authorize, and enforce the permitting program and review all permit applications. Strategy R.1 in the Regulatory Action Plan further describes the full permitting program. The FWC and Monroe County also issue permits for certain activities within their jurisdictions and staff coordinates with these programs.

> *Status:* On-going.
> *Implementation*: When determining whether to issue a research permit, the potential for damage is compared to expected benefits. Research that may result in resource alteration must be of the highest quality and be considered highly beneficial. Staff may request a committee of coral experts to review applications to collect live coral. Information and forms required for a research permit request are posted at the Sanctuary's web site (http://floridakeys.noaa.gov/research_monitoring/permits.html). The results of permitted research are evaluated through a peer review. The Sanctuary is the lead agency, in collaboration with the FWC and Monroe County.

STRATEGY W.29 DISSEMINATION OF FINDINGS

Strategy Summary
This strategy will develop a program to synthesize and disseminate scientific research and monitoring results, including an information exchange network, conferences, and support for the publication of research findings in peer-reviewed scientific journals. It will help disseminate research findings among scientists, resource managers, and the general public.

Activities (5)

(1) Develop Periodic Reports on Sanctuary Health. This activity will create *State of the Sanctuary* reports for the general public. The reports will include up-to-date information on the status and trends of water quality, critical habitats, and species of particular interest. The reports will review the effectiveness of marine zoning in protecting biodiversity, sensitive habitats, fisheries resources and in modifying use patterns and user perceptions. The reports will also consider the state of the Sanctuary in the context of other tropical marine ecosystems at regional and global scales. Reports will be prepared periodically as the Science Program produces significant new information.

> *Status:* No action has been taken to publish a *State of the Sanctuary* report; however, an annual science report is posted at the Sanctuary's Internet site.
> *Implementation:* The Sanctuary is the lead agency.

(2) Continue to Communicate Findings of the Science Program. Staff conducts symposia and prepares newsletter articles, public presentations, annual reports, and other written and oral materials.

> *Status:* On-going.
> *Implementation:* Sanctuary staff publish a newsletter (*Sounding Line*) (refer to the Outreach and Education Action Plan) and make frequent public presentations. An annual science report is posted at the Sanctuary's Internet site. In April 2003, Sanctuary staff organized a symposium at the Joint Conference on the Science and Restoration of the Greater Everglades and Florida Bay Ecosystem entitled "The Marine Ecosystems of the Florida Keys." The half-day symposium included 10 oral presentations covering a wide range of topics. The Sanctuary is the lead agency. Collaborating organizations have primary roles.

(3) Establish an Information Exchange Network. This activity would develop a compendium of on-going and planned research to be updated periodically.

> *Status:* No action has been taken to develop a compendium; however, a summary of on-going monitoring and research is posted at the Sanctuary's Internet site.
> *Implementation:* A Sanctuary Science Advisory Panel (December 2000) reviewed existing science projects and recommended future action. Based on that review, a *Final Draft Comprehensive Science Plan* has been developed and the Technical Advisory Committee has provided further comment and review. The Sanctuary is the lead agency; the EPA has a primary role.

(4) Sponsor Conferences. This activity involves sponsoring conferences to keep scientists and managers informed on research and monitoring results and existing or planned management actions.

Status: On-going.
Implementation: Sanctuary and EPA staff convened a meeting in December 2000 at which principal investigators presented all elements of the science program to an independent panel for peer review. In December 2001, the Sanctuary, EPA, State of Florida, and other agency partners hosted a symposium in the NOAA Main Auditorium entitled "The Florida Keys National Marine Sanctuary: An Ecosystem Report Card." This one-day symposium presented results from status and trends monitoring of coral reefs, seagrasses, and water quality, and also reviewed performance of fully protected marine zones on benthic communities and fishery populations. Principal investigators from each monitoring project were present to discuss their findings and answer questions. The Sanctuary is the lead agency; the EPA and FWC have primary roles.

(5) Support Journal Publication. This activity involves funding the publication of research and monitoring findings in peer-reviewed scientific and management journals, as needed. Some publications have no associated fees.

Status: On-going.
Implementation: Recent publications have appeared in *Gulf and Caribbean Research, Marine Technology Society Journal,* and *Proceedings of the 2003 Georgia Basin/Puget Sound Research Conference*. NOAA is the lead agency; the EPA and FWC have primary roles.

STRATEGY W.32 MAINTAINING A TECHNICAL ADVISORY COMMITTEE

Strategy Summary
This strategy will maintain a previously established Technical Advisory Committee composed of scientists and other staff from Federal agencies, state agencies, academic institutions, and private, non-profit organizations as well as knowledgeable citizens. Its purpose is to advise the EPA and the Sanctuary on the design and prioritization of water quality and ecological research and monitoring.

