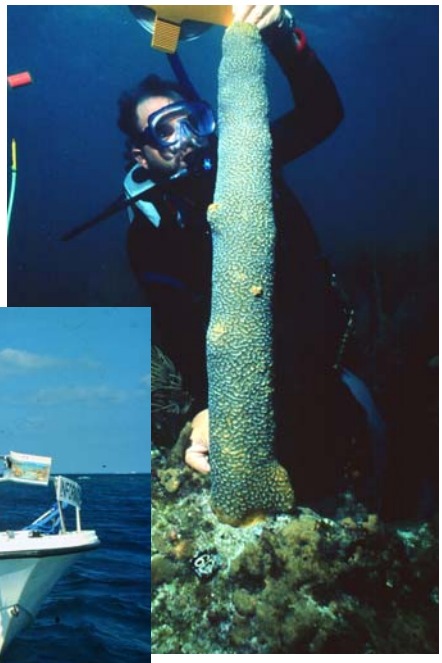
Florida Keys
National Marine Sanctuary
Draft Revised Management Plan



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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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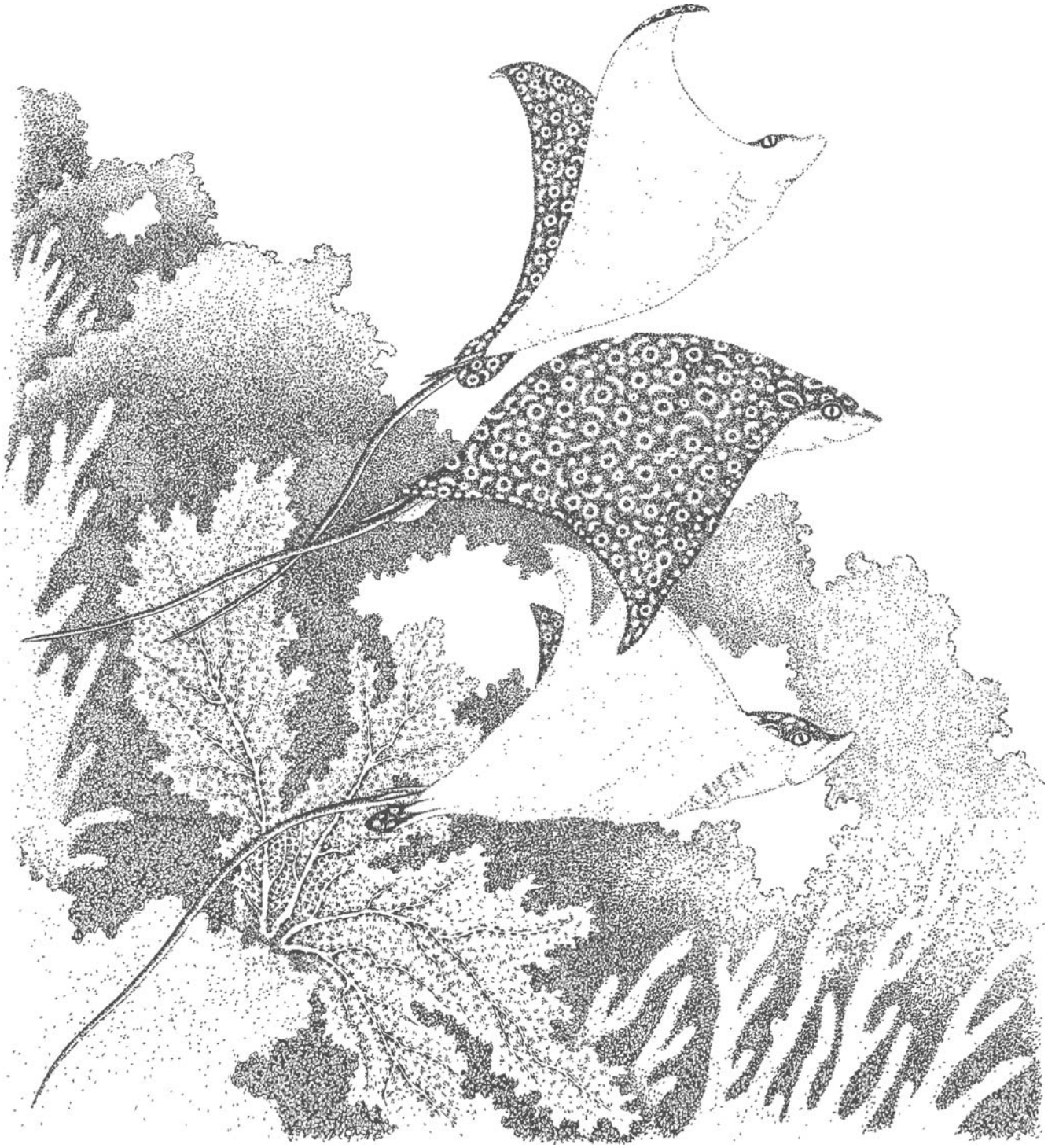
Acronyms

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

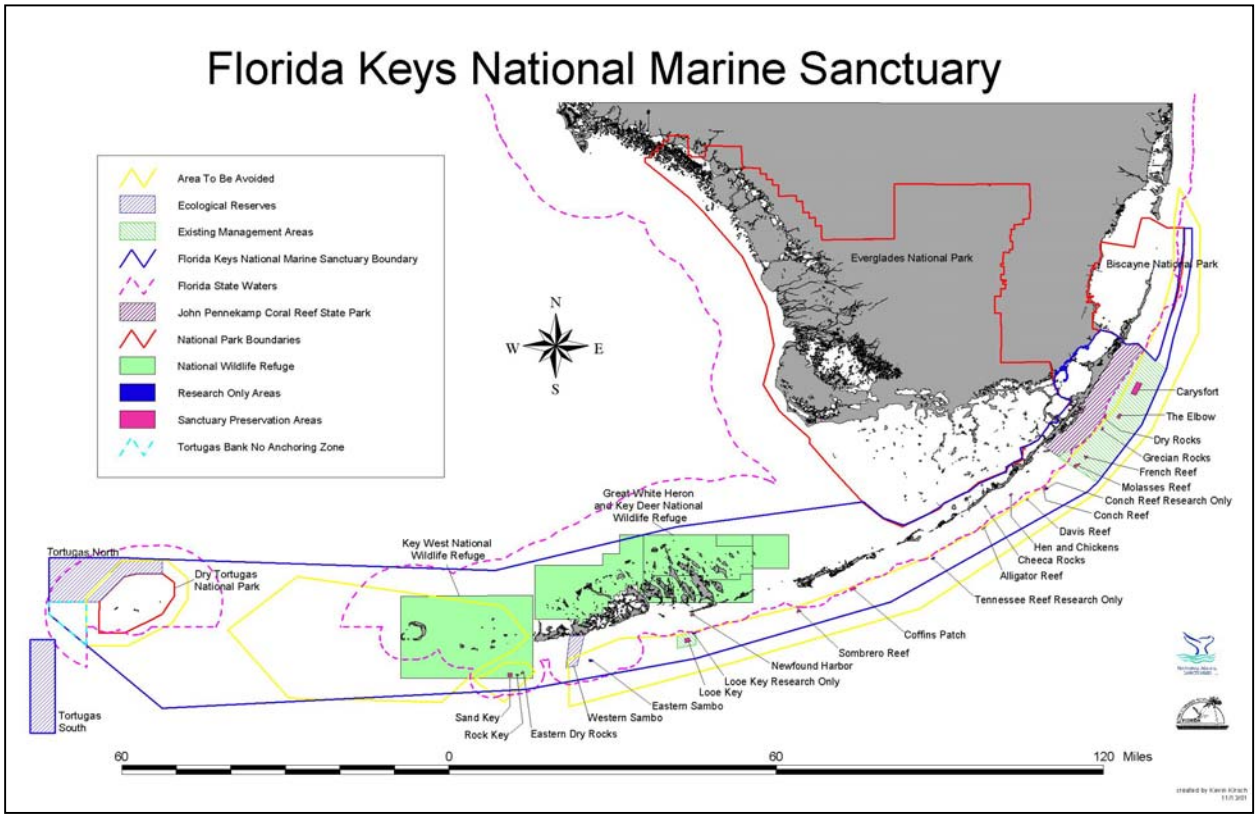
National Park and up its eastern boundary along the reef tract at a depth of approximately 60 feet until its northeastern-most point.

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.

