

Florida Keys National Marine Sanctuary Draft Revised Management Plan



February 2005

U.S. Department of Commerce

National Oceanic and
Atmospheric Administration

National Ocean Service

National Marine Sanctuary Program

C:\Science\Coastal Reef Task Force\National\
Florida Keys Nat. Mar. Sanctuary
2.5 kb



IN REPLY REFER TO:

United States Department of the Interior

National Park Service
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634



L76

Memorandum

To: All BISC Division Chiefs, Amanda Bourque, Todd Kellison & Brenda Lanzendorf.

From: Rick Clark, Park NEPA Coordinator

Subject: Coordination Regarding BISC Review and Comments Concerning the Draft Management Plan Issued by the Florida Keys National Marine Sanctuary.

As discussed at the 3/1 BISC Mgm't. Team meeting, the Florida Keys National Marine Sanctuary recently issued a draft management plan for interagency and public review and comment. The draft management plan is comparable to NPS general management plans. Given the close proximity of FKNMS boundaries to the park, as well as overlapping mutual interests, it is prudent for BISC to comment on this document. To make our/park review manageable and provide meaningful comments under the narrow response window established by NOAA requires we spread the wealth between us. As such, I have attached a copy of the table of contents from the plan and taken the liberty to identify BISC staff with lead responsibility to review certain sections and provide any comments back to me by Wednesday, March 23.

There is a hard copy of the document on the table near the main front entrance to the HQ building. The document can also be accessed via the Internet at the following web address:

<http://a257.g.akamaitech.net/7/257/2422/01jan20051800/edocket.access.gpo.gov/2005/05-2949.htm>

After your review, please provide me with your comments electronically via email and via hard copy in my park mail box. Should you not have any comments based upon your review of the section I have indicated for you, please let me know that as well. I will compile all BISC comments and provide to SERO. SERO will be issuing a consolidated letter under Regional letterhead to the FKNMS with all NPS unit comments included.

Thanks,

CC: Acting Superintendent Mary Collier

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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 Statutes
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

2- 3.1 SANCTUARY SCIENCE

The Sanctuary Science management division consists of two action plans: ^① Science Management and Administration, and Research and Monitoring. An effective science program requires management and administration that focuses on coordinating research and monitoring projects, communicating findings of the program, and engaging in other regional science efforts. This coordination role is substantial with participation from a number of government, academic and non-governmental scientists. Permitting is a component of this action plan, along with other critical aspects of administering an effective science program. ^{where is 2?}

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

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

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

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

3.1.1 SCIENCE MANAGEMENT & ADMINISTRATION ACTION PLAN

Introduction

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

basically not getting permits

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

How is this established?

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

what are "upstream" areas?

Goals and Objectives

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

should also consider down stream effects especially will respect to NEPA (Biscayne NP, Dade & Broward Counties)

The objectives of this action plan are to: identified

does this mean it has yet to be developed?

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

prohibited but let them happen?

yet to be defined

how

what is the mechanism

Implementation

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

or is?

Accomplishments

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

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

Strategies

There are five strategies in this Action Plan:

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

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

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

B.11: Issuance of Sanctuary Research Permits	20	20	20	20	25	105
W.29: Dissemination of Findings	15	15	15	15	20	80
W.32: Maintaining a Technical Advisory Committee	10	10	10	10	15	55
W.34: Regional Science Partnerships and Reviews	60	60	65	65	70	320
W.35: Data Management	60	60	65	65	70	320

STRATEGY B.11 ISSUANCE OF SANCTUARY RESEARCH PERMITS

Strategy Summary

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

we would hope that all research allowed would achieve this!

Activities (1)

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

Status: On-going.

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

Boundary authorities are not generally consulted or consulted

- where do these come from?

STRATEGY W.29 DISSEMINATION OF FINDINGS

Strategy Summary

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

Activities (5)

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

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

Implementation: The Sanctuary is the lead agency.

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

Status: On-going.

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

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

Status: No action has been taken to develop a compendium; however, a summary of on-going monitoring and research is posted at the Sanctuary's Internet site.

Implementation: A Sanctuary Science Advisory Panel (December 2000) reviewed existing science projects and recommended future action. Based on that review, a *Final Draft Comprehensive Science Plan* has been developed and the Technical Advisory Committee has provided further comment and review. The Sanctuary is the lead agency; the EPA has a primary role.

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

Status: On-going.

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

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

Status: On-going.

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

STRATEGY W.32 MAINTAINING A TECHNICAL ADVISORY COMMITTEE

Strategy Summary

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

Activities (1)

(1) Convene Meetings of a Technical Advisory Committee. The Technical Advisory Committee meets *selected* once or twice per year to advise Sanctuary managers. The EPA develops agendas in consultation with the Sanctuary and FDEP. *In house design? how is Tech Advisory Committee established? How come members for what term for what compensation*

Status: On-going.

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

STRATEGY W.34 REGIONAL SCIENCE PARTNERSHIPS AND REVIEWS

Strategy Summary

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

but not the other way around

Activities (1)

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

Status: On-going.

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

STRATEGY W.35 DATA MANAGEMENT

Strategy Summary

As technologies evolve, research and monitoring programs become more complex and the volume of information increases. It is clear that a distributed data management strategy is most appropriate. This strategy centers around an Internet-based data search engine that points interested parties to Internet sites that serve the requested databases, maps, text files, etc. For the most part, these Internet sites would be maintained by the information creators to ensure data currency and accuracy. This strategy is being carried out in accordance with recommendations of the Technical Advisory Committee and FWC. It evolved from W.33: Ecological Research and Monitoring (Activity 2 - page 3A?) Establish an Ecological Information System) and W.28: Regional Database.

Activities (3)

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

Status: On-going.

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

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

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

Status: No action has been taken to complete the protocol. ✓

Implementation: Pending funding, the FWC will continue to produce annual CD-ROMs for the Water Quality Protection and Marine Zone Monitoring Programs. Some principal investigators are posting data and reports at individual web sites. The FWC is the lead agency; the EPA and Sanctuary have primary roles.

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

Status: On-going.

Implementation: Staff and volunteers assist with GIS software and imagery.

grandiose plans that really mean nothing

3.1.2 Research and Monitoring Action Plan

Introduction

Overview

Congress mandates that Sanctuary managers identify research priorities and the funds needed to improve the management and preservation of the Florida Keys coral reef ecosystem. The marine ecosystem of the Florida Keys is diverse and complex, and many of its physical and ecological processes and their interrelationships are not well known. Although many resource impacts are obvious and severe, they are often not documented or quantified, and their causes may be even less clear or unknown.

The purpose of monitoring is to establish a baseline of information on natural resources and other components of the ecosystem, and to measure changes over time. As monitoring studies gather data, they have the potential to detect significant changes in natural resources that result from management actions or from other causes. The findings of research projects must also help managers and scientists identify cause-and-effect relationships that generate ecological patterns and trends, and stressors and other factors that threaten the health of the coral reef ecosystem.

The Sanctuary's Water Quality Protection Program established comprehensive, long-term monitoring of three components of the ecosystem: water quality, coral reefs and hard-bottom communities, and seagrasses. The Marine Zone Monitoring Program documents effects of 24 fully protected marine zones, including the Tortugas Ecological Reserve, that were implemented in 1997 and 2001.

Monitoring projects in this program document trends in ecological processes, reef fishes, spiny lobster, queen conch, other invertebrates, and benthic community structure within fully protected marine zones and nearby reference areas. Social and economic parameters are also being surveyed. Together, these monitoring programs provide Sanctuary managers with basic information about the state of the Florida Keys coral reef ecosystem and changes resulting from a key management action - marine zoning.

U.S. Coral Reef Task Force

It has long been recognized that research and monitoring efforts in the Florida Keys must be focused on priority issues. The 1997 *Management Plan* summarizes early workshops and symposia that helped define key issues for scientists around the world. More recently, the 1998 Hawaii Coral Reef Monitoring Workshop; the 1999 International Conference on Scientific Aspects of Coral Reef Assessment, Monitoring, and Restoration; the Ninth and Tenth International Coral Reef Symposia (2000 and 2004); the 2002 *Acropora* Workshop in Miami; the 2003 Coral Reefs, Climate, and Coral Bleaching Workshop in Hawaii; the 2004 *Diadema* workshop in Miami; and the 2002 and 2004 workshops of the Coral Disease and Health Consortium (Charleston, Key Largo, and Madison) all have added to the sense of urgency.

Another significant development was the 1998 establishment of the U.S. Coral Reef Task Force. In 2000, the Task Force issued *The National Action Plan to Conserve Coral Reefs*, which included the following statement about monitoring:

"Successful coral reef conservation requires adaptive management that responds quickly to changing environmental conditions. This, in turn, depends upon monitoring programs that track trends in coral reef health and reveal significant trends in the condition - before irreparable harm occurs.

Monitoring can also play a vital role in guiding and supporting the establishment of complex or potentially controversial management strategies such as no-take ecological reserves, fishing gear restrictions or habitat restoration, by documenting the impacts of gaps in existing management schemes and illustrating the effectiveness of new measures over time."

The *National Action Plan* notes that accurate mapping and rigorous monitoring and assessment directly contribute to coral reef conservation by:

- Documenting the status of ecologically and economically important reef species.
- Tracking and assessing changes in reef communities in response to environmental stressors or specific human activities and uses.
- Evaluating the effectiveness of specific management strategies and identifying directions for future adaptive responses.
- Evaluating the natural recovery and/or restoration of injured or degraded reefs.
- Enabling informed decisions about the location of potentially harmful activities.
- Providing baselines for assessing catastrophic damage from natural or manmade events such as storms, diseases, vessel groundings, and toxic spills.
- Serving as an early warning system for identifying declines in coral reef health.

The *National Action Plan* also points out that modern coral reef ecology is still a comparatively young discipline, and many phenomena remain only partially understood, particularly as they relate to coral reef conservation. For example, the causes and impacts of many coral reef stressors remain uncertain, as do many of the fundamental ecological processes that determine the structure, condition, and dynamics of healthy coral reef communities and the recovery of impaired systems.