Activities (1)

(1) Convene Meetings of a Technical Advisory Committee. The Technical Advisory Committee meets once or twice per year to advise Sanctuary managers. The EPA develops agendas in consultation with the Sanctuary and FDEP.

Status: On-going.
Implementation: The EPA and FDEP are the lead agencies; the Sanctuary has a primary role.

STRATEGY W.34 REGIONAL SCIENCE PARTNERSHIPS AND REVIEWS

Strategy Summary
Sanctuary staff actively participate in science-related committees, review panels, and other groups that collaborate on science issues pertaining to South Florida, coral reefs, resource management, and other topics. This strategy ensures that consideration of Sanctuary resources is included in regional planning, that there is broad-based recognition of scientific findings concerning the Sanctuary, and that Sanctuary expertise is shared with partners.

Activities (1)

(1) Continue Regional Science Partnerships and Reviews. Several Sanctuary staff are members of or participate in the U.S. Coral Reef Task Force, South Florida Ecosystem Restoration Task Force's Working Group, Comprehensive Everglades Restoration Plan Project Delivery Teams, Florida Bay and Adjacent Marine Systems Program Management Committee, grant proposal review panels, and other committees and panels.

> *Status:* On-going.
> *Implementation:* Sanctuary staff regularly participate in meetings of various committees and panels as noted above. NOAA and FWC are the lead agencies; the EPA and FDEP have primary roles.

STRATEGY W.35 DATA MANAGEMENT

Strategy Summary
As technologies evolve, research and monitoring programs become more complex and the volume of information increases. It is clear that a distributed data management strategy is most appropriate. This strategy centers around an Internet-based data search engine that points interested parties to Internet sites that serve the requested databases, maps, text files, etc. For the most part, these Internet sites would be maintained by the information creators to ensure data currency and accuracy. This strategy is being carried out in accordance with recommendations of the Technical Advisory Committee and FWC. It evolved from W.33: Ecological Research and Monitoring (Activity 2 – Establish an Ecological Information System) and W.28: Regional Database.

Activities (3)

(1) Continue the Ecological Information System. Spatial and temporal information about ecological resources has been incorporated into an existing South Florida Geographic Information System (GIS). Information summarizing benthic habitats, species distributions and life histories, water quality, etc., is included. These are essential baseline data for effective ecological monitoring. Additionally, information will be derived from existing sources such as the Minerals Management Service / Marszalek / Dade Department of Environmental Resource Management maps and the NOAA/FWC benthic habitat maps, all of which have been digitized and incorporated into the FWC/Fish and Wildlife Research Institute's Marine Resources GIS.

> *Status:* On-going.
> *Implementation:* The FWC and other agencies, pending funding, have several separate but related projects underway that should meet this need. For example, the FWRI worked with the ACOE and Florida Department of Community Affairs (DCA) on the Florida Keys Carrying Capacity Study, which generated new scenario-based information. The carrying capacity project incorporated comprehensive growth plans, human-use, and environmental data into a model designed to facilitate growth management. Monroe County is also developing a GIS for land-use analysis, with some marine applications. Pending funding, the FWC would be the lead agency for integrating the data for easy access by Sanctuary staff over the Internet using map servers and Internet-served databases.

(2) Establish a Data Management Protocol. This protocol will standardize the way investigators manage data by creating a single approach to maintaining, storing, and accessing digital data. For many years, researchers have maintained and analyzed their data as they saw fit. With research shifting focus from single organisms to ecosystems, the need arises to integrate multiple databases. In addition, a dynamic, distributed system is necessary for annual data gathering and archiving. A regional database and data management system will also be

established for recording research results and the biological, physical, and chemical parameters associated with monitoring programs.

Status: No action has been taken to complete the protocol.
Implementation: Pending funding, the FWC will continue to produce annual CD-ROMs for the Water Quality Protection and Marine Zone Monitoring Programs. Some principal investigators are posting data and reports at individual web sites. The FWC is the lead agency; the EPA and Sanctuary have primary roles.

(3) Develop a Geographic Information System. This activity seeks to use photographs of sea bottom features near coral reefs to provide baseline data on coral cover at a particular time. The photographs provide information on the location of monitoring stations in relation to benthic cover and assist mooring-buoy specialists in pinpointing the location of buoy anchors. A comparison between 1995 and 1999 color infrared photographs shows seagrass damage over time, and turbidity increases caused by boats crossing over shallow areas. GIS analysis also shows the status of nearshore areas and details of the destruction caused by vessel groundings. A GIS will provide satellite views of the entire Florida Keys, showing areas of monitoring efforts, and nearshore aerial photographs of research areas where benthic habitat studies are being conducted.

Status: On-going.
Implementation: Staff and volunteers assist with GIS software and imagery.