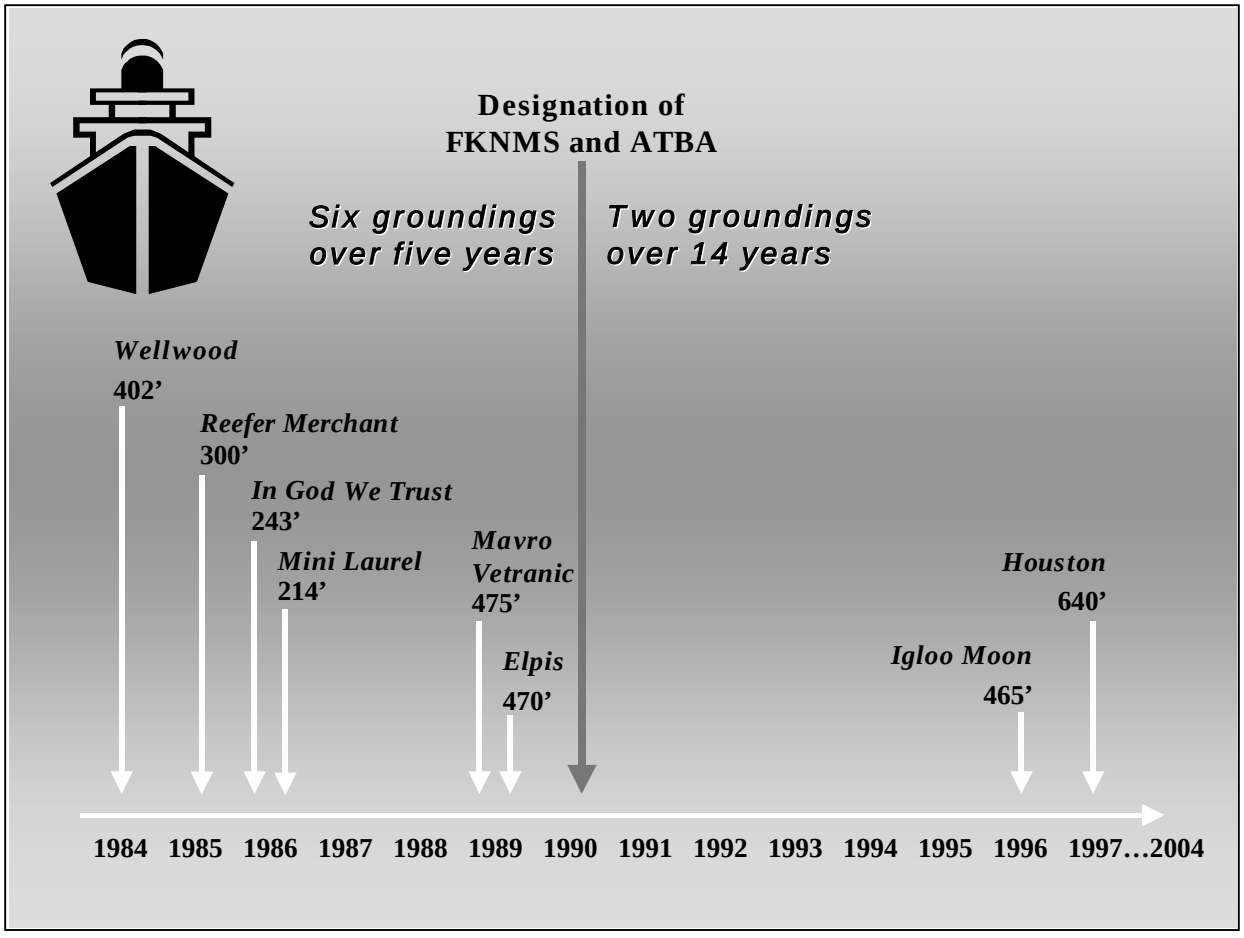
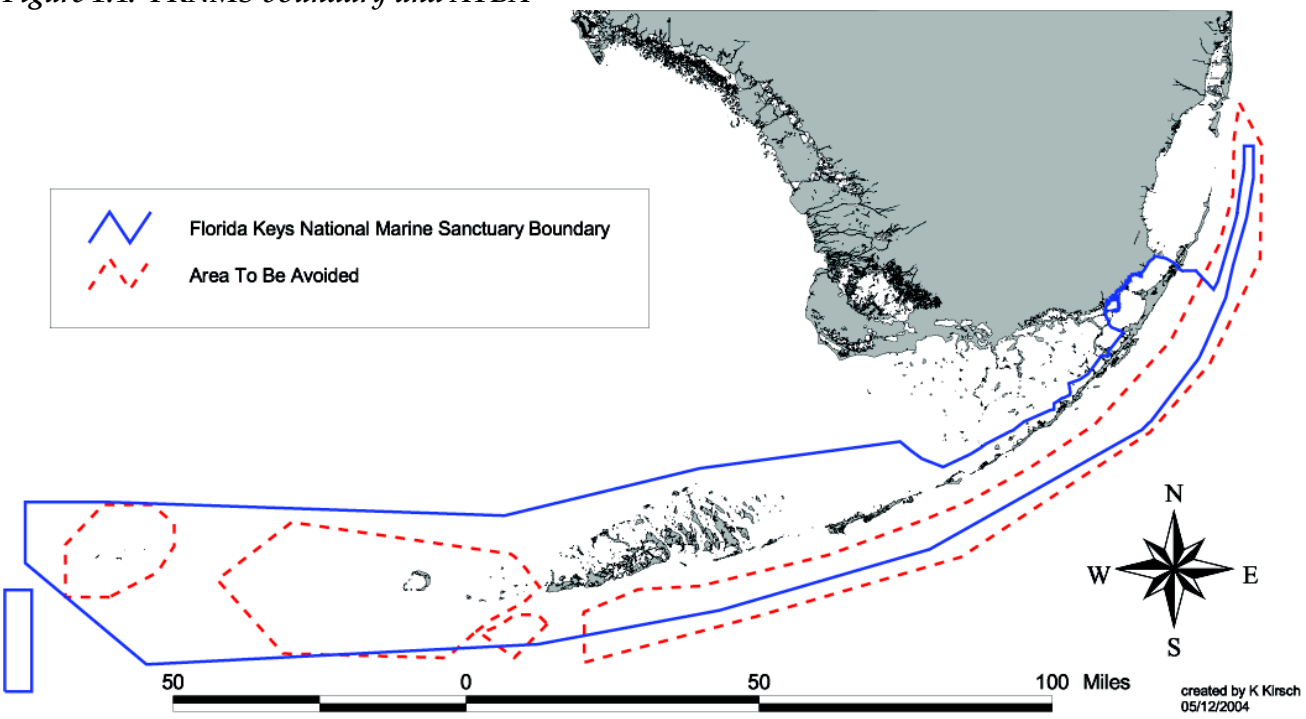


Figure 1.4. FKNMS boundary and ATBA



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.

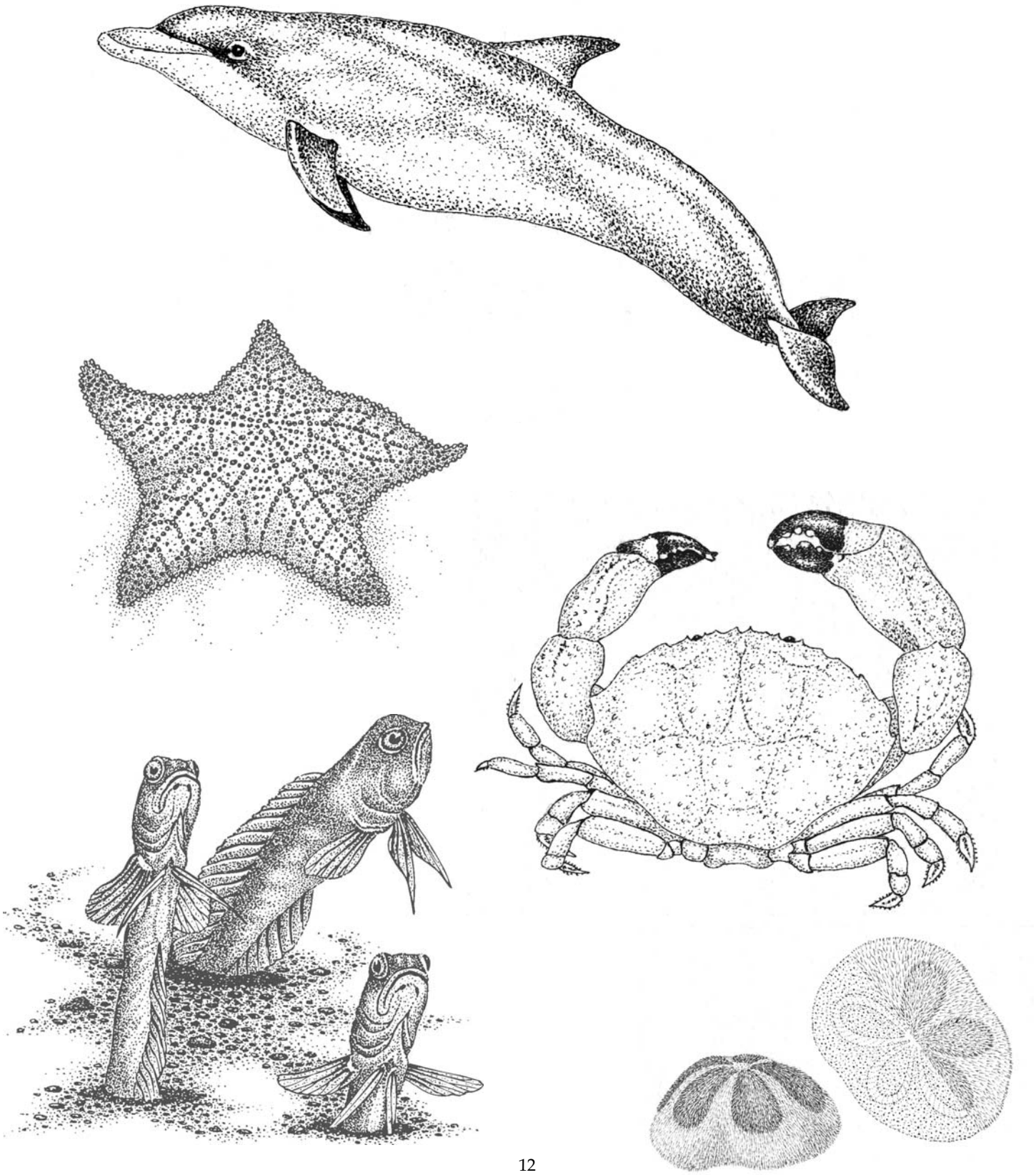
9. Damage Assessment and Restoration. The Damage Assessment and Restoration Action Plan is new to this document but is based on accumulated data and lessons learned since 1982. The cross-disciplinary strategies will prove useful in reducing the number of vessel groundings in Sanctuary waters as well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

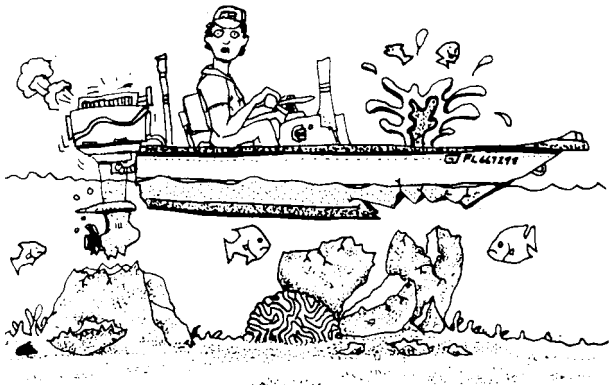
Most pressures stem from the 5 million annual visitors and 80,000 year-round residents. Their high levels of use in the Sanctuary have significant direct and indirect effects on the ecosystem. Sanctuary visitors primarily seek water-related recreation, including fishing, diving, snorkeling, and boating.