As a result, the coral reef conservation community is at a great disadvantage because threats to coral reefs apparently are increasing faster than the scientific knowledge base needed to understand and ameliorate them through active conservation measures. Without significant effort to strategically target research on coral reef conservation issues, further losses of live coral may be widespread across the Florida Reef Tract within our lifetimes. At present, research on coral reef ecosystems - both basic and applied - is insufficient to meet these needs. Moreover, further efforts are needed to identify and target critical knowledge gaps through cooperative assessment and planning by federal and state resource and funding agencies with responsibilities for coral reef ecosystems.

In order to obtain a peer-reviewed evaluation of its research and monitoring efforts, the Sanctuary convened a meeting in December 2000, at which principal investigators presented findings of their monitoring and research projects to an independent Science Advisory Panel. In turn, the panel provided recommendations, which have been incorporated into the *Comprehensive Science Plan*. This plan links research and monitoring to specific management objectives to help ensure science-based management of Sanctuary resources.

Goals and Objectives

The goal of the Sanctuary's Research and Monitoring Action Plan is to provide the knowledge necessary to make informed decisions concerning the protection of the biological diversity and natural ecosystem processes of the Sanctuary and its resources.

The objectives of this action plan are to:

- Encourage and provide support for research and monitoring that lead to better understanding of key ecological processes and criteria for recognizing ecological change; and
- Use research and monitoring results to evaluate management actions and improve them accordingly.

Implementation

The Sanctuary's Research and Monitoring Action Plan will be implemented by a coordinated framework of Federal, state, and local agencies in cooperation with academic and research institutions. In many cases, academic institutions take the lead in implementing strategies and activities that deal with predictive modeling, research, or monitoring. The FKNMS, FDEP, and FWC, however, have the lead responsibility for overall program implementation. The EPA, programs within NOAA other than the FKNMS, and other agencies and organizations will continue to provide leadership in implementing many research and monitoring strategies.

Priorities

The Research and Monitoring Action Plan includes 13 strategies. Five strategies from the 1997 *Management Plan* have not been included here because of the low likelihood of implementing low-priority strategies over the next five years (see "Previous Strategies at the end of this Action Plan). The highest-ranking strategies are Ecological Research and Monitoring and Marine Zone Monitoring. Strategies of high or medium priority typically seek to develop information to evaluate water quality and ecosystem health. High- and medium-priority activities also result in information useful to marine zoning, boating, and fisheries management.

Geographic Focus

All research and monitoring strategies apply to the entire Sanctuary. However, some strategies may include components applicable to specific areas, such as fully protected marine zones. It is important to recognize that some ecosystem patterns and trends within the Sanctuary may be caused by larger-scale phenomena such as variable oceanic circulation features and weather cycles.

excluding the National
Park Areas (Biscay Dero)

Personnel

The staff required to implement the Research and Monitoring Action Plan are a mix of personnel from the agencies and organizations listed in the detailed discussion of each strategy. When EPA or FWC is the lead agency for implementing a strategy, Sanctuary personnel assist in directing the activities. Researchers are registered through a regional permitting system (see the Science Management and Administration Action Plan).

Scientists from universities, research institutions, and environmental firms are involved in research and monitoring activities on a long- or short-term basis. NOAA, FDEP, or FWC personnel dedicated to research and monitoring activities direct the remaining activities.

Sanctuary Employees

Science activities require three full-time Sanctuary employees: a science coordinator, a research interpreter, and an assistant. The Sanctuary Superintendent and Regional Managers also are actively involved in these activities. Additional Sanctuary staff assists many science projects, including vessel and diving support.

STRATEGY W.33 ECOLOGICAL RESEARCH AND MONITORING

Strategy Summary

The purpose of this strategy is to detect status and trends of various ecological parameters in order to discern local and system-wide effects of human and natural disturbances on natural resources and to assess the overall health of the ecosystem.

The initial science program emphasized characterizations, surveys, and monitoring, which have yielded comprehensive baseline data on water quality, coral reef and hard-bottom communities, seagrasses, and important fishery species. As was recommended by an independent Science Advisory Panel in December 2000, the Sanctuary's science program needs to include more research on *a need* ecological processes. This mechanistic level of understanding will enable resource managers to determine whether management actions are feasible to remedy patterns or trends determined by monitoring projects. *Just who are these people?*

The Sanctuary is the lead agency for the overall implementation of the Ecological Research and Monitoring Program, working with the EPA, FWC, academic and nongovernmental organizations, and the Technical Advisory Committee. The Comprehensive Science Plan identifies and prioritizes specific research and monitoring needs to meet management objectives. *a separate document not available on internet*

Activities (7)

(1) Continue Status and Trends Monitoring of Water Quality, Coral Reef and Hard-bottom Communities, and Seagrasses. This activity produces long-term, comprehensive information on Sanctuary-wide status and trends of water quality parameters and biological resources. Water quality parameters being monitored include temperature, salinity, dissolved oxygen, turbidity, relative fluorescence, light attenuation, nutrients, chlorophyll, and alkaline phosphatase activity. Biological monitoring of coral reef and hard-bottom communities and seagrasses is also being conducted.

Status: On-going.

Implementation: The Southeast Environmental Research Center, Florida International University, has monitored water quality since 1995. The FWC/Fish and Wildlife Research Institute has monitored coral reef and hard-bottom communities since 1996. Monitoring of seagrasses has been conducted by the Southeast Environmental Research Center and Department of Biology, Florida International University, since 1996. *anything published (references)*

will seek to link ecosystem indicators to performance measures established for the Comprehensive Everglades Restoration Plan.

Status – No action has been taken.

Implementation – The Sanctuary will be the lead agency for this activity; the FWC and FDEP will have primary roles. Sanctuary staff will include this activity in a request for proposals.

(6) *Initiate or Expand Research and Monitoring of Marine-life Species.* In light of changes in fish community structure that may result from the network of fully protected marine zones, there is a need for more data on marine herbivores and fish cleaners. Other fisheries, such as the aquarium and shell trades, have unknown ecosystem impacts and need investigation. For example, collectors annually gather and sell large numbers of sea biscuits, an important consumer of dead organic material; the ecological effects of its collection may be significant. This activity highlights the need to investigate components of the ecosystem that generally are overlooked in lieu of studies of habitats and commercially important species.

Status: On-going.

Implementation: The University of North Carolina at Wilmington/National Undersea Research Center at Key Largo collects data on distribution and abundance of some marine-life species through its Rapid Ecological Assessment surveys. The Sanctuary will be the lead agency, in cooperation with the FWC. This strategy is also included in the Volunteer, Outreach and Education, and Water Quality Action Plans. Sanctuary staff will include this activity in a request for proposals.

(7) *Long-Term Monitoring of Water Temperature.* Extreme water temperature fluctuations in the FKNMS have been linked to bleaching and disease in reef corals and mass mortality of seagrass in Florida Bay. Recording thermographs are deployed throughout the Florida Reef Tract to monitor this important environmental parameter.

Status: On-going.

Implementation: Initiated in 1989, this program has expanded to include 34 stations from Miami to the Dry Tortugas in depth that range from 5 to 70 ft. The thermographs sample at 2-hour intervals and are secured on the seabed in theft-proof housings. The units are serviced annually and recalibrated every 2 years FKNMS staff oversee the program, including deploying and recovering instruments, downloading thermographs, and providing data to management and other user groups.

Hudson?

STRATEGY Z.6 MARINE ZONE MONITORING

Strategy Summary

There are five types of marine zones in the Sanctuary: Wildlife Management Areas, Ecological Reserves, Sanctuary Preservation Areas, Special-use (Research-only) Areas, and Existing Management Areas. Marine zone monitoring occurs in the three types of marine zones that are fully protected from consumptive activities ("no-take zones"): Ecological Reserves, Sanctuary Preservation Areas, and Special-use (Research-only) Areas. The purpose of this strategy is to determine the effectiveness of fully protected marine zones as a management action for the conservation and sustainable use of marine resources. The basic design of these monitoring studies is to compare surveys within and outside of fully protected marine zones. Some studies, such as monitoring of reef fishes by NOAA Fisheries/Southeast Fisheries Science Center and the Reef Environmental Education Foundation, include surveys prior to implementation of the fully protected marine zones, enabling an optimal BACI (before/after, control/impact) sampling design. Initial findings of the Marine Zone Monitoring Program are in the 1998 and 1999 *Zone Performance Reviews*, the *Sanctuary Monitoring Report 2000*, and the *Sanctuary Science Report 2001: An Ecosystem Report Card* (available at http://floridakeys.noaa.gov/research_monitoring/).

Activities (3)

(1) Develop Baseline Data. Before monitoring begins, a baseline survey of existing resources in Ecological Reserves, Sanctuary Preservation Areas, and Special-use Areas must be conducted. The surveys characterize the status of important marine species and their habitats.

Status: Surveys of Western Sambo Ecological Reserve have been completed as part of long-term monitoring projects, and characterization studies of the Tortugas Ecological Reserve were completed prior to its implementation. Surveys of Sanctuary Preservation Areas were conducted prior to or soon after their implementation. Surveys of Special-use Areas were conducted.

Implementation: The University of North Carolina at Wilmington/National Undersea Research Center at Key Largo conducts Rapid Ecological Assessments of benthic communities, and the Dauphin Island Sea Lab conducts additional coral reef community surveys at three fully protected zones and reference areas. NOAA Fisheries/Southeast Fisheries Science Center and the Reef Environmental Education Foundation conduct surveys of reef fishes. The FWC/ Fish and Wildlife Research Institute conducts surveys of spiny lobster and queen conch.

(2) Monitor Marine Zones and Utilize as Controls. Research and monitoring of the Sanctuary marine zones determine the degree to which the zones meet goals and objectives for protecting natural resources, as well as human-use patterns, attitudes and compliance. In order to determine where additional Special-use Areas might be appropriate, it is necessary to compile and review data on use patterns and areas of high resource impact. Additional data will be gathered to address particular concerns, including issues identified by the SAC and the public.

Status: On-going.

Implementation: An interdisciplinary team (Florida Institute of Oceanography, Dauphin Island Sea Lab, Bermuda Biological Station for Research, and NOAA Fisheries/Southeast Fisheries Science Center) monitors the Western Sambo Ecological Reserve, Eastern Sambo Research-only Area, Carysfort Sanctuary Preservation Area, and reference sites in order to detect functional changes (predation, herbivory, and coral recruitment) and structural changes (population abundance and size structure) that result from the restriction of consumptive activities. The University of Florida/Florida Sea Grant/Monroe County Cooperative Extension Service, in collaboration with a commercial fisher, conducted an additional shorter-term investigation of spiny lobster "spillover" at the Western Sambo Ecological Reserve and adjacent reference sites. Coordination of existing research and monitoring and the implementation of new programs will occur in the Tortugas Ecological Reserve, as described in the *Final Supplemental Environmental Impact Statement/Supplemental Management Plan* for the Tortugas Ecological Reserve. The focus of ecological monitoring of Sanctuary Preservation Areas, Special-use (Research-only) Areas, and reference sites is on detecting structural changes (population abundance and size structure) that result from the restriction of consumptive activities. These monitoring studies examine benthic community structure (University of North Carolina at Wilmington/National Undersea Research Center at Key Largo), reef fishes (NOAA Fisheries/Southeast Fisheries Science Center and the Reef Environmental Education Foundation), and spiny lobster and queen conch (FWC/ Fish and Wildlife Research Institute). Monitoring of human-use patterns, attitudes, and compliance with marine zone regulations is being conducted by an interdisciplinary team (NOAA/National Ocean Service/Special Projects Division, University of Miami/Rosenstiel School of Marine and Atmospheric Science, and Thomas J. Murray & Associates). NOAA is the lead agency for organizing the activity; however, partnerships, contracts, and agreements with other academic, agency, or non-governmental programs will likely be required for full implementation.

(3) Utilize Marine Zones as Research Areas. For all three types of fully protected marine zones, permitted researchers may conduct non-invasive experiments to address management strategies.

Status: Some research projects are being conducted in Ecological Reserves and Sanctuary Preservation Areas. Looe Key and Conch Reef have longer-term data sets.

Implementation: Academic and agency scientists conduct research projects. Grants to implement this strategy have been provided by NOAA/NOS/NCCOS/Coastal Ocean Program, EPA/Special Studies, and NOAA/National Undersea Research Program.

STRATEGY W.36 CONDUCTING SOCIOECONOMIC RESEARCH

Strategy Summary

Continue researching the socioeconomic impacts of Sanctuary management on user groups. This research is necessary to achieve a management objective identified by the SAC: "Providing a management system which is in harmony with an environment whose long-term ecological, economic, and sociological principles are understood, and which will allow appropriate sustainable uses." Socioeconomic issues include consequences to fishers who were displaced by implementation of fully protected zones in 1997 and 2001, user-group perceptions about changes in natural resources associated with management actions such as zoning, use patterns of Sanctuary waters, and user-group valuation of Sanctuary resources.

Activities (4)

(1) Utilize Ecological Reserves, Sanctuary Preservation Areas, and Special-use Areas for Socioeconomic Research. Data are needed to test hypotheses about detrimental socioeconomic impacts of marine zoning and user-group perceptions about changes in natural resources within the Sanctuary. User-group perceptions of changes in natural resources can be compared with quantitative ecological data.

Status: Several socioeconomic studies are underway.

Implementation: In 1998, the socioeconomic program (a collaboration of NOAA/National Ocean Service/Special Projects Division, University of Miami/Rosenstiel School of Marine and Atmospheric Science, and Thomas J. Murray & Associates) began to monitor commercial fisheries. Panels of fishers displaced by Sanctuary Preservation Areas and the Western Sambo Ecological Reserve were created. Their catch and financial performance are being tracked. One panel consists of Keys-wide fishers who were not impacted by the areas. In addition, a panel was constructed of Tortugas fishers and three years of baseline data were obtained before creation of the Tortugas Ecological Reserve. In 2000-2001, NOAA formed a multi-agency partnership to estimate the economic value of southeast Florida's artificial and natural reefs. Additional information was gathered on the use of artificial reefs and on residents' support for additional fully protected marine areas (<http://marineeconomics.noaa.gov/>). In addition, the study completed a five-year comparison of visitors and residents who used reefs (1995-96 and 2000-01). Importance and satisfaction ratings for 25 natural resource attributes (e.g., water clarity, coral cover, diversity of marine life, etc.), facilities and services in the Florida Keys were compared (<http://marineeconomics.noaa.gov/SocmonFK/impsat.pdf>).

(2) Monitor Use Patterns of the Entire Sanctuary and the Market and Non-market Economic Values of Sanctuary Resources. This effort will provide data and analysis to examine use and valuation of artificial and natural reefs by residents and visitors.

Status: On-going.

Implementation: Baseline data on recreation and tourism were developed in 1995-96. In 2000-2001, many of the 1995-96 measurements were updated and some measurements of direct reef use (artificial and natural reefs separately) were made. (<http://marineeconomics.noaa.gov/SocmonFK/impsat.pdf>). In 2000-2001, a study was conducted on recreation and tourism in the four-county southeast Florida area that includes

the Sanctuary. Artificial and natural reef use by residents and visitors was a major focus. The report establishes links between the economy and reef use and develops estimates of the recreational value of the reefs (<http://marineeconomics.noaa.gov/>).

(3) Monitor Use Patterns on Existing Artificial and Natural Reefs Surrounding Sites for Sinking New Artificial Reefs. This effort will provide data and analysis to test the hypothesis that sinking a new artificial reef in a natural reef environment will reduce use on the surrounding natural reefs.

Status: On-going.

Implementation: In 2001, two pre-sinking and post-sinking data collection efforts were planned. Efforts to monitor the impact of sinking the *Spiegel Grove* off Key Largo were initiated in 2001. A second effort proposes studies that will be implemented in the event that the *U.S.S. Hoyt Vandenberg* is sunk off Key West. The State is a partner in the proposed Vandenberg study.

(4) Support Science of Socioeconomic Analysis of Marine Protected Areas. Very little is known about applied socioeconomic analysis to marine protected areas. Funding support will be provided for scientists to meet and share information on this subject.

Status: On-going.

Implementation: In 2000 and 2001, the socioeconomic program partnered with NOAA/National Ocean Service/International Programs Office, to fund technical sessions on the socioeconomics of marine protected areas.

STRATEGY F.3 RESEARCHING QUEEN CONCH POPULATION ENHANCEMENT METHODS

Strategy Summary

Research has investigated optimal approaches to increasing queen conch populations through release of aquaculture-reared juveniles. Research to date has determined that rearing juveniles to a size suitable for release in the field is cost-prohibitive. Results are being shared with interested parties for possible continuation of aquaculture-based population enhancement. Further research utilizing reciprocal transplants supports the efficacy of moving queen conch from non-reproductive, inshore environments to reproductive, offshore environments. On-going research is investigating possible endocrine disruption of queen conch near shore.

Activities (2)

(1) Transplant Queen Conch from Inshore to Offshore Environments. Research has determined that moving queen conch from non-reproductive, inshore environments to reproductive, offshore environments is a cost-effective method for increasing reproductive output.

Status: On-going.

Implementation: This activity is an existing priority of the FWC/FWRI and is supported by volunteers. This activity is also included in the Volunteer Action Plan.

(2) Investigate the Cause of Reproductive Failure of Inshore Queen Conch. Research on various snails in other parts of the world has shown that snails are susceptible to endocrine disruption caused by various anthropogenic contaminants. This activity will determine the cause of reproductive failure, possibly by endocrine disruption, of queen conch in the Keys.

Status: On-going.

Implementation: The FWC/FWRI, in collaboration with the University of Florida, has obtained a grant from the NOAA/NOS/NCCOS/Coastal Ocean Program to investigate anthropogenic effects on queen conch reproductive development.

STRATEGY F.7 RESEARCHING IMPACTS FROM ARTIFICIAL REEFS

Strategy Summary

A number of artificial reefs (intentionally sunk ships) have been placed in the Sanctuary. The impacts of these structures on fish and invertebrate populations and habitats, and the longevity of these structures, are not known. Research is needed on these topics to determine whether the placement of artificial reefs is consistent with goals and objectives of the Sanctuary.

Activities (3)

(1) Investigate Impacts of Artificial Reefs on Fish and Invertebrate Populations for Long-term Management Including Location, Size, and Materials. The effects of artificial reefs on fish and invertebrate abundance and community composition and on other Sanctuary resources will be assessed. The longevity of artificial reefs composed of different materials will be evaluated. Appropriate artificial reef locations will be determined, based in part on these findings.

Status: On-going.

Implementation: Impacts on reef fishes of the *Spiegel Grove* are being investigated by the Reef Environmental Education Foundation. Permit holders are responsible for these investigations with oversight from Sanctuary staff.

(2) Monitor and Evaluate Habitat Modification Caused by the Installation of Artificial Reefs. This activity complements Activity 1; information on habitat modifications caused by artificial reefs is a necessary element of evaluating consistency of artificial reefs with Sanctuary goals and objectives. Soft sediments may be altered during installation of artificial reefs, and water flows around these structures are likely to continue to modify soft sediments and their associated communities. Nearby hard-bottom habitats may also experience modifications as a result of altered flows and other factors associated with artificial reefs.

Status: No action has been taken.

Implementation: Permit holders are responsible for these investigations with oversight from Sanctuary staff.

(3) Assess and Develop Regulations for Artificial Reef Construction and Evaluate Habitat Suitability for Artificial Reefs.

Status: No action has been taken.

Implementation: Permit holders assess and report the impacts and benefits of artificial reefs. This activity is included in the Volunteer and Regulatory Action Plans.