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.

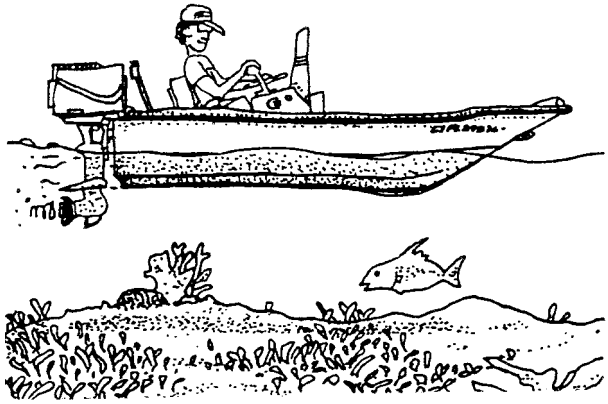
In Florida Bay, reduced freshwater flow has increased plankton blooms, sponge and seagrass die-offs, and fish kills. Since Florida Bay and nearshore waters provide important nursery and juvenile habitat for a variety of reef species, the declines in these areas affect the overall health and structure 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.

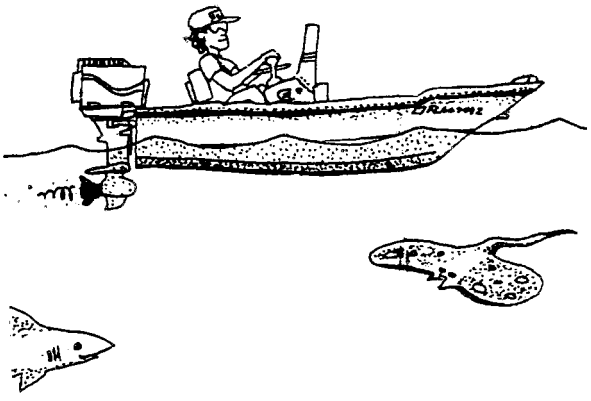
3.0 ACTION PLANS



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	●	●	●

3.4 RESOURCE THREAT REDUCTION

Resource protection and conservation can be achieved with non-regulatory tools such as those action plans bundled in this management division. Those action plans include: the Marine Zoning Action Plan; the Mooring Buoy Action Plan; the Waterway Management Action Plan; and the Water Quality Action Plan. Each of these action plans contains tools that allow managers to directly protect and conserve Sanctuary resources through the implementation of various management strategies. These action plans when implemented provide very targeted means of protecting resources whether it is by establishing marine zones to conserve Sanctuary resources or by providing mooring buoys to eliminate anchor damage to corals in high-use areas. The effective marking of channels and waterways to aid in the prevention of vessel groundings is yet another non-regulatory approach to protecting Sanctuary resources.

Water quality degradation is the primary issue that is affecting the health and vitality of Sanctuary resources. This management division includes the Water Quality Action Plan that is designed to identify the sources of water quality decline and to outline the various corrective management actions that need to be implemented to improve water quality.

3.4.4 Water Quality Action Plan

Introduction

Overview

Declining water quality continues to be a major concern for the Sanctuary. The Water Quality Protection Plan, mandated by Congress and developed jointly by EPA, NOAA, the State of Florida, and Monroe County, has been an evolving and effective model for identifying water-quality problems and solutions. The model has also been productive in providing the extensive monitoring and research needed to implement science-based management. However, the model has been of less help in resolving some local concerns regarding implementation.

Each activity in the Water Quality Action Plan is derived from the management strategies described in the 1997 final management plan. The strategies address sources of pollution, priority corrective actions and compliance schedules. The strategies seek to restore and maintain a balanced, indigenous population of corals, shellfish, fish and wildlife, and recreation in and on the water. The strategies include a water-quality monitoring program and opportunities for public participation in all aspects of development and implementation. This action plan is an abbreviated version of Strategies and Activities described in the *Water Quality Protection Program Document.* The Water Quality Protection Program' s *Progress Report on Implementation* (March 1997) was revised and updated in May 1998, January 1999, and June 2001. The details of research and monitoring strategies related to water quality are published in the Sanctuary's *Comprehensive Science Plan*.

Relationship to Other Action Plans

Many water quality strategies appear in other action plans because of the need to establish separate components for common goals. For example, in addition to addressing water quality, a strategy may have research, education, or volunteer components. If a strategy appears in more than one action plan, this is noted.

Goals and Objectives

The goal of the Water Quality Action Plan is to work with Federal, State and local governments to understand and address water quality problems that plague the south Florida Ecosystem.

The objectives of this action plan are to work with relevant agencies and the public to increase understanding of water quality issues and address the issues through research, monitoring and the development and implementation of wastewater and stormwater master plans, as well as development of wastewater treatment facilities.

Implementation

Strategies are typically implemented by a combination of Federal, state, and local effort. The U.S. EPA and the FDEP lead the implementation of most strategies in this plan. Others entities, including Monroe County, the South Florida Water Management District, the Florida Department of Health, and the U.S. Coast Guard, have also led major efforts.

Costs
Based upon 1997 estimates in the *Water Quality Protection Program Document,* the cost to implement all strategies was initially estimated to be between $290 million and $510 million. Two expensive strategies, stormwater system retrofitting ($200 million) and wastewater infrastructure ($57 million to $257 million) accounted for most of that. Excluding stormwater and wastewater strategies, the cost was estimated between $34 million and $55 million.

Since those estimates were made, Monroe County has updated its *Sanitary Wastewater Master Plan* and *Stormwater Master Plan*. The estimates in those documents for complete implementation of recommendations are, in the *Wastewater Master Plan,* $520 million, and in the *Stormwater Master Plan,* $500 million. Costs of the remaining activities have not been re-estimated, but can be assumed to be somewhat higher than original estimates. Funding comes from a combination of public (Federal, state and local) and private sources. Eighteen government institutions have been identified as potential participants. Table 3.14 lists estimated costs to implement each strategy and its component activities.

Contingency Planning for Changing Budgets
The Water Quality Action Plan includes a wide variety of strategies and activities that will be implemented by various agencies and funded through various mechanisms. A separate study of potential funding sources was conducted by the EPA, and is included in the Water Quality Protection Program Phase II Report. The EPA and DEP, with guidance from the Technical Advisory Committee (established under strategy W.32, found in the Science Management and Administration Action Plan), will be responsible for reprioritizing strategies and activities depending on the available funds.

Accomplishments
Since the 1997 management plan went into effect, the Sanctuary and its partners in water quality protection have accomplished many of its initial goals. Highlights of the accomplishments include:

- Developed the first Water Quality Protection Program for a National Marine Sanctuary, including a comprehensive Action Plan and Implementation Plan at a cost of $1.3 million.
- Established a high-level Water Quality Steering Committee and Technical Advisory Committee.
- Fully implemented 26 of 49 high-priority activities and 37 of 95 total activities in the initial Water Quality Action Plan.
- Completed ten years of comprehensive monitoring throughout the Sanctuary related to water quality, seagrasses, and coral reef/hard-bottom communities at a total cost of $10 million.
- Developed and implemented a Data Management Program for the Sanctuary at a cumulative cost of $695,000.
- 15 special studies and research projects designed to identify cause-and-effect relationships between pollutants and ecological impacts at a total cost of $1.8 million.
- Assisted Monroe County to develop comprehensive wastewater and stormwater master plans.
- Assisted Monroe County to develop a Wastewater Facilities Plan for the Marathon service area.
- Constructed an advanced wastewater treatment facility and collection system for the Little Venice area of Marathon through a Title II Construction Grant in the amount of $4,326,000 awarded by the Florida Keys Aqueduct Authority.
- Provided over $290,000 to the Sanctuary for public education and outreach.

- Provided a $500,000 grant to Florida Department of Health to identify and test innovative and alternative on-site wastewater systems to reduce nutrient loading in ground and surface waters.
- Worked with the City of Key West to designate the waters surrounding the city as a no-discharge zone.
- Designated all State waters in the FKNMS as a no-discharge zone in 2002. Mobile pump-out facilities were established to support compliance with the new designation.
- Provided a $400,000 grant to the Florida Audubon Society/Florida Keys Environmental Restoration Trust Fund for restoration projects.
- Prepared and widely distributed the *Report to Congress* (1996) on the Water Quality Protection Program, a white paper entitled "Water Quality Concerns in the Florida Keys: Sources, Effects, and Solutions," and several annual "Progress Reports on Implementation," describing the status of the Water Quality Protection Program.
- Implemented a half-million dollar demonstration project for Onsite Sewage Treatment & Disposal Systems (OSTDS) that compared five systems. A final report comparing the nutrient-removal capabilities, costs, and limitations of these systems is available at www.myflorida.com/environment/ostds/products/products/html. The results have been used to design and install new and replacement systems with combinations of technologies that meet Florida Keys effluent-disposal standards.
- Completed the *Sanitary Wastewater Master Plan*, which is currently being implemented as a high priority.
- Improved interagency coordination has reduced wastewater pollution by refining and simplifying OSTDS permitting and increasing funds for compliance monitoring and enforcement.
- Improved stormwater management through local government implementation of stormwater management ordinances.

Strategies

The Water Quality Action Plan consists of the 18 strategies listed below. Fifteen of these strategies are included here, grouped under 8 categories, and the remaining 3 strategies presented in other action plans.