STRATEGY F.6 FISHERIES SAMPLING

Strategy Summary

An improved fisheries sampling program requires improving the spatial resolution of commercial and recreational fisheries-dependent and fisheries-independent sampling programs to provide statistics on catch and effort. This can be accomplished by establishing smaller sampling areas. Fisheries-independent samples measure pre-recruits of economically important species in the statistical areas. Regulations will be developed and implemented in accordance with FWC and the protocols for consistent regulations (see also Strategy R.2, Activity 6 in the Regulatory Action Plan).

Activities (3)

(1) *Evaluate and Enhance Existing Census Programs.* Existing commercial landing and recreational creel census programs continue to be evaluated and improved to provide statistically based management information for regulating take. This includes the assessment and modification of information types and mandatory vs. voluntary information. To increase the resolution, smaller sampling areas should be considered by NOAA Fisheries/Southeast Fisheries Science Center (SEFSC) and FWC. Estimation of private recreational fishing activity and catch should also be considered for a more complete assessment of scope and sources of fisheries impacts.

Status: Several on-going projects.

Implementation: The FWC and National Marine Fisheries Service (NMFS) are the lead agencies for implementing this activity. The National Park Service and the South Atlantic and Gulf of Mexico Fishery Management Councils provide primary support. NOAA Fisheries/SEFSC has taken a yearly census of fish populations for 15 years at the Key Largo and Looe Key National Marine Sanctuaries. Since 1986, the FWC/FWRI has administered a commercial fishery-dependent monitoring program that includes the snapper-grouper complex, pompano, dolphin, mackerel, spiny lobster, amberjack, and stone crab. The FWC/FWRI is also conducting a fisheries-dependent monitoring program for charter boats.

(2) *Continue a Fishery Pre-recruitment Monitoring Effort.* A fisheries pre-recruitment monitoring effort has been initiated for the long-term prediction of fishery stocks for Sanctuary management. This effort is independent of commercial monitoring activities. The FWC has begun implementation of fishery pre-recruitment monitoring efforts for other areas in the State. Several statistical areas have been established, and this activity will evaluate and implement the programs to that level. It has not been possible to monitor all species at all areas.

Status: On-going.

Implementation: The FWC has partially implemented a statewide fisheries pre-recruitment monitoring program that includes the Sanctuary.

(3) *Investigate Life Histories of Fishery Species.* For most fishery species, scientific studies of complete life histories are lacking. Life histories describe the ecology of an organism's life cycle, e.g., survival from stage to stage, stage-specific feeding and habitat utilization, adult reproduction, and life span. These investigations should include species on the FWC marine life list.

Status: No action has been taken.

Implementation: NOAA and FWC are the lead agencies for implementing this activity.

STRATEGY F.11 EVALUATING FISHING GEAR/METHOD IMPACTS

Strategy Summary

Approximately half-a-million lobster traps and a million stone crab traps are deployed in Sanctuary waters during the fishing seasons for these species, which last eight months and seven months, respectively. The habitat impacts of lowering and raising such a considerable number of traps, as well as additional impacts from "ghost traps" and entangled lines, require investigations.

Activities (3)

(1) Evaluate Impacts of Existing Fishing Gear and Methods on Habitats. Research is needed to investigate impacts on habitats of commercial and recreational fishing gear and methods.

Status: Preliminary investigations have been conducted.

Implementation: The NOAA/NOS/NCCOS/Center for Coastal Fisheries and Habitat Research is investigating impacts of lobster traps on seagrass habitat and NOAA Fisheries is investigating coral reef impacts.

(2) Conduct Research on Low-impact Fishing Gear and Methods. This activity will facilitate research to develop gear designs and types that minimize impacts to corals, hard-bottom, seagrasses, and other habitat and species. Biodegradable fishing line, traps, and buoy lines are examples of gear types that would be studied. Modified trap designs would also be considered. Fishing methods, including resource handling and gear placement, would be examined to develop methods and gear that minimize impacts to resources while maintaining efficiency. Volunteers will provide assistance.

Status: No action has been taken.

Implementation: The FWC, SAFMC, and GMFMC will be the lead agencies.

(3) Conduct Research on the Ecological Impacts on Sanctuary Preservation Areas of Bait Fishing and Catch-and-release Fishing by Trolling. In order to make an informed decision about whether to maintain the catch-and-release fishing by trolling and bait-fishing provisions for some of the protected areas, it is necessary to assess the ecological effects of these limited consumptive activities.

Status: No action has been taken.

Implementation: NOAA will be the lead agency for organizing; partnerships, contracts, and agreements with other academic, agency, or non-governmental programs will likely be required for full implementation of this activity.

STRATEGY F.15 ASSESSING SPONGE FISHERY IMPACTS

Strategy Summary

The purpose of this strategy is to determine which sponge fishing methods have a low adverse impact on species and habitat and identify areas that exhibit low abundance, low recovery rates, and habitat damage. The strategy supports the development and implementation of regulations for the sponge fishery.

Activities (1)

(1) Assess Impacts of Sponge Fishery Methods. Research is needed to compare impacts on resources and habitats of different sponge fishing methods.

Status: The SAC held two workshops in 2000 to gather information about commercial sponging and forwarded its recommendations to the FWC.

Implementation: The FWC is the lead agency for implementing this activity. Investigators at Old Dominion University have been awarded grants from the NOAA/NOS/NCCOS/ Coastal Ocean Program to investigate dynamics of hard-bottom communities, including commercially fished sponge species.

STRATEGY W.18 CONDUCTING PESTICIDE RESEARCH

Strategy Summary

This strategy will establish an independent research program to identify the impacts of spraying practices on Sanctuary resources and identify alternative means of mosquito control. Because pesticides used in mosquito control are nonspecific to the larval stages of crustaceans, fish and natural mosquito predators, the effects of the chemicals and all application methods need to be examined. In addition, the impacts of housing patterns, design, and landscaping need to be investigated as they affect the demand for mosquito control. This strategy is partnered with Strategy W.17 in the Water Quality Action Plan, which focuses on mosquito spraying.

Activities (3)

(1) Research Impacts and Alternatives. Research the impacts of current spraying practices on Sanctuary resources and identify alternative means of mosquito control.

Status: A special study was funded in 1997 to investigate if aerial or truck-sprayed pesticides drift into nearshore surface waters. Dibrom and its breakdown product were found in some subsurface samples several hours after application in sufficient concentrations that represented an ecological hazard to sensitive marine organisms. More research is needed to quantify the risk of mosquito spraying and larvicide application on non-target organisms. The Monroe County Mosquito Control District asked USFWS for permission to aerially apply larvicides on refuge islands adjacent to population centers. USFWS approved limited use of ground application if it was part of a pilot project that included monitoring of impacts on target and non-target species. That alternative was supported by the Sanctuary's Technical Advisory Committee but rejected by the Monroe County Mosquito Control District.

Implementation: The lead agency will be the Florida Department of Agriculture and Consumer Services (FDACS). The FDEP will also have a primary role regarding evaluations of pesticide toxicity. The FDCA may also have an assisting role as the State land-planning agency for a designated Area of Critical State Concern, with oversight responsibility to ensure that local development regulations adequately protect the area's natural resources.

(2) Modify the Mosquito Control Program. The results of the pesticide research program will be used to modify the existing mosquito control program as necessary.

Status: No action has been taken.

Implementation: The lead agency will be the FDACS; the FDEP will also be a primary agency.

(3) Conduct a Field Survey of Household use of Pesticides and Herbicides and Develop a Plan to Minimize Their Impact on the Environment. This activity would involve a survey of pesticides, herbicides, and fungicides used in the Keys. The activity seeks to develop a plan, with a strong public education component, that will minimize the environmental impacts of household chemicals.

Status: No action has been taken.

Implementation: The lead agency will be the FDACS; the FDEP will also be a primary agency.

STRATEGY W.22 ASSESSING WASTEWATER POLLUTANTS IMPACTS

Strategy Summary

The purpose of this strategy is to: 1) conduct special studies to establish pollutant-loading thresholds above which biotic communities are adversely affected; 2) detect the presence of wastewater pollutants from on-site sewage treatment and disposal systems (OSTDS), cesspits, package plant boreholes, and surface-water dischargers; 3) determine the relative pollution contribution of each method to surface waters, groundwaters, and sediments, document the transport of pollutants into the environment; and 4) describe the severity and extent of ecological impacts that can be linked to the pollutants.

Activities (1)

(1) Conduct Wastewater Pollutants and Ecological Impact Studies. Potential approaches include experimental studies, eutrophication gradient studies; comparative studies of impacted and non-impacted sites; historical studies; geographic comparisons, use of biochemical and ecological indicators, use of sewage tracers; and high-frequency and spatially intensive water quality sampling.

Status: To date, six special studies have been completed. A comprehensive monitoring program has been initiated at Little Venice (Marathon, FL) to document conditions in canal and nearshore waters prior to and after construction of a central collection and treatment system for wastewater. This strategy is also included in the Water Quality Action Plan.

Implementation: EPA and FDEP are the lead agencies. The Sanctuary and Monroe County also have primary roles. The Water Quality Protection Program's Technical Advisory Committee and Steering Committee approve research topics and products.

STRATEGY W.23 RESEARCHING OTHER POLLUTANTS AND WATER QUALITY ISSUES

Strategy Summary

Conduct special studies to document the fate and ecological impacts of non-wastewater pollutants, develop innovative monitoring tools, and examine effects of global climate change on organisms and ecosystems of the Keys.

Activities (4)

Do mention of canal & Bays & Sound
(1) Estimate Other Pollutant Loadings. This activity will document the locations and magnitudes of pollution impacts other than wastewater. Sources will include those both inside and outside of the Sanctuary (for example, permitted discharges, stormwater runoff, groundwater leachates, marinas, the C-111 canal, Biscayne Bay, Florida Bay, southwest Florida, oceanic fluxes, and gyre-induced upwellings). Pollutants will include hydrocarbons, heavy metals, and pesticides.

what!
Status: Three special studies found that water movement through tidal passes is predominantly towards the Atlantic Ocean, and wind may be a controlling factor in speed and direction; pesticides used for mosquito control, or their toxic breakdown products are found in some canals in concentrations high enough to adversely affect marine organisms; and human pathogenic viruses were present in residential canals in the Keys, and these viruses were viable in cooler months. *what is that level*

Implementation: EPA and FDEP will be the lead agencies. Assistance may be provided by the Sanctuary, National Park Service (NPS), and South Florida Water Management District (SFWMD).

(2) Identify Causal Linkages Between Pollutants and Ecological Impacts. This activity will conduct research to identify and document causal linkages between non-wastewater pollutants and specific ecological problems.

Status: A special study demonstrated that corals exposed to water from Florida Bay grow more slowly than corals at control sites, probably in response to increased turbidity of Florida Bay waters. Current monitoring at the Little Venice site (Marathon, Florida) includes quantifying the structure of the seagrass community near the mouths of residential canals before and after improvements to wastewater treatment. Implementation: EPA and FDEP are the lead agencies. NOAA, NPS and SFWMD may provide assistance.

(3) Develop and Evaluate Innovative Monitoring Tools. This activity will identify and evaluate monitoring tools and methodologies used to detect pollutants and identify cause-and-effect relationships among water quality and biological resources.

Status: Special studies to date have found that coral growth rates and the concentration of zooxanthellae respond to environmental conditions; that the algal community changes in structure between Florida Bay and the Keys; and that chlorophyll in surface waters is a reliable and easily measured indicator of movements of water masses.

Implementation: EPA and FDEP are the lead agencies. NOAA also has a primary role.

This makes no sense - what is the point?

(4) *Conduct Research on Global Change.* This activity will involve research to examine the effects of stresses associated with global change on the ecosystem. Examples of stresses include changes in temperature, salinity, frequency and intensity of storms, turbidity, sea level change, and ultraviolet and visible radiation.

Status: No action has been taken; several independently funded research projects have investigated some of the stresses listed above.

Implementation: The Sanctuary will be the lead agency. EPA, USFWS, and FDEP will assist. This activity is also included in the Water Quality Action Plan.

STRATEGY W.24 RESEARCHING FLORIDA BAY INFLUENCES

Strategy Summary

Conduct research to understand effects of water transported from Florida Bay on water quality in the Sanctuary.

Activities (3)

(1) Conduct a Historical Assessment. This activity will involve a historical assessment of the hydrology of the Everglades, Florida Bay, and Florida Keys water as it has affected water quality and biological communities in the Sanctuary. It will clarify the role of freshwater inflows and water quality from the Everglades and other freshwater discharges to the southwest shoreline of Florida, Florida Bay, and the Sanctuary. The activity will examine the effects of structural modifications and changes in quality, quantity, timing and distribution of freshwater releases from existing structures and will examine land-based practices affecting the water quality of runoff.

Status: Four Florida Bay Science Conferences have been successfully completed. A Paleoecology Report has been prepared for Florida Bay. ACOE has developed a Water Quality Model for Florida Bay. That model has not been implemented because it depends on an accurate hydrodynamic model that has not yet been prepared.

Implementation: SFWMD and NPS are the lead agencies. Assistance is provided by ACOE, which has historical data concerning water management activities affecting the Everglades and Florida Bay. A water quality monitoring network has been established in Florida Bay and surrounding coastal areas, including Biscayne Bay, Whitewater Bay, Ten Thousand Islands, the Southwest Florida Shelf, and waters of the Sanctuary. Historical salinity data for Florida Bay have been assembled and summarized.

(2) Conduct Circulation Studies. This activity will involve water circulation studies to estimate present-day, long-term net transport and episodic transport from Florida Bay to the Sanctuary. Studies of groundwater flow may also be included.

Status: A special study entitled "Hawk Channel Transport Study: Pathways and Processes" has been completed. A hydrodynamic model for Florida Bay has been developed by ACOE, but during testing it did not successfully duplicate known salinity patterns. Another hydrodynamic model for Florida Bay will be developed as part of the Florida Bay/Florida Keys Feasibility Study of the Comprehensive Everglades Restoration Plan. The University of Miami is conducting bimonthly cruises of Florida Bay and the west Florida shelf and continues to employ satellite-tracked drifters to study circulation patterns in Florida Bay and ocean currents.

Implementation: The EPA, FDEP, and NOAA are the lead agencies.

(3) Conduct Ecological Studies. This activity will involve studies to document any ecological impacts of Florida Bay waters on Sanctuary communities and potentially endangered or threatened species. Documentation of potential impacts could provide a stronger basis for action to restore historical freshwater flow to Florida Bay.

repeat →
Status: Three special studies have been completed that address the impact of Florida Bay waters on Sanctuary resources. Findings include a demonstration that corals exposed to Florida Bay water grow at slower rates than those at a control site; that corals exposed to Florida Bay water had significantly higher zooxanthellae concentrations, probably in response to decreased light penetration in the more turbid water; and that differences in the algal community structure in waters surrounding the Florida Keys may, in part, be explained by the influence of Florida Bay waters. One study used carbon and nitrogen isotope ratios to attempt to determine sources of organic matter and nitrogen on the reef tract.

Implementation: EPA and the FDEP are the lead agencies.

STRATEGY W.21 DEVELOPING PREDICTIVE MODELS

Strategy Summary

This strategy will develop predictive models that, with appropriate scientific guidance, would help resource managers predict and evaluate the outcome of a particular strategy, such as engineering to reduce wastewater nutrient loadings. Initial conceptual models would be developed, information needs identified, environmental data gathered, and quantitative models developed and refined over the long-term and on a continuous basis.

Activities (2)

(1) Conduct a Modeling Workshop. This activity will involve conducting a workshop to discuss modeling approaches, develop preliminary conceptual models, and define specific information needs for the models.

Status: The Florida Keys Carrying Capacity Study developed an Integrated Water Module for the Sanctuary that included stormwater and wastewater loading estimates for total nitrogen, total phosphorus, biochemical oxygen demand, and total suspended solids. A National Research Council Report (*A Review of the Florida Keys Carrying Capacity Study*) identified a number of deficiencies with this module.

Implementation: The lead agencies will be EPA, FKNMS, and FDEP.

(2) Develop a Modeling Implementation Plan. This activity will involve developing an overall plan for developing predictive models focused on management needs. The plan will include discussion of preliminary conceptual models, data needs, data gathering, and model development and refinement. The plan will also discuss mechanisms for ensuring that the modeling effort remains closely tied to management needs.

Status: No action has been taken. Hydrodynamic, water quality, and ecological modeling for Florida Bay is being conducted as part of the Florida Bay/Florida Keys Feasibility Study of the Comprehensive Everglades Restoration Plan.

Implementation: The lead agencies will be EPA, FKNMS, and FDEP. NPS, SFWMD, and ACOE will assist.

PREVIOUS STRATEGIES

This review of the FKNMS Management Plan identified some Action Strategies that no longer warrant the low- or medium-priority attention they originally received in the *1997 Management Plan*. The following strategies are not included in this action plan because of the low likelihood of implementing low-priority strategies over the next five years:

- W.9 Laboratory Facilities
- F.4 Aquaculture Alternatives
- F.10 Bycatch
- F.14 Spearfishing
- R.5 Carrying Capacity

3.4.1 Marine Zoning Action Plan

Introduction

In its enabling legislation, Congress instructed NOAA to consider temporal and geographical zoning to ensure protection of Sanctuary resources. During the development of the 1997 *Management Plan*, NOAA and its partners determined that marine zoning would be critical to achieving the Sanctuary's primary goal of resource protection, especially in light of the multiple-use mandates.

The FKNMS established the nation's first comprehensive network of marine zones in 1997 after years of planning, design, and public input. The marine zoning plan for the Sanctuary includes five types with varying levels of protection called Sanctuary Preservation Areas (SPAs), Ecological Reserves, Special-use Areas, Wildlife Management Areas (WMAs), and Existing Management Areas.

In its 2001 evaluation of the this Action Plan, the SAC found that the five strategies in the 1997 Zoning Action Plan had been implemented according to the 1997 *Final Management Plan*. This represents a highly effective component of Sanctuary management. The Advisory Council also found that marine zoning is one of the most immediately successful tools used by the Sanctuary for conservation and protection of threatened natural marine resources. The Sanctuary's zones have met with favorable response from the community, and many areas are effecting positive biological change inside their boundaries after just a few years of protection.

Public comments during scoping as well as comments received by Sanctuary Managers since the implementation of the Marine Zoning Action Plan in 1997 have resulted in the consideration of additional WMAs and SPAs in the FKNMS. These areas will be proposed through a separate regulatory process (also see Strategy R.2, Regulatory Action Plan, Activity 17).

Types of Zones In The Sanctuary

There are five types of zones in the Sanctuary: Sanctuary Preservation Areas, Ecological Reserves, Special-use (Research-only) Areas, Wildlife Management Areas, and Existing Management Areas.

Sanctuary Preservation Areas

SPAs protect shallow, heavily used reefs where conflicts occur among user groups and where concentrated visitor activity leads to resource degradation. These zones encompass discrete, biologically important areas and are designed to reduce user conflicts and sustain critical marine species and habitats. Regulations for SPAs are designed to limit consumptive activities while continuing to allow activities that do not threaten resource protection. There are eighteen SPAs totaling approximately 6.5 square nautical miles. The largest area is Carysfort/South Carysfort, and the smallest areas are Dry Rocks and Cheeca Rocks.

Ecological Reserves

Ecological Reserves seek to protect biodiversity by setting aside areas with minimal human disturbance. Ecological Reserves encompass large, contiguous, diverse habitats, in order to protect and enhance natural spawning, nursery, and permanent-residence areas for the replenishment and genetic protection of fish and other marine life. Allowing certain areas to evolve in or return to a natural state preserves the diverse range of resources and habitats throughout the Sanctuary. Ecological Reserves protect the food and home of commercially and recreationally important species, as well as the hundreds of marine organisms not protected by fishery management regulations.