Florida Bay/External Influence Strategies

- W.19 Florida Bay Freshwater Flow
- W.24 Researching Florida Bay Influences (see the Research & Monitoring Action Plan)

Domestic Wastewater Strategies

- W.3 Addressing Wastewater Management Systems
- W.5 Developing and Implementing Water Quality Standards
- W.7 Resource Monitoring of Surface Discharges

Stormwater Strategies

- W.11 Stormwater Retrofitting
- W.14 Instituting Best Management Practices

Marina and Live-Aboard Strategies

- B.7 Reducing Pollution Discharges
- Z.5 Special-use Areas (see Marine Zoning Action Plan)
- L.1 Elimination of Wastewater Discharge From Vessels
- L.3 Reducing Pollution From Marina Operations

- E.4 Developing Training, Workshops, and School Programs (see Education and Outreach Action Plan)

Landfill Strategy

- L.7 Assessing Solid Waste Disposal Problem Sites

Hazardous Materials Strategies

- W.15 HAZMAT Response
- W.16 Spill Reporting
- L.10 HAZMAT Handling

Mosquito Spraying Strategy

- W.17 Refining the Mosquito Spraying Program

Canal Strategy

- W.10 Addressing Canal Water Quality

Each of these strategies is detailed below. Table 3.14 provides estimated costs for implementation of these strategies over the next five years.

Table 3.14 Estimated Costs of the Water Quality Action Plan

Water Quality Action Plan Strategies	Estimated Annual Cost (in thousands)*					Total Estimated 5 Year Cost
	YR 1	YR 2	YR 3	YR 4	YR 5	
W.19: Florida Bay Freshwater Flow	5	5	5	5	5	*25*
W.3: Addressing Wastewater Management Systems	50,000	125,000	125,000	100,000	100,000	*500,000*
W.5: Developing and Implementing Water Quality Standards	-	-	-	-	-	*0*
W.7: Resource Monitoring of Surface Discharges	5	5	5	5	5	*25*
W.11: Stormwater Retrofitting	1,500	1,500	1,000	1,000	1,000	*6,000*
W.14: Instituting Best Management Practices	50	50	25	25	25	*175*
B.7: Pollution Discharges	200	200	200	200	200	*1,000*
L.1: Elimination of Wastewater Discharge from Vessels	550	200	750	350	350	*2,200*
L.3: Marina Operations	25	25	25	25	25	*125*
L.7: Assessing Solid Waste Disposal Problem Sites	20	20	20	20	20	*100*
W.15: HAZMAT Response	250	250	250	250	250	*1,250*

W.16: Spill Reporting	10	10	10	10	10	*50*
L.10: HAZMAT Handling	10	10	10	10	10	*50*
W.17: Refining the Mosquito Spraying Program	5	5	5	5	5	*25*
W.10: Addressing Canal Water Quality	1,000	100	100	500	100	*1,800*
Total Estimated Annual Cost	*53,630*	*127,380*	*127,405*	*102,405*	*102,005*	*512,825*
* Contributions from outside funding sources also anticipated.						

Florida Bay/External Influence Strategies

Severe water quality and ecological problems have developed in Florida Bay in recent years, and the Bay has undergone rapid changes in community structure. Problems have included a massive seagrass die-off; phytoplankton blooms; sponge die-offs; mangrove die-backs; and a localized overgrazing of seagrass by dense aggregations of variegated sea urchins. All of these phenomena have the potential to cause catastrophic, cascading ecological effects throughout the ecosystem. Since 1987, much of Florida Bay has been affected by a massive, unprecedented seagrass die-off that has left tens of thousands of acres of denuded sediments. The resulting sediment suspension and nutrient release may have contributed to massive phytoplankton blooms that have affected the Bay during recent years. Sponge die-offs caused by phytoplankton blooms have resulted in reduced numbers of juvenile spiny lobsters, which reside by day under sponges for protection from predation.

Most scientists believe that recent ecological problems in Florida Bay are the result of long-term reduction in freshwater flow from the Everglades. The mechanism has not been documented, but high salinities and a long-term change from an estuarine to a marine system may be contributing factors.

These conditions in Florida Bay are a potential threat to water quality and resources in the Sanctuary. The need to deal with water-delivery problems in Florida Bay has been strongly stressed by workshop participants and other scientists throughout the development of the Water Quality Protection Program. The Florida Bay and Adjacent Coastal Ecosystems Program Management Committee is keenly aware of the role that Everglades restoration plays in future water-quality conditions in the Sanctuary. The *Comprehensive Everglades Restoration Plan* acknowledges that downstream impacts are an important concern in planning restoration activities.

Two strategies have been developed to address this issue:

- *Strategy W.19* recommends that the Steering Committee for the Water Quality Protection Program take a leading role in working to restore historical freshwater flow to Florida Bay.
- *Strategy W.24*, included in the Research and Monitoring Action Plan, supports research that will further document and quantify the influence of Florida Bay on the Sanctuary's water quality and biological resources.

STRATEGY W.19 FLORIDA BAY FRESHWATER FLOW

Strategy Summary

One role of the Water Quality Protection Program's Steering Committee is to ensure that restoring historical freshwater flow from South Florida and the Everglades into Florida Bay will not detrimentally impact Sanctuary resources. Sanctuary representatives work with appropriate Federal, state, and local agencies to ensure that restoration plans and surface-water improvement and management plans for South Florida and the Everglades are compatible with efforts to maintain water quality within the Sanctuary. The interagency Florida Bay and Adjacent Coastal Ecosystems Program Management Committee is charged with developing restoration goals and performance measures for Florida Bay in the *Comprehensive Everglades Restoration Plan*. Goals include restoring the timing, quality, quantity, and distribution of freshwater through the Everglades and into Florida Bay.

The Florida Bay and Adjacent Coastal Ecosystems Program Management Committee has a science plan to coordinate research and monitoring activities that address five central questions in the Florida Bay.

Activities (2)

(1) Establish a Leading Role for the Steering Committee. The Water Quality Protection Program's Steering Committee includes high-level representatives of all relevant agencies. The Steering Committee has taken a lead role in water-management issues affecting Florida Bay and Sanctuary resources.

> *Status*: Implemented and on-going. The Steering Committee was established in 1991 and expanded in 1992 and 1995 in order to initiate activities and generate support for the recommendations in the Water Quality Protection Program. Its leading role in ecosystem restoration activities continues.
> *Implementation*: The responsible agencies are EPA and DEP, which jointly administer the Water Quality Protection Program. All other agencies represented on the Steering Committee have a primary role, including NOAA, NPS, FWS, ACOE, FDCA, FDOH, SFWMD, Monroe County, municipalities, and the Florida Keys Aqueduct Authority.

(2) Participate in a Review/Revision of Water-management Strategies. Sanctuary representatives shall participate in the review and revision of restoration plans and water-management plans for Florida Bay and adjacent areas to ensure that the proposals and actions enhance and complement water-quality improvement in the Sanctuary. These plans include but are not limited to the *Comprehensive Everglades Restoration Plan*, the West Dade Wellfield, U.S. 1 widening, and the Lower East Coast Water Supply Plan.

> *Status*: Implemented and on-going. The members of the Management Committee or their staff regularly participate in activities associated with planning and implementation of the *Comprehensive Everglades Restoration Plan*, including the Florida Bay and Adjacent Coastal Ecosystems Program Management Committee, the South Florida Environmental Restoration Task Force Working Group, Science Coordination Team, and Project Coordination Team.
> *Implementation*: The Water Quality Protection Program Management Committee coordinates and administers water-management activities in the Sanctuary. The responsible agencies are

EPA and DEP. NOAA has a primary role. The main agencies involved in water management decisions for the Everglades and Florida Bay are the NPS, SFWMD, and ACOE. As the State land-planning agency for a designated Area of Critical State Concern, the FDCA is also involved. Other primary agencies are the FWS and Monroe County.

Domestic Wastewater Strategies

The purpose of these strategies is to reduce pollution from land-based sources of domestic wastewater in the Florida Keys. Sources include cesspits, on-site treatment and disposal systems, package plants, and municipal treatment plants. Wastewater pollution from live-aboard boaters is discussed in Marina and Live-Aboard Strategies.

The first two domestic wastewater strategies (W.1 and W.2) are demonstration projects that would provide information to assist in deciding among options for the main engineering strategy (W.3) for wastewater management systems (exclusive of the City of Key West). Strategy W.4 is also an engineering strategy, but is applicable only to Key West. The remaining domestic wastewater strategies (W.5, W.7, and W.8) involve management activities designed to reduce pollution by developing water quality standards (including biocriteria) specific to the Florida Keys, and making the regulatory/management system work more efficiently.

STRATEGY W.3 ADDRESSING WASTEWATER MANAGEMENT SYSTEMS

Strategy Summary

This strategy will reduce the amount of pollutants entering groundwater by enforcing existing standards. On-site inspection programs would be implemented to identify and eliminate all cesspits and ensure that On-Site Disposal Systems (OSDSs) and package plants are in compliance with existing standards. Penalties would be imposed for noncomplying systems. Cesspits are illegal and provide no sewage treatment. OSDSs provide adequate sanitary treatment and limited nutrient reduction; however, there is no routine inspection and enforcement program to ensure that these systems are operating properly. Package plants provide secondary treatment and are inspected routinely (although not frequently). The elimination of cesspits and replacement with approved OSDSs would reduce nutrient loading to groundwater and eliminate health hazards from untreated sewage. Aggressive inspection/enforcement programs for OSDSs and package plants could be expected to further reduce nutrient loadings to groundwater. In addition, this strategy would involve research to estimate the level of reduction in wastewater nutrient loading necessary to restore and maintain water quality and Sanctuary resources. Based on these nutrient reduction targets and the results of the wastewater demonstration projects (strategies W.1 and W.2), a Sanitary Wastewater Master Plan would be developed that would evaluate options for further treatment (e.g., construction of community wastewater plants, upgrading package plants to Advanced Wastewater Treatment (AWT), or the use of alternate, nutrient-removing OSDSs. The Sanitary Wastewater Master Plan would also specify details of costs, schedules, service areas, etc. for implementation. *(High Priority)*

Activities (4)

(1) Establish Inspection and Compliance Programs for Cesspits, OSTDS, and Package Plants. This activity seeks to establish on-site inspection programs to identify all cesspits and ensure that OSTDS and package plants comply with existing standards. Inspection and enforcement programs for OSTDS and package plants would ensure that these systems operate properly, reduce nutrient loading to groundwater. DEP has an on-going inspection and compliance program for package plants. Cesspits identified would eventually be replaced with an approved OSTDS or a connection to a community wastewater-treatment plant, as recommended by the *Monroe County Sanitary Wastewater Master Plan* (described in Activity 3). Because development and implementation of the *Sanitary Wastewater Master Plan* was a long-term process, Monroe County developed an interim policy to address non-compliant wastewater-treatment systems. This activity includes a public education and outreach component that informs the public of ways to assess and improve existing wastewater treatment systems.