Regulations for Ecological Reserves are designed to meet the objectives of these zones by limiting consumptive activities while continuing to allow activities that do not threaten resource protection. Ecological Reserves therefore restrict all consumptive activities and allow non-consumptive activities only where such activities are compatible with resource protection. There are currently two Ecological Reserves in the Sanctuary, the Western Sambo Ecological Reserve and the Tortugas Ecological Reserve, totaling approximately 160 square nautical miles (548 square kilometers).

Special-use (Research-only) Areas

Special-use (Research-only) Areas are set aside for research and education, or for the recovery or restoration of injured or degraded resources. Special-use Areas may also be established to facilitate access to or use of Sanctuary resources, or to prevent user conflicts. The areas may confine or restrict activities such as personal watercraft operation and live-aboard mooring. Access is restricted to permitted entry only. The four permanent Special-use Areas in the Sanctuary are designated for Research-only and are located at Conch Reef and Tennessee Reef in the Upper and Middle Keys, and Looe Key Patch Reef and Eastern Sambo in the Lower Keys.

Wildlife Management Areas

Wildlife Management Areas (WMAs) seek to minimize disturbance to especially sensitive or endangered wildlife and their habitats. These zones typically include bird nesting, resting, or feeding areas, turtle-nesting beaches, and other sensitive habitats. Regulations are designed to protect these species or the habitat while providing for public use. Access restrictions may include no-access buffers, no-motor zones, idle-speed only/no-wake zones, and closed zones. Some restrictions may apply to time periods, others to areas. There are currently 27 WMAs in the Sanctuary. Twenty WMAs are co-managed with the U.S. Fish and Wildlife Service as part of their plan for managing backcountry portions of the Key West, Key Deer, Great White Heron, and Crocodile Lake National Wildlife Refuges. NOAA manages the remaining seven WMAs.

Existing Management Areas

Existing Management Areas are resource management areas that were established prior to the 1997 Sanctuary management plan. Sanctuary regulations supplement the existing authorities to facilitate comprehensive protection of resources. There are 21 Existing Management Areas in the Sanctuary. Fifteen are administered by the Florida Department of Environmental Protection, four by the US Fish and Wildlife Service, and two by NOAA (Key Largo and Looe Key National Marine Sanctuaries).

Goals and Objectives

Marine zoning's purpose is to protect and preserve sensitive components of the ecosystem while facilitating compatible activities. Marine zoning ensures that areas of high ecological importance evolve naturally, with minimal human influence. Marine zoning also promotes sustainable uses, protects diverse habitats, and preserves important natural resources and ecosystem functions. The objectives for marine zoning are to:

- Reduce stresses from human activities by establishing areas that restrict access to sensitive wildlife populations and habitats.
- Protect biological diversity and the quality of resources by protecting large, contiguous and diverse habitats that provide natural spawning, nursery, and permanent residence areas for the replenishment and genetic protection of marine life and protect and preserve all habitats and species.

- Minimize conflicting uses.
- Protect resources and separate conflicting uses by establishing a number of non-consumptive zones in areas that are experiencing conflict between consumptive and non-consumptive uses and in areas experiencing significant declines.
- Eliminate injury to critical or sensitive habitats.
- Disperse concentrated collection of marine organisms.
- Prevent heavy concentrations of uses that degrade Sanctuary resources.
- Provide undisturbed monitoring sites for research.
- Provide control sites to help determine the effects of human activities.

Implementation

NOAA remains the primary agency responsible for Ecological Reserves, Sanctuary Preservation Areas, and Special-use Areas in the Sanctuary. NOAA is also responsible for seven Wildlife Management Areas and shares responsibility and jurisdiction over 20 Wildlife Management Areas with the FWS. The 21 Existing Management Areas within the Sanctuary are administered by a variety of Federal and state agencies, including NOAA. Any additional management areas proposed by Federal, state, or county governments or local municipalities would be administered under the jurisdiction of those authorities.

The Sanctuary has the lead responsibility for implementing zoning strategies outlined in this action plan. NOAA staff continues to be directly responsible for maintaining zone boundary markings. Continued, full implementation of the Marine Zoning Action Plan often requires participation of various agencies and organizations, volunteer support, and private vendors for specific activities. NOAA remains the primary funding source for strategies in this action plan, except for marking the Wildlife Management Areas in FWS jurisdictions.

Marine Zoning Maps

This Marine Zoning Action Plan describes specific activities related to establishing, marking, implementing, and evaluating marine zones. Maps showing the marine zones can be found at http://floridakeys.noaa.gov/research_monitoring/map.html.

Relationship to Other Action Plans

Several other Action Plans are either directly or indirectly connected to marine zoning activities in the Sanctuary, such as:

- The Enforcement Action Plan describes enforcement strategies.
- The Waterway Marking/Management Action Plan describes marking and maintenance of boundary buoys or signs.
- The Mooring Buoy Action Plan describes buoy placement in many of the zones.
- The Education and Outreach Action Plan describes education and outreach programs aimed at interpreting the zones.
- The Research and Monitoring Action Plan and Science Management and Administration Action Plan describe monitoring of the zones, dissemination of monitoring results, and the degree to which the zones meet their goals and objectives.

Accomplishments

There have been multiple zoning accomplishments during implementation of the 1997 management plan, including:

- Designated the Tortugas Ecological Reserve in the westernmost portion of the Sanctuary. The process began by establishing a diverse, 25-member Tortugas 2000 Working Group and culminated with the release of the *Final Supplemental Environmental Impact Statement / Final Management Plan for the Tortugas Ecological Reserve* in November 2000.
- Gathered extensive input and public participation in the Tortugas Ecological Reserve process that highlighted the importance of this zoning issue to the local and national community. The area received all agency approvals necessary and was fully implemented on July 1, 2001.
- Implemented a Zone Monitoring Program to examine the effects of the fully protected zones on marine resources.
- Established a temporary and then permanent rule to protect living corals and significant habitats of Tortugas Bank from anchor damage by freighters.
- Deployed 118 boundary markers (highly visible 30-inch yellow buoys) for the 18 Sanctuary Preservation Areas, four Special-use Areas, and the Western Sambo Ecological Reserve.
- Deployed boundary markers for the Wildlife Management Areas and adjacent no-motor zones.
- Developed a simple, no-cost permit system to allow the netting of bait fish in certain zones.
- Prioritized Sanctuary enforcement in "no take" areas, resulting in a high level of compliance.
- Instituted education and outreach efforts, such as Team OCEAN and participation in public events and presentations, resulting in a better-informed public and greater compliance.

Strategies

There are five management strategies in this Marine Zoning Action Plan. Each of these strategies is detailed below.

- Z.1 Sanctuary Preservation Areas
- Z.2 Ecological Reserves
- Z.3 Special-use Areas
- Z.4 Wildlife Management Areas
- Z.5 Existing Management Areas

Each of these strategies is detailed below. Table 3.10 provides estimated costs for implementation of these strategies over the next five years.

Table 3.10 Estimated Costs of the Marine Zoning Action Plan

Z.1: Sanctuary Preservation Areas	100	120	100	80	80	480 ^{1,2}
Z.2: Ecological Reserves	100	120	100	80	80	480 ^{1,2}
Z.3: Special-use Areas	100	120	100	80	80	480 ^{1,2}
Z.4: Wildlife Management Areas	100	120	100	80	80	480 ^{1,2}
Z.5: Existing Management Areas	-	-	-	-	-	-
¹ Estimated 5 Year Cost listed here does not include funding for placement and maintenance of buoys and markers along zone boundaries. Refer to Waterway Management Action Plan for these figures.						
² Estimated 5 Year Cost listed here does not include funding for monitoring, evaluating, and reporting on zone effectiveness. Refer to Research and Monitoring Action Plan for these figures.						

STRATEGY Z.1 SANCTUARY PRESERVATION AREAS

Strategy Summary

Sanctuary Preservation Areas have been established to protect shallow, heavily used reefs where conflicts occur among user groups, and where concentrated visitor activity leads to resource degradation. The zones encompass discrete, biologically important areas and are designed to reduce user conflicts in high-use areas and sustain critical marine species and habitats.

Regulations for Sanctuary Preservation Areas seek to limit consumptive activities while continuing to allow activities that do not threaten resource protection. Therefore consumptive activities are restricted with two exceptions. The first exception is that NOAA currently allows catch-and-release fishing by trolling in four preservation areas: Conch Reef, Alligator Reef, Sombrero Key, and Sand Key. The second exception is that the taking of ballyhoo (bait fish) by cast and lampara nets is currently allowed by permit in all Sanctuary Preservation Areas. Non-consumptive activities are allowed in all of these zones. The full regulations for Sanctuary Preservation Areas are in Appendix C.

There are currently 18 Sanctuary Preservation Areas, totaling approximately 6.5 square nautical miles. The largest is Carysfort/South Carysfort, and the smallest are Dry Rocks and Cheeca Rocks. Maps and coordinates can be found at http://floridakeys.nos.noaa.gov/research_monitoring/map.html.

Activities (8)

(1) Maintain Buoys Along Zone Boundaries. Boundary buoys have been placed at the corner of each Sanctuary Preservation Area. Buoys carry stickers to clarify no-take regulations. For all Sanctuary Preservation Areas, buoy positions may be altered to clearly distinguish zone boundaries. NOAA continues to provide regular buoy maintenance under the Waterway Management Action Plan.

Status: Buoys have been placed at the corner of each Sanctuary Preservation Area.

Implementation: Buoys continue to be maintained by NOAA under the Waterway Management Action Plan.

(2) Establish and Implement Management Responsibilities. The Sanctuary continues to oversee all aspects of zone management for Sanctuary Preservation Areas. Eighteen areas have been fully implemented. Mooring buoys are installed and maintained to facilitate non-consumptive use and reduce anchor damage, as described in the Mooring Buoy Action Plan. Research and monitoring aimed at determining the efficacy of these areas in preserving species populations and habitats are described in the Research and Monitoring Action Plan. Regulations for all Sanctuary Preservation Areas are listed in Appendix C.

Enforcement in Sanctuary Preservation Areas has been minimal to date, which may compromise their ecological integrity and reduce their effectiveness in separating use conflicts. A strategy to address enforcement by increasing officers is contained in the Enforcement Action Plan.

NOAA also recognizes that public compliance with zone regulations is greatly enhanced through education and outreach. To this end, strategies that address public education and outreach are of high priority and further explained in the Education and Outreach Action Plan. Despite excellent

educational products and programs, interpreting the boundaries of the marine zones continues to be a priority. These issues are discussed in Activities below. Addressing these issues and altering Sanctuary Preservation Areas is critical to reducing conflicts and protecting the shallow, heavily used reefs as intended by this designation.

Status: All 18 Sanctuary Preservation Areas have been fully implemented.

Implementation: NOAA will continue to manage all Sanctuary Preservation Areas.

(3) Assess Existing Zone Boundaries and Adjust as Needed. The placement of Sanctuary Preservation Areas requires periodic evaluation and adjustment as new scientific data, socioeconomic and use information, user group knowledge, and other information become available. Some boundaries may be altered to remove strain from degraded habitats, protect unique features, or facilitate certain uses.

Boundary changes may also be appropriate in areas where use conflicts occur or enforcement is problematic. The configuration and regulations of some zones needs to be evaluated and altered to improve enforcement and protection.

Status: Boundaries of the Sanctuary Preservation Areas, including the Conch Reef Sanctuary Preservation Area and adjacent Conch Reef Special-use/Research-Only Area, have yet to be assessed.

Implementation: NOAA is the agency responsible for this activity and will undertake a boundary assessment of the Sanctuary Preservation Areas when resources permit. At that time the Conch Reef Sanctuary Preservation Area and Conch Reef Special-use/Research-Only Area will be given priority.

(4) Evaluate Allowable Activities in Existing Zones and Make Regulatory Changes as Needed.

Sanctuary Preservation Areas have specific regulations that allow and disallow certain activities within the zones. Unlike Ecological Reserves, which prohibit all consumptive activities without exception, Sanctuary Preservation Areas restrict consumptive uses but do permit limited taking of marine life by specific methods in specific zones. Catch-and-release fishing by trolling is allowed in four areas: Conch Reef, Alligator Reef, Sombbrero Key, and Sand Key. Taking ballyhoo (bait fish) by cast net or lampara net (commercial gear for this species) is currently allowed by permit in existing zones.

These two exceptions to no-take regulations need to be re-evaluated in order to improve enforcement and education of these areas. People gather information on allowable activities from sources such as brochures, boat-ramp signs, and word-of-mouth, but also by observing the actions of others. The yellow boundary buoys of Sanctuary Preservation Areas, Ecological Reserves, and Special-use Areas indicate when one enters a protected zone. Allowable and prohibited activities for each area, and individual restrictions for each zone require periodic evaluation and may need to be changed.

Status: The activities currently allowed within the Sanctuary Preservation Areas have yet to be evaluated.

Implementation: NOAA is the agency responsible for this activity and will undertake regulatory assessments and associated changes when resources permit.

(5) Identify and Evaluate Areas/Regions for Additional Marine Zoning, and Establish and Implement Zones if Appropriate. Existing Sanctuary Preservation Areas were established based on the status of important habitat, the ability of an area to sustain the habitat, the level of use, and the degree of conflict between consumptive and non-consumptive users. The size and location of the areas were then guided by examining user patterns, aerial photography, and ground-truthing. As new information on resource damage or decline, conflicts, or critical habitats becomes available, additional areas for new Sanctuary Preservation Areas will be evaluated.

Status: The identification of additional areas/regions suitable for the placement of Sanctuary Preservation Areas has not been undertaken to date.

Implementation: NOAA is the agency responsible for this activity and will undertake identification and evaluation when resources permit.

(6) Monitor, Evaluate, and Report on Effectiveness of Zones. Monitoring is necessary in order for NOAA to assess the effectiveness of Sanctuary Preservation Areas in ameliorating resource degradation and reducing user conflicts. Monitoring in all Sanctuary Preservation Areas has been ongoing for over three years. These results and how they are reported are described in the Research and Monitoring Action Plan and Science Management and Administration Action Plan. In order to make informed decisions about continuing catch-and-release fishing by trolling and bait fishing, the ecological effect of these activities will be assessed and is described in the Research and Monitoring Action Plan.

Status: Scientific monitoring is currently underway in all Sanctuary Preservation Areas, and is further described in the Research and Monitoring Action Plan.

Implementation: NOAA is the agency responsible for this activity and will continue to monitor the Sanctuary Preservation Areas in conjunction with other programs or agencies.

(7) Evaluate Uses of Existing and New Zones and, if Appropriate, Manage Impacts as Needed. NOAA recognizes that patterns of resource use, levels of impact, and user satisfaction are likely to change over time. Changes and fluctuations in marine life species populations and habitats will also be observed. As needed, existing and new impacts will be assessed, evaluated, and managed.

Status: An evaluation of use and other patterns in the Sanctuary Preservation Areas has not been undertaken to date.

Implementation: NOAA is the agency responsible for this activity and will undertake use evaluations and associated management changes when resources permit.

(8) GIS and NOAA/NOS Chart Revisions. NOAA will use GIS to accurately site and establish legal boundaries for zones and ensure these are provided to the NOAA/NOS Charting Division to be placed on all relevant navigational charts.

Status: This is a new activity.

Implementation: NOAA is responsible for this activity.

STRATEGY Z.2 ECOLOGICAL RESERVES

Strategy Summary

Ecological Reserves have been established to protect biodiversity by setting aside areas with minimal human disturbance. They encompass large, contiguous and diverse habitats, in order to protect and enhance natural spawning, nursery, and residence areas for the replenishment and genetic protection of fish and other marine life. Allowing certain areas to evolve in or return to a natural state preserves the full range of diversity of resources and habitats found throughout the Sanctuary. Ecological Reserves protect the food and home of commercially and recreationally important species, as well as the hundreds of marine organisms not protected by fishery management regulations.

The SAC developed a list of criteria for Ecological Reserves and the Tortugas 2000 Working Group established criteria for the creation and establishment of the Tortugas Ecological Reserve (Table 3.11). Regulations for Ecological Reserves are designed to meet their objectives by limiting consumptive activities while continuing to allow activities that do not threaten resource protection. Thus, Ecological Reserves restrict all consumptive activities and allow non-consumptive activities in some zones where such activities appear compatible with protection.

There are currently two Ecological Reserves in the Sanctuary: the Western Sambo Ecological Reserve (9 nm²) and Tortugas Ecological Reserve (151 nm²). Maps and coordinates can be found at http://floridakeys.nos.noaa.gov/research_monitoring/map.html.

An Ecological Reserve had been proposed in the Dry Tortugas region during the 1995 Draft Management Plan process. However, extensive public comment received at that time indicated that the proposed boundaries would pose serious, adverse economic impacts on users of the area. In response to those comments, NOAA withdrew the proposal but committed to determining boundaries and final regulations for a reserve in the Tortugas within two years. NOAA then undertook an extensive process in coordination with the National Park Service to design and establish the Tortugas Ecological Reserve. At the core of this process, called "Tortugas 2000," was a diverse stakeholder and agency working group that reviewed scientific and socioeconomic data and gathered input from users, environmental organizations, and the public to build a consensus recommendation on the boundaries and regulations. The Tortugas 2000 process, resulting working group recommendation, alternatives for the reserve, NOAA's final boundary and regulatory action, and a comprehensive socioeconomic analysis are published in the *Final Supplemental Environmental Impact Statement/Supplemental Management Plan for the Tortugas Ecological Reserve*. This document has not been reproduced as part of this action plan, but is considered an integral component of it. It can be downloaded from the Sanctuary's web site at <http://www.floridakeys.noaa.gov>.

Table 3.11 Criteria for the Creation and Establishment of the Tortugas Ecological Reserve

Criteria	Objective
Biodiversity and habitat	Try to choose an area that would contain the greatest level of biological diversity and widest range of contiguous habitats representative of the Florida Keys marine ecosystem.
Fisheries sustainability	Try to choose an area that would provide the greatest benefit in protecting and enhancing commercially and recreationally important fish species, especially those that are rare, threatened, or depleted.
• Spawning areas • Full life cycles	• Try to choose an area that would include significant fish spawning aggregation sites. • Try to choose an area that would encompass all the habitats required to support the full life cycle of commercially and recreationally important fish.
Sufficient size	Try to choose a boundary that would encompass an area that is large enough to meet the criteria listed above and to achieve the potential benefits and goals of an ecological reserve.
Allowable activities	Try to allow only those activities in the Ecological Reserve that would be compatible with achieving its goals.
Socio-economic impacts	Try to choose an area and craft recommendations that would serve to minimize adverse socio-economic impacts in the short- and long-term on established users of resources in the area.
Reference area/monitoring	Try to choose an area that would serve as a reference or control area to facilitate the monitoring of anthropogenic impacts and to evaluate the consequences of establishing the Ecological Reserve.
Enforcement/compliance	Try to choose a boundary and craft regulations that would facilitate enforcement and encourage compliance.
Water quality	Try to choose an area that is known to have suitable water quality.

Activities (8)

(1) Place and Maintain Buoys Along Zone Boundaries. Boundary buoys have been placed along the Western Sambo Ecological Reserve. The buoys carry stickers to clarify no-take regulations. Boundary buoys will not be placed along the Tortugas Ecological Reserve. Deepwater and open-ocean conditions make the placement of buoys in this area difficult to impossible. GPS and marked navigational charts are more practical methods of depicting these areas to the public.

For all Ecological Reserves, boundary buoys may be added, removed, or shifted in exact location to clearly distinguish boundaries. NOAA continues to provide regular maintenance of boundary buoys

under the Waterway Management Action Plan. If additional Ecological Reserves are established, NOAA would place and maintain buoys and signs as appropriate.

Status: Buoys will continue to be added, removed, or shifted in exact location to clearly distinguish zone boundaries.

Implementation: NOAA is the agency responsible for this activity.