> <u>*Status*</u>: Initiated and on-going. The OSTDS inspection and compliance program has been initiated in compliance with the Governor's Executive Order 96-108, which requires elimination of all cesspits and issuance of an operating permit for each onsite disposal system in Monroe County. A 1997 county ordinance specifies timeframes and procedures for implementing the cesspit replacement. The county ordinance served as an interim response to address non-compliant onsite wastewater systems until the June 2000 *Sanitary Wastewater Master Plan* recommended a change to central collection and treatment systems for large or multiple islands. Onsite systems or small clustered systems were recommended for less-dense areas. As a result, the focus of the cesspit identification and elimination program shifted to only the areas identified for onsite wastewater systems. Grant money is available to assist

qualified property owners in replacing onsite systems. In addition, $4 million in congressional appropriations through EPA is available to initiate an onsite wastewater utility demonstration project. A grant was made to FKAA, which administers this project.
Implementation: DEP and FDOH are the responsible agencies. Other primary agencies involved are the EPA, Monroe County, and local municipalities.

(2) Evaluate Development of Nutrient-Reduction Targets. The goal of this activity was to identify and evaluate strategies for developing nutrient reduction targets for wastewater and stormwater in the Sanctuary. The information helped the EPA and the State of Florida to determine if nutrient reduction targets should be developed and if so, how development should proceed.[10]

Status: Completed.
Implementation: A 1995 workshop concluded that the best short-term approach to reduce nutrient loading from wastewater is a technology-based approach, rather than establishment of nutrient-reduction targets. It was generally agreed that nutrient sources for canals and nearshore waters are known and that these problems can and should be addressed quickly with best-available technology. Workshop participants generally agreed that over the long-term it may be appropriate to develop resource-based, nutrient-reduction targets. The Water Quality Protection Program Steering Committee approved these recommendations in May 1996. The EPA and FDOH led this activity.

(3) Implement a Master Plan. The goal of this activity was to complete a *Sanitary Wastewater Master Plan* taking into consideration a series of studies and demonstration projects outlined in the 1997 management plan.

Status: Completed.
Implementation: The *Sanitary Wastewater Master Plan* has been completed. Its implementation is the focus of Activity 4, below.

(4) Implement a Master Plan. Completion of this activity would result in the implementation of the preferred wastewater-treatment option specified in the *Sanitary Wastewater Master Plan*. The plan recommends that regional wastewater treatment plants be built in Key Largo, Islamorada, Marathon, Big Pine Key, Cudjoe Key, Big Coppitt, and Stock Island. This would provide a high level of treatment for approximately 95 percent of the wastewater flows outside Key West. In addition, the plan recommends that 17 existing package plants be upgraded and expanded to serve local areas.

Status: The City of Key West upgraded its treatment facility to meet AWT standards and retrofitted collection systems to significantly reduce infiltration and inflow. In addition, the City retired the ocean outfall and disposes of treated wastewater to a deep well

[10] In 1999, the Florida Legislature adopted treatment and disposal standards for the Florida Keys. New and existing or expanding facilities with design capacities of 100,000 gallons per day or greater, must meet AWT standards (5 mg/l CBOD, 5 mg/l TSS, 3 mg/l TN, 1 mg/l TP). New and expanding facilities with design capacities of less than 100,000 gpd must achieve 10 mg/l CBOD, 10 mg/l TSS, 10 mg/l TN, and 1 mg/l TP no later than 2010. Additionally, design specifications were adopted into legislation for Class V injection wells. Facilities with a capacity of greater than 1,000,000 gpd are required to case disposal wells to a minimum depth of 2,000 feet. Facilities with a capacity of less than 1,000,000 gpd are required to case disposal wells to 60 feet. Surface water discharges are prohibited.

(approximately 3,000 feet). The ocean outfall is retained for emergency use. The City of Key Colony Beach upgraded its treatment facility to meet AWT standards. Key Colony Beach is also addressing infiltration problems. The City of Islamorada began the selection process for treatment facilities for each of its four islands and a Technical Review Committee has made recommendations to its City Council. The committee reviewed the selected treatment and disposal methods and found them consistent with recommendations in the *Monroe County Wastewater Master Plan*.

Implementation: The primary agencies are Monroe County and FKAA within the unincorporated areas of the County. Other primary agencies involved are EPA, DEP, FDCA, the municipalities, and FDOH. The City of Islamorada has taken primary responsibility for its wastewater improvements and is progressing along lines similar to those recommended in the Monroe County plan. The City of Marathon has adopted the FKAA as its wastewater authority. The FKAA has completed construction of the Little Venice (Marathon) facility, which was dedicated in June 2004, and is preparing a request for proposals for sewage collection and treatment system for greater Marathon. The FKAA is also in the early planning phases for wastewater improvements at Conch Key, Hawks Cay and Bay Point Subdivision on Saddlebunch Key. A technical review of proposals for a design-build-operate system for Key Largo has been completed and an engineering firm selected. However, no action was taken because of legal challenges of the review process and the decision to determine appropriate sewage treatment requirements by an elected Wastewater Board.

STRATEGY W.5 DEVELOPING AND IMPLEMENTING WATER QUALITY STANDARDS

Strategy Summary
This strategy will reduce the impacts of pollution on Sanctuary resources by determining water quality conditions to ensure resource protection. The intent is to implement water quality standards as guidance in determining permitted discharge limitations. Outstanding Florida Water (OFW) standards will be used until research indicates that new, more-stringent regulations are necessary.

Activities (2)

(1) Develop and Evaluate Indicators. This activity will identify and evaluate indicators (biochemical and ecological measures to provide early warning of widespread ecological problems) in each type of ecosystem. Examples are tissue C:N:P ratios, alkaline phosphatase activity, and shifts in community structure by habitat. These measures could be incorporated into the Sanctuary's Water Quality Monitoring Program and provide the basis for resource-oriented water-quality standards.

> *Status*: The DEP has initiated a process to develop appropriate bioassessment methods and criteria for various water body types. Field tests and data analysis have been initiated in streams, lakes, and wetlands throughout the State. At present, there are no plans to incorporate biocriteria in Water Quality Standards for marine waters. Florida, in response to draft numeric nutrient criteria published by EPA, is initiating efforts to develop new water quality standards for nutrients. However, no specific action currently is proposed for waters in the Keys. This strategy is also included in the Research and Monitoring Action Plan.
> *Implementation*: The EPA and DEP are the responsible agencies through the Sanctuary Management Plan's Research/Special Studies Program. NOAA and NMFS may have a research role.

(2) Develop Water Quality Standards. This activity will develop water quality standards, including nitrogen and phosphorus standards and biocriteria, appropriate to Sanctuary resources. The intent is to implement water quality standards as guidance in determining permitted discharge limits. Outstanding Florida Waters (OFW) standards will be used until research indicates that new, more stringent regulations are necessary.

> *Status*: There are no current plans to develop new water quality standards for nutrients specific to waters of the Keys. The existing water quality standards for marine waters are published in Rule 62-302.530 of the Florida Administrative Code (FAC). Chapter 62-302 FAC. also designates the Keys' ambient waters as Outstanding Florida Waters, subject to special protection. The intent of the designation is to maintain existing ambient water quality and provide authority to regulate activities that may cause pollution of those waters. Existing water-quality standards already prohibit discharges that may cause biological imbalance in the receiving waters.
> *Implementation*: The lead agency for any revisions to the State's water quality standards will be DEP, which would initiate formal rule-making procedures. Once enacted, the new standards would be implemented at the time new permits are issued or existing permits reissued. Other primary agencies will be EPA and FDOH.

STRATEGY W.7 RESOURCE MONITORING OF SURFACE DISCHARGES

Strategy Summary

This strategy will help to evaluate environmental impacts of point-source discharges by requiring all National Pollutant Discharge Elimination System (NPDES)-permitted surface dischargers to develop resource monitoring programs. This could be accomplished in one of two ways: 1) EPA could eliminate the baseline exemption for resource monitoring under the Ocean Discharge Program as it applies to the Keys. All surface dischargers except the City of Key West sewage treatment plant are currently exempted from developing resource monitoring programs because the end of their discharge pipe does not extend beyond the baseline (the mean low-tide line); or 2) FDEP, through the State of Florida's permitting authority, could require resource monitoring when individual NPDES permits come up for renewal. This approach would probably be easier because it can be accomplished under existing rules, whereas eliminating EPA's baseline exemption would require a Federal rule change.

Activity

(1) Require Resource Monitoring. This activity seeks to evaluate environmental impacts of discharges by requiring all NPDES-permitted surface dischargers to develop monitoring programs.

> *Status*: On-going. Monitoring of the City Electric cooling-water outfall on Stock Island continues. In October 2001, Key West began using a deep well for disposal of wastewater effluent, retaining the ocean outfall for emergency use only. This change eliminated the other major surface water point discharge in the region. It is not anticipated that any new surface water discharges will be permitted in the future.
> *Implementation*: EPA and DEP are the responsible agencies.

Stormwater Strategies

Since the 1997 management plan, two of the strategies developed to reduce pollution from stormwater runoff in the Keys have been completed. Strategies W.12 and W.13 worked together to require enactment of stormwater management ordinances and master plans that would cover the entire Keys. These plans are now being implemented through strategy W.11 that involves engineering modifications at hot spots to control pollutants in stormwater runoff. Another strategy, W.14, involves the development and implementation of widely used Best Management Practices and public education to reduce pollutants entering stormwater runoff.

STRATEGY W.11 STORMWATER RETROFITTING

Strategy Summary
This strategy will reduce loadings of sediment, toxics, and nutrients to Sanctuary waters through engineering methods applied to stormwater hot spots (e.g., commercial and industrial facilities) and limited sections of U.S. 1.

Activity

(1) Retrofit Hot Spots and Portions of U.S. 1. This activity involves using grass parking, swales, pollution-control structures, and detention/retention facilities to control pollutants in stormwater runoff. Swales and detention facilities are being installed along portions of U.S. 1. Engineering actions are underway to control stormwater runoff in areas handling toxic and hazardous materials.

> *Status*: Implemented and on-going. This activity has a high priority in Monroe County's and Islamorada's Stormwater Management Master Plans and implementation began in 2002. It is estimated that it will take approximately five years to completely retrofit hot spots. The City of Key Colony Beach is addressing stormwater runoff by creating swales and retention basins. The City of Key West has an inadequate stormwater-management system with many outfalls discharging untreated stormwater. The City has begun construction of new stormwater control and treatment structures.
> *Implementation*: Monroe County is the responsible agency for stormwater retrofitting. Other primary agencies involved are the DEP, FDOT, and SFWMD.

STRATEGY W.14 INSTITUTING BEST MANAGEMENT PRACTICES

Strategy Summary
This strategy will reduce pollution by instituting a series of "Best Management Practices" and a public education program to prevent pollutants from entering stormwater runoff.

Activity

(1) Develop and Implement Best Management Practices and a Public Education Program. This activity seeks to reduce pollution from stormwater runoff through a variety of programs, including street sweeping; ordinances to control fertilizer application on landscaping; collection locations and public education regarding the proper use and disposal of fertilizers, pesticides, motor oil, and other hazardous chemicals; and strenuous litter-control programs.

> *Status*: On-going. DEP provides public information on proper disposal of oil and is currently preparing information on proper disposal of boater wastes. DEP has several stormwater public education materials available on its web site. Local governments have provided some information on best management practices for residential stormwater. Local ordinances require use of best management practices for stormwater on residential construction projects.
> *Implementation*: The responsible agencies are local governments. Other primary agencies are the DEP, FDCA, SFWMD, and FDACS. Educational aspects are coordinated with the Sanctuary's educational staff.

Marina and Live-Aboard Strategies

These five strategies and activities aim to reduce pollution from marinas and live-aboard boaters. Strategy B.7 seeks to reduce pollution by restricting discharges and educating the public. Strategy Z.5, found in the Marine Zoning Action Plan, concentrates live-aboards in areas where wastewater-treatment facilities can be provided. Strategy L.1 (expanded to include previous strategy L.6) increases the availability of pump-out facilities. Strategy L.3 will reduce pollution from marina operations. Finally, strategy E.4, included in the Education and Outreach Action Plan, will reduce pollution from boaters and marinas in general by expanding an existing education and environmental-awareness program.

STRATEGY B.7 REDUCING POLLUTION DISCHARGES

Strategy Summary
This summary aims to strengthen implementation and enforcement of existing regulations to reduce pollution discharges and the impact of discharges on the marine environment.

Activities (3)

(1) Implement the 1994 Florida Clean Vessel Act. The Florida Clean Vessel Act prohibits boaters from discharging raw sewage into State waters, effective October 1, 1994. In addition, all vessels 26 feet or more in length with an enclosed cabin and berthing facilities are required to have a toilet on board. Houseboats and floating structures must, by October 1, 1996, have permanently installed toilets attached to Type III marine sanitation devices (a holding tank), or directly connect their toilets to shore-side plumbing. Full implementation and enforcement of the Clean Vessel Act is expected to reduce sewage in Sanctuary waters.

> *Status*: On-going.
> *Implementation*: The FWC enforces the Clean Vessel Act. NOAA works with EPA and the State to phase in implementation in Federal waters after public review of the draft rules and public hearings, prior to issuance of final regulations. Sanctuary regulations prohibit discharge from all marine sanitation discharges in the Ecological Reserves and Sanctuary Preservation Areas.

(2) Enforce No-discharge Zones. At the request of the City of Key West, EPA was asked to designate no-discharge zones in accordance with provisions of marine-sanitation devices where live-aboard vessels congregate, and where there is a history of water-quality violations. In 2000, EPA designated all waters within the city's 600-foot jurisdiction as a no-discharge zone. The Steering Committee passed a resolution recommending that Monroe County pursue designation of a no-discharge zone for State waters in the Keys. In turn, the Monroe County Board of County Commissioners passed a resolution requesting that the Governor petition EPA to declare all State waters in the Sanctuary as a no-discharge zone. EPA published the proposed rule in the Federal Register and the comment period expired on October 26, 2001. EPA responded to all public comments and announced a final determination in the Federal Register, effective June 19, 2002

> *Status*: On-going.
> *Implementation*: The EPA is the responsible agency. Enforcement procedures and responsibilities are being coordinated through an interagency management committee. DEP and Monroe County have assisting roles.

(3) Develop and Implement a Public Education Program. This activity would create a program to educate the boating public about ways to reduce pollution from vessels. The program would include providing information about the Clean Vessel Act and other regulations affecting discharges from vessels. This activity is also included in the Education and Outreach Action Plan.

> *Status*: The Sanctuary has worked with the City of Key West and Reef Relief to develop and implement a "Pump it, Don't Dump it!" boater-education program. Marina and pump-out locations have been incorporated in *The Upper Keys Boater Guide,* published by Florida Marine Research Institute and Monroe County. This information and a detailed fact sheet are posted

on Monroe County's web site. An intergovernmental task force will prepare an implementation plan for the designation of all State waters within the Sanctuary as a no-discharge zone. The plan includes a public education and outreach component. An interagency committee has developed a management plan for the Keys-wide no-discharge zone.
Implementation: FWC is the lead agency, with assistance from EPA and NOAA.

STRATEGY L.1 ELIMINATION OF WASTEWATER DISCHARGE FROM VESSELS

Strategy Summary

This strategy will work to eliminate discharge of wastewater, whether treated or not, from all vessels into Sanctuary waters. Although sewage discharges from vessels may be a relatively minor contributor to the total pollutant load, vessels are normally moored or anchored in confined waters that may be more susceptible to the impacts of such loading. By requiring marinas to provide pump-out facilities, two problems will be resolved: 1) boats in marinas that do not currently pump out will be provided the means to do so; and 2) boats that moor outside of marinas can take advantage of the increased number and availability of pump-out facilities.

Activities (5)

(1) Develop a Plan to Eliminate Vessel Sewage Discharge. This activity has resulted in the development of a comprehensive plan to address problems associated with sewage discharges from live-aboards and other vessels. The plan includes elements such as requiring all marinas to install pump-out facilities; enforcing pump-out use; establishing mobile pump-out services; establishing mooring fields; and evaluating the treatment and disposal of pumped out wastewater.

> *Status*: EPA published in the Federal Register the intent to declare all State waters in the Sanctuary as a no-discharge zone. The deadline for public comments expired on October 26, 2001. EPA responded to the public comments and published them and its decision in the Federal Register, effective June 19, 2002. An interagency task force developed an implementation plan that will recommend the number of pump-out facilities to adequately serve the boating pubic. Additional financial assistance for marinas currently without pump-out facilities is being pursued. The implementation plan also includes education and enforcement components.
> *Implementation*: EPA has designated All State waters in the Sanctuary as a no-discharge zone. Implementation is by Monroe County and the municipalities. The DEP and FDCA have a primary role. The EPA, USCG and NOAA continue to assist.

(2) Require Marinas to Install Pump-out Facilities. This activity seeks to require all marinas (10 or more slips, as defined by the State) to provide pump-out services, greatly increasing their number and accessibility.

> *Status*: In progress. Monroe County and several municipalities have prepared ordinances; adoptions are anticipated throughout 2002.
> *Implementation*: This activity is implemented by local ordinances requiring marinas offering overnight docking to boats over a given length to have stationary or mobile equipment to pump holding tanks. Monroe County has actively sought funding and plans to coordinate with marinas to facilitate compliance.

(3) Establish Mobile Pump-out Services. Establish mobile pump-out services through local governments or franchises with private contractors to pump out live-aboard vessels and other anchored or moored vessels located outside of marinas.

Status: On-going. Key West's Garrison Bight Marina provides mobile pump-out facilities for vessels using the local mooring field. A mobile pump-out facility is also in place in Boot Key Harbor.
Implementation: Local governments are responsible to assure that pump-out facilities are available for vessels located outside of marinas.

(4) Establish Mooring Field. Establish mooring fields at congested anchorages throughout the Keys as a means of managing transient and live-aboard boaters and ensuring compliance with sewage disposal regulations.

Status: On-going. Monroe County is increasing the number of moorings at existing mooring fields as well as planning for the implementation of moorings at least three other locations in the Keys. Studies are being conducted to look at the feasibility of installing moorings at Blackwater Sound, Community Harbor and Pine Channel.
Implementation: The Monroe County Department of Marine Resources will be responsible for the planning, permitting, funding, and implementation of additional mooring fields. The County will likely partner with privately owned marinas to manage the mooring fields.

(5) Enforce Pump-out Use. This activity seeks to enforce use of pump-out facilities. Coordinated enforcement procedures are being developed as part of the implementation plan. Historically, pump-out usage had been low, in part because there was no law requiring it. Also, more pump-out facilities are needed in areas identified in the implementation plan. One enforcement tool considered is the issuance of a sticker for boats anchored in or passing through the Sanctuary. Each time a vessel's holding tanks are pumped, the sticker could be date stamped. If the vessel does not have its tanks pumped within a given length of time based on its size and occupancy, a citation would be issued.