(2) Establish and Implement Management Responsibilities. The Sanctuary continues to oversee all aspects of zone management for the Ecological Reserves. The Western Sambo Ecological Reserve has been fully implemented. The Mooring Buoy and Research and Monitoring Action Plans describe specific activities in Western Sambo. The Tortugas Ecological Reserve has also been fully implemented. A permitting system for access to Tortugas North has been implemented and is described in the *Final Supplemental Environmental Impact Statement/Supplemental Management Plan for the Tortugas Ecological Reserve*. Mooring buoys have been installed at some locations in Tortugas North and are described in the Mooring Buoy Action Plan.

Regulations for both reserves are listed in Appendix C. A strategy to address enforcement needs by increasing officers is in the Enforcement Action Plan. Public compliance with zone regulations is greatly enhanced through education and outreach. Strategies for public education and outreach are in the Education and Outreach Action Plan. Research and monitoring efforts aimed at determining the efficacy of these zones are described in the Research and Monitoring Action Plan.

Status: Both Ecological Reserves have been fully implemented.

Implementation: NOAA will continue to be the responsible agency for managing the Ecological Reserves.

(3) Assess Existing Zone Boundaries and Adjust as Needed. The placement of existing Ecological Reserves requires periodic evaluation and adjustment as new scientific data, socioeconomic information, user group knowledge, and other information becomes available. Boundaries of some reserves may be altered to capture important habitats or ecological features. For example, if new scientific data identifies a previously unknown benthic formation unique to the Sanctuary but falling just outside a zone, the boundary may be altered to protect the feature.

Status: Boundaries of the Western Sambo Ecological Reserve have yet to be assessed. Boundaries of the Tortugas Ecological Reserve were based on the most current information available in 2000 and do not require assessment at this time.

Implementation: NOAA is the agency responsible for this activity and will undertake a boundary assessment of the Western Sambo Ecological Reserve when resources permit.

(4) Evaluate Allowable Activities in Existing Zones and Make Regulatory Changes as Needed. Ecological Reserves have specific regulations that allow and disallow certain activities. Activities for each reserve require periodic evaluation and may be changed to address issues of concern. For example, if public input indicates resources are damaged by a particular activity, the possibility of changing regulations to reduce the conflict will be evaluated.

Status: The activities currently allowed within the Western Sambo Ecological Reserve have yet to be evaluated. Allowable activities for the Tortugas Ecological Reserve were based on extensive scientific data and public input in 2000 and do not require evaluation at this time.

Implementation: NOAA is the agency responsible for this activity and will undertake regulatory assessments and associated changes when resources permit.

(5) Identify and Evaluate Areas/Regions for Additional Marine Zoning, and Establish and Implement Zones if Appropriate. The two Ecological Reserves were established based on a thorough review of scientific data on ocean current patterns, known fish spawning aggregations, unique coral formations, and other biological resource information available at the time that each reserve was considered. Extensive socioeconomic information was also used to assess potential impacts on user groups. If new scientific data, socioeconomic information, local user group knowledge, and other information become available, additional areas or regions for new reserves will be evaluated.

Status: The identification of additional areas/regions suitable for Ecological Reserve placement has not been undertaken.

Implementation: NOAA is the agency responsible for this activity and will undertake identification and evaluation when resources permit.

(6) Monitor, Evaluate, and Report on Effectiveness of Zones. Monitoring is necessary to assess the effectiveness of Ecological Reserves in preserving biodiversity and protecting habitats. Monitoring in the Western Sambo Ecological Reserve has been on-going for more than three years. Coordination of existing research and monitoring and the implementation of new monitoring programs has occurred in the Tortugas Ecological Reserve. These activities are described in the Research and Monitoring Action Plan and the *Final Supplemental Environmental Impact Statement/Supplemental Management Plan for the Tortugas Ecological Reserve*.

Status: Scientific monitoring is currently underway in both Ecological Reserves, and is further described in the Research and Monitoring Action Plan.

Implementation: NOAA is the agency responsible for this activity and will continue to monitor the Ecological Reserves in conjunction with other programs and agencies.

(7) Evaluate Uses of Existing and New Zones, and if Appropriate, Manage Impacts as Needed. Ecological Reserves seek to protect biodiversity and preserve the full range of habitats, allowing areas to evolve in or return to a natural state. Ecological Reserves, therefore, have the highest level of protection; only non-consumptive activities compatible with resource protection are permitted. However, NOAA recognizes that patterns of use, marine life species populations and habitats are likely to change over time. Therefore, NOAA is committed to evaluating and managing existing and new impacts to ensure proper function and performance of Ecological Reserves.

Status: An evaluation of use or other patterns in the Ecological Reserves has not been undertaken to date.

Implementation: NOAA is the agency responsible for this activity and will undertake use evaluations and associated management changes when resources permit.

(8) *GIS and NOAA/NOS Chart Revisions.* NOAA will use Geographic Information Systems to accurately site and establish legal boundaries for zones and assure these are provided to the NOAA/NOS Charting Division to be placed on all relevant navigational charts.

Status: This is a new activity.

Implementation: NOAA is responsible for this activity.

STRATEGY Z.3 SPECIAL-USE AREAS

Strategy Summary

Special-use Areas are set aside areas for scientific research and education or the recovery or restoration of injured or degraded resources. The areas may also be established to facilitate access to or use of resources, and to prevent user conflicts. Special-use Areas may also be designated to minimize adverse environmental effects of high-impact activities. Because Special-use Areas seek to facilitate special management programs such as habitat recovery, restoration, and research, or to minimize impacts on sensitive habitats, access is restricted to permitted entry only. The regulations are in Appendix C.

There are currently four permanent Special-use Areas, all designated for scientific research and monitoring (Research-Only Areas). The Special-use/Research-Only Areas are Conch Reef and Tennessee Reef in the Upper and Middle Keys, and Looe Key Patch Reef and Eastern Sambo in the Lower Keys. Maps and coordinates can be found at http://floridakeys.nos.noaa.gov/research_monitoring/map.html.

To date, Special-use Areas represent an under-utilized tool that offers the flexibility in design to achieve many conservation goals. Ideally, applying a combination of Sanctuary regulations to any given issue may be the most comprehensive approach to long-term resource protection. For example, the No-anchor Area of the Tortugas Bank for vessels more than 50 meters long was implemented in 1998. Although this zone was established under regulations not directly associated with Special-use Areas, closure to high-impact activities is an appropriate application of the designation. Another example is the temporary closure of discrete areas to aid large-scale coral reef restoration efforts.

Activities (9)

(1) Place and Maintain Buoys Along Zone Boundaries. Boundary buoys have been placed at the corner of each Special-use Area. The buoys are marked "Research-only" and buoy stickers to clarify no-entry regulations for these zones are being considered. For all Special-use Areas, buoy positions may be altered to clearly distinguish zone boundaries. NOAA will continue regular maintenance of boundary buoys under the Waterway Management Action Plan.

Status: Buoys have been placed at the corner of each Special-use Area.

Implementation: Buoys continue to be maintained by NOAA under the Waterway Management Action Plan.

(2) Establish and Implement Management Responsibilities. The Sanctuary continues to oversee all aspects of zone management for Special-use Areas. Research and monitoring efforts aimed at determining the efficacy are described in the Research and Monitoring Action Plan. Further monitoring inside and outside of Special-use/Research-Only Areas is required to ascertain the effects of non-consumptive activities on resources. Regulations are listed in Appendix C. Although not directly a provision of Sanctuary regulations associated with Special-use Areas, the ease of enacting temporary, emergency closures should be improved and their duration lengthened to allow fast, adequate response to immediate resource impacts.

Enforcement in these areas needs to be increased. A strategy to address pressing enforcement needs for these zones by increasing officers is contained in the Enforcement Action Plan. NOAA recognizes that public compliance with zone regulations is greatly enhanced through education. Currently the boundary buoys of Special-use/Research-Only Areas read "Research-only;" however, new stickers to clarify no-entry regulations are being considered. Additional strategies that address public education and outreach are explained in the Education and Outreach Action Plan.

Status: All four Special-use/Research-Only Areas have been fully implemented.

Implementation: NOAA will continue to manage all Special-use Areas.

(3) Assess Existing Zone Boundaries and Expand/Adjust as Needed. The placement of existing Special-use/Research-Only Areas requires periodic evaluation and adjustment as new scientific research, compliance information, and other data become available. Boundaries of some areas may need adjustment to protect unique biological features or remove strain from degraded habitats. Boundary changes may also be appropriate in areas where use conflicts occur or enforcement is problematic. The configuration and regulations of some zones needs to be evaluated and altered to improve enforcement and protection.

Status: Boundaries of the Special-use Areas, including the Conch Reef Special-use/Research-Only Area and adjacent Conch Reef Sanctuary Preservation Area, have yet to be assessed.

Implementation: NOAA is the agency responsible for this activity and will undertake a boundary assessment of the Special-use Areas when resources permit. At that time the Conch Reef Special-use/Research-Only Area and Conch Reef Sanctuary Preservation Area will be given priority.

(4) Evaluate Allowable Activities in Existing Zones and Make Regulatory Changes as Needed. The Special-use/Research-Only Areas have stringent regulations that restrict access to only permitted entry to facilitate research and monitoring. Allowable activities for each area require periodic evaluation. Also, changes in designation from Research-Only to another Special-use Area type may be appropriate where a zone is not being used as intended.

Status: The activities currently allowed within the Special-use Areas have not been evaluated to date.

Implementation: NOAA is the agency responsible for this activity and will undertake regulatory assessments and associated changes when resources permit.

(5) Determine High Impact Activities or User Conflicts. In order to determine where implementation of Special-use Areas might be appropriate and the type of designation required, it is necessary to assess and evaluate activities that have a high impact on resources and identify conflicting activities. The Sanctuary will accomplish this by compiling and reviewing data on use patterns and high impact areas. Additional data will be gathered to address particular concerns or issues. Input from the SAC and the public about critical issues and areas of concern are essential to this activity.

Status: The assessment and evaluation of high impact activities and user conflicts has not been undertaken to date.

Implementation: NOAA is the agency responsible for