Status: An interagency committee is developing an enforcement strategy for the no-discharge zone. Coordination is expected to be formalized through memoranda of understanding and inter-local agreements.
Implementation: FWC, USCG, Monroe County Sheriff's Department, and local governments to coordinate enforcement.

STRATEGY L.3 REDUCING POLLUTION FROM MARINA OPERATIONS

Strategy Summary
This strategy aims to reduce pollution from marina operations by establishing appropriate infrastructure and information resources.

Activities (2)

(1) Prevent Discharge of Pollutants from Marinas. This activity would establish paved and curbed containment areas for boat-maintenance activities, such as hull scraping and repainting, mechanical repairs, fueling, and lubrication. It would create secondary containment, generally in the form of curbing or synthetic liners, for areas where significant quantities of hazardous or toxic materials are stored. Procedures to avoid or reduce fuel spillage during refueling operations would be evaluated.

> *Status*: The voluntary Florida Clean Marina Program is being implemented and periodic workshops encourage non-participating marinas to join. DEP has been conducting compliance inspections and audits of marinas and boat yards. Inspections target marinas that are the subject of complaints or which have large, full-service marinas. Marinas are encouraged to limit boat-maintenance areas. Waste containment is required. DEP has suggested that EPA provide an overview of the NPDES permitting requirements and a list of marinas that have applied for or received permits.
> *Implementation*: The responsible agency is the DEP. Local governments (Monroe County and the municipalities) may have an assisting role. The NPDES stormwater discharge rule is the mechanism to implement this activity. In 1990, the EPA enacted rules to control stormwater discharges from a variety of uses, known as the NPDES Permit Application Regulations for Stormwater Discharges. The rules require applicants to describe plans to eliminate pollutants generated by marina activities. Applicants must identify the Best Management Practices used. Marina owners are encouraged to participate in environmentally oriented organizations, such as the Marine Industry Association and the Florida Clean Marina Program.

(2) Encourage Marina Owners to Provide a User Manual with Local Environmental Information. The information could include locations of pump-out facilities and trash receptacles, as well as sensitive habitats.

> *Status*: Implemented and on-going. Yearly discharge prevention and response certificate inspections are conducted at marinas with diesel-fuel operations. During inspections, marinas receive educational materials, information about approved clean-up methods, proper handling of used oils, and local hazardous-waste collection locations. DEP's draft Best Management Practices for marinas is also distributed. The Florida Clean Marina Program's booklet, "Clean Boating Habits," is available to boaters through local marinas, Marine Industries Association, and Florida Sea Grant agents.
> *Implementation*: The responsible agencies are Monroe County and municipalities working with DEP.

Landfill Strategy

This strategy addresses potential pollution problems due to leaching from landfills. All landfill sites in the Florida Keys, with the exception of the Cudjoe Key expansion, were developed prior to current regulations that require bottom liners and leachate collection. At many sites, filling with solid waste probably occurred below the water table in the early stages. Consistent with common practice at the time, there was probably little or no control over materials deposited in the landfills. These conditions result in a significant potential for ground- and surface-water contamination.

Although the potential exists for problems, monitoring data do not indicate leaching or water quality degradation due to landfills; therefore, no corrective actions are currently proposed. However, two investigative activities are proposed under strategy L.7, Sanitary Waste Disposal Problem Sites. These activities involve searching for and assessing abandoned landfills and dumps, and intensifying existing monitoring programs around landfills to ensure that no leaching into marine waters is occurring, and implementing remedial actions if problems are discovered.

STRATEGY L.7 ASSESSING SOLID WASTE DISPOSAL PROBLEM SITES

Strategy Summary
This strategy aims to address contamination of marine waters from landfills through assessment, monitoring, and, when required, remedial action.

Activities (3)

(1) Conduct a Historical Landfill Search and Assessment. Conduct a comprehensive search for abandoned landfills and dumps. Evaluate sites to determine if they contain hazardous materials or cause environmental problems. Knowledgeable state and local government personnel believe there are a number of abandoned landfills and dumps, many on private property, within the Florida Keys. A comprehensive program needs to be set up to locate, map, and evaluate these historic, casual dumps.

> *Status*: Implemented and on-going. The locations of landfills have been identified; however, illegal dumping is a continuing problem, and DEP continues to identify abandoned, unlined, and unmonitored sites. Funds are lacking for cleanup and disposal of illegally dumped wastes. The U.S. Navy is assessing and conducting remedial action at former solid waste disposal sites on Navy properties.
> *Implementation*: Monroe County, working with the DEP, is the responsible agency. The U.S. Navy has a primary role in dealing with landfills on its properties. The EPA has an assisting role.

(2) Intensify Landfill Monitoring. Intensify existing monitoring around landfills to ensure that no leaching is occurring into marine waters. Identify and monitor old landfills that were never permitted, and therefore have no closure plans or closure permits. This activity seeks to ensure that existing monitoring programs are adequate to detect leaching from landfills. Current data from landfills do not indicate a leaching problem; however, the number of monitored locations is small and should be increased. In addition, this strategy seeks monitoring of older landfills that are not now monitored. Monroe County is currently complying with all state and Federal monitoring guidelines.

> *Status*: Fully implemented and on-going. All permitted landfills in Monroe County are closed. Landfills at Key Largo, Long Key, Cudjoe Key, and Stock Island have been properly closed with a top liner and a permit requirement includes quarterly monitoring.
> *Implementation*: The responsible agency is DEP. The U.S. Navy has a primary role in dealing with landfills on its properties. EPA has an assisting role.

(3) Evaluate and Implement Remedial Actions. If problems are discovered, evaluate and implement appropriate remedial action, such as boring or mining, upgrading, closure, collecting and treating leachate, constructing slurry walls, or hauling.

> *Status*: On-going. To date, no need for remedial action has been determined.
> *Implementation*: The responsible agency is Monroe County, working with DEP. The U.S. Navy has a primary role for landfills on its properties. EPA has an assisting role.

Hazardous Materials Strategies

These strategies and activities aim to reduce the likelihood of pollution from spills of hazardous materials in and near the Keys. The current management strategy appears to be functioning adequately; however, some actions could be taken to further reduce the potential for accidental spills. These management strategies would enhance hazardous materials (HAZMAT) response (W.15), improve spill reporting (W.16), and develop an inventory of hazardous materials handling and use in the Keys (L.10).

STRATEGY W.15 HAZMAT RESPONSE

Strategy Summary

This strategy seeks to reduce the chances that a spill of oil or other hazardous materials will have a significant negative impact on Sanctuary resources. This will be accomplished by improving coordination and cooperation among the Federal, state, and local agencies responding to spills; by encouraging improvements in response and containment technologies appropriate to the Keys and by creating a spill contingency plan for the Sanctuary that includes crew and equipment staged in the Keys. The strategy recognizes that hazardous materials spills are handled independently of marine spills and improvement measures will be developed for both response programs.

Activities (3)

(1) Develop and Periodically Revise Sanctuary Spill Contingency Plan. This activity would involve creating and periodically revising the spill contingency plan for the Sanctuary that includes crew and equipment staged in the Keys (possibly including skimmers). The plan should cover spills of a size not responded to by the USCG and should include training and education of a local response team. The USCG Marine Safety Office in Miami will coordinate marine HAZMAT response. Because spills of hazardous materials are handled independent of marine spills, improvement measures will be developed for both response programs.

> *Status*: On-going. DEP has personnel on-call 24 hours a day for initial response to environmental emergencies. Oil spill equipment is available at the Port of Key West. The USCG has a Marine Safety Office located in Marathon. The USCG has the responsibility to develop a HAZMAT protocol and has officially adopted the National Interagency Incident Command System as its response management system when responding to oil and hazardous substance spills. That system unifies the efforts of industry, and Federal, state, and local government agencies and the entity responsible for the pollution incident. The USCG has designated response regions. The Sanctuary is part of the South Florida Oil Spill Contingency Plan Area Committee. An "Area Contingency Plan" includes area contacts.
> *Implementation*: USCG and DEP are responsible. NOAA, Monroe County and FDCA assist.

(2) Improve Coordination and Cooperation. This activity seeks to improve coordination and cooperation between Federal, state, and local agencies responding to spills.

> *Status*: Initiated and on-going. The National Preparedness for Response Exercise Program (PREP) was developed in conjunction with the Oil Pollution Act of 1990 to provide a workable exercise program. PREP is a unified Federal effort and satisfies the exercise requirements of USCP, EPA, Research and Special Programs Administration, Office of Pipeline Safety, and the Minerals Management Service. PREP exercises are an opportunity to improve the response plan and response system. Participation in PREP exercises allows agencies to work together and facilitates response in the event of a pollution incident. The Florida Coastal Management Program has hosted a series of Florida Summits, attended by DEP Bureau of Emergency Response, NOAA, USCG, and FWRI staff. In addition, regional coordination is conducted at contingency plan meetings, regularly held by USCG in Miami.
> *Implementation*: The responsible agencies are USCG and DEP. NOAA, Monroe County, and the FDCA assist.

(3) Improve Response/Containment Technologies. This activity encourages improvements in response and containment technologies appropriate to the Keys.

Status: Initiated and on-going. FWRI has compiled an environmental sensitivity atlas and developed a computerized spill-analysis system. The USCG's Area Contingency Plan is updated annually. Sanctuary personnel participate as observers in the National Preparedness for Response Program field exercises. NOAA conducts training workshops in Key West and Key Largo on spill response.
Implementation: USCG and DEP are the responsible agencies. NOAA, FWRI, Monroe County, and FDCA assist.

STRATEGY W.16 SPILL REPORTING

Strategy Summary
This strategy will ensure that Sanctuary managers are informed of all spills (e.g., of petroleum products) in and near the Sanctuary.

Activities (2)

(1) Establish a spill-reporting system. This activity establishes a reporting system to ensure that all spills documented by various agencies are reported to Sanctuary managers. In particular, small spills occur frequently, are under-reported, and may have a significant cumulative effect on water quality.

> *Status*: Implemented and on-going. A reporting system is in place. Education is required to increase awareness of the reporting program.
> *Implementation*: The responsible agency is the USCG. Other primary agencies involved are NOAA and DEP. DEP assists in reporting land-based spills that might affect Sanctuary waters. The National Response Center is notified of all spills.

(2) Establish and Maintain a Sanctuary Spills Database. This activity establishes and maintains a geo-referenced database for the Sanctuary to track spill information (locations, quantities, types of material, environmental impacts).

> *Status*: Implemented and on-going. DEP has established and maintains a database that includes marine and upland spills and coastal emergency response incidents. It is DEP's responsibility, in conjunction with USCG, to initially determine the severity of a coastal discharge or pollution incident within its jurisdiction. The Bureau of Emergency Response maintains a spill database, seeks reimbursement for expenses, and assesses natural resource damage. Education is required to increase reporting of all spills.
> *Implementation*: USCG is the responsible agency with assistance from DEP and NOAA.

STRATEGY L.10 HAZMAT HANDLING

Strategy Summary
This strategy supports the importance of inventorying and assessing the handling of hazardous materials. Such oversight is a preventative measure increasing protection of the marine environment from potential spills or mishandling.

Activity

(1) Conduct a HAZMAT Assessment/Inventory. This activity involves conducting an assessment and inventory of hazardous materials handling and use in the region, including facilities, types and quantities of materials, and transportation. Information is added to GIS databases.

> *Status*: Monroe County Emergency Management Authority has a *Hazardous Materials Plan* that is revised annually. The plan includes a list of facilities with reportable quantities of hazardous materials. DEP regulates hazardous wastes, but not materials.
> *Implementation*: The responsible agency is DEP. Other primary agencies involved are DEP, Monroe County Emergency Management Authority, and Monroe County Health Department, which maintains a database on hazardous materials. FDCA has an assisting role.

Mosquito Spraying Strategy

This strategy seeks to reduce pollution from pesticides used in mosquito control. Currently, there is little information on environmental concentrations and effects of pesticides in the Sanctuary. Additional data concerning pesticide concentrations in sediments and biological tissues throughout the Sanctuary will be collected through the Water Quality Research Program. Strategies for major changes to the Mosquito Control Program are not appropriate at this time. Additional data from the Water Quality Research and Monitoring Program will help to determine if major changes are warranted.

STRATEGY W.17 REFINING THE MOSQUITO SPRAYING PROGRAM

Strategy Summary
This strategy seeks to reduce the amount of pesticides entering Sanctuary waters by refining the existing aerial spraying program. Ground spraying by truck is the current method of choice for controlling the adult mosquito population. However, aerial spraying is initiated when the mosquito population reaches a certain threshold, as determined by mosquito landing counts at test sites. Although the Monroe County Mosquito Control District attempts to avoid marine areas during aerial spraying, the potential for pesticides to reach marine waters could be further reduced.

Activities (2)

(1) Review the Aerial Spraying Threshold. The threshold for initiating aerial spraying will be reviewed to determine whether it can be raised.

> *Status*: No action has been taken on this activity. EPA funded a special study in 1997 to assess potential impacts of mosquito spray chemicals and their breakdown products. Although the study was not conclusive, it did determine that sprayed chemicals reach surface waters in concentrations that are of concern. The study raises continuing concerns about the impacts of the chemicals on non-target organisms. More research is required.
> *Implementation*: The responsible agency will be the Florida Department of Agriculture and Consumer Services (FDACS) and FDCA will have an assisting role.

(2) Review Flight Plans and Equipment. The aerial spraying program should be reviewed to determine whether refining flight lines, alternative spray technologies, or the use of improved equipment could reduce the amount of pesticide released over water.

> *Status*: Ultra low-volume aerial spray has been adopted. Use of ultra low-volume spray has significantly reduced the volume of pesticide applied and has eliminated the use of fogging oil contamination. However, the area being sprayed is now harder to define because the spray is not visible. The drift of finer particles released in ultra low-volume spray needs further definition. No other actions have been taken on this activity.
> *Implementation*: FDACS is the responsible agency. FDCA has an assisting role.

Canal Strategy

This canal strategy strives to reduce water-quality problems in canals. Although many water quality problems are linked to wastewater discharges from cesspits and septic tanks of homes along canals and stormwater discharges, others may be due to a canal's structure and orientation. These physical factors can lead to low flushing and the buildup of weed wrack, which consumes oxygen and releases nutrients as it decays. The strategy described here would inventory and characterize canals and investigate technologies to determine whether it would be worthwhile to implement corrective actions, such as weed gates and aeration systems, to improve water quality. Any plan for implementing such improvements in canal circulation and flushing would have to be developed in coordination with plans for dealing with stormwater and wastewater pollution from cesspits and septic tanks, which contribute to water quality problems in many canal systems. The goal is to reduce nutrient loading to other surface waters from canal systems.

STRATEGY W.10 ADDRESSING CANAL WATER QUALITY

Strategy Summary
This strategy will improve water quality in nearshore, confined areas, with emphasis on dead-end canals and basins where reduced circulation increases the risk of reduced dissolved oxygen, retention of both dissolved and particulate pollutants, and potential impacts on benthic and pelagic environments. A comprehensive management plan will be developed for improving water quality in nearshore confined basins and canals. Improvement strategies will be implemented in all canals and basins identified as hot spots throughout the Sanctuary. *(High Priority)*

Activities (7)

(1) Evaluate and Revise Hot Spot List. A priority list of areas of degraded water is required to effectively focus needs for remedial action and efficiently utilize available resources.

> *Status*: Completed. A hot spot list was developed as part of Phase I of the Water Quality Protection Program. That list was revised by the SFWMD as a result of a workshop held in early 1996. The SFWMD list includes recommended actions to improve water quality at priority hot spots. The list has been updated for the Monroe County Sanitary Wastewater Master Plan and Stormwater Master Plan.
> *Implementation*: The responsible agency is South Florida Water Management District. Other agencies with primary roles are EPA, DEP, Monroe County, and the City of Key West.

(2) Inventory and Characterize Canals. An inventory of dead-end canals and other confined water bodies will be conducted to identify areas where reduced circulation increases the risk of depressed dissolved oxygen, retention of both dissolved and particulate pollutants and potential impacts on benthic and pelagic environments. Canals with water quality problems attributable mainly to their physical structure, flushing rates, and orientation (e.g., allowing weed wrack buildup), would be targeted for improvements.

> *Status*: On-going. In 2001, a contract was granted to inventory canals in the Keys and prioritize potential canal improvement projects. The inventory is expected by Fall 2002.
> *Implementation*: The responsible agency is Monroe County and FDCA. Other agencies with primary roles are EPA, DEP, and the municipalities.

(3) Develop and Evaluate Improvement Strategies. A comprehensive management plan will be developed for improving water quality in nearshore confined basins and canals. Potential methods of improving water quality (e.g., aeration, weed gates, and air curtains) will be tested in limited areas to determine whether widespread application is appropriate.

> *Status*: On-going. In 2001, a contract was granted to conduct an inventory of canals in the Keys and prioritize potential canal-improvement projects. This project is underway.
> *Implementation*: The responsible agencies will be Monroe County and FDCA. Other agencies with primary roles will be EPA, DEP, and the municipalities.

(4) Identify and Compile Technologies. This activity seeks to identify and compile a list of technologies for improving water quality in canals.

> *Status*: On-going. In 2001, a contract was granted to conduct an inventory of canals in the Keys and prioritize potential canal improvement projects. This project is underway.
> *Implementation*: The responsible agency is Monroe County and FDCA. Other agencies with primary roles are EPA, DEP and the municipalities.

(5) Develop Community Education and Involvement Program. This activity involves developing a community education program, including citizen monitoring.

> *Status*: A volunteer citizen monitoring program (Florida Bay Watch) was established by The Nature Conservancy, which published quarterly and annual reports on the weekly analyses of canal and nearshore water quality provided by Florida International University. Florida Bay Watch was terminated in 2002. Florida Keys Watch was initiated in 2002 and provides information on bacteria and virus concentrations in canals. This activity is also included in the Education and Outreach action plan.
> *Implementation*: The responsible agency is DEP and EPA. Other agencies with primary roles are Monroe County and the municipalities.

(6) Conduct Canal System Restoration Pilot Project.

> *Status*: On-going. Residential canals at Sunset Acres (Key Largo) have been opened to tidal flushing. Permits for opening the canals included shallowing, implementing a stormwater collection system, eliminating onsite sewage treatment systems, and monitoring. Pre- and post-project monitoring have been performed. In May 2001, a multi-year monitoring project was initiated in canals and nearshore waters of Little Venice (Marathon). Water-quality data were collected weekly from ten stations for approximately two years before completion of the central wastewater collection and treatment systems. Monitoring will continue for approximately two years after all homes and businesses are connected. This project is expected to demonstrate changes to water quality in canals and nearshore waters with improved sewage treatment practices.
> *Implementation*: The responsible agency is Monroe County and FDCA. Other agencies with primary roles are EPA, DEP and the municipalities.

(7) Implement Improvement Strategies. Effective improvement strategies identified through previous activities will be implemented in all canals and basins identified as hot spots.

> *Status*: On-going. Physical improvements have been made at two canal systems (Cudjoe Gardens and Jolly Roger Estates) by local homeowner associations. Both projects include monitoring before and after improvements. The on-going canal inventory study cited above will develop a prioritized list of canal improvement projects and cost estimates.
> *Implementation*: The responsible agency is Monroe County and FDCA. Other agencies with primary roles are EPA, DEP, and the municipalities.

PREVIOUS STRATEGIES

The following strategies from the 1997 management plan are not included in this action plan because they have been completed and do not require further action:

- W.1 OSTDS Demonstration Project
- W.2 WT Demonstration Project
- W.4 Evaluating Wastewater Disposal, City of Key West
- W.8 OSTDS Permitting
- W.12 Stormwater Permitting
- W.13 Stormwater Management
- L.2 Asessing Marina Siting and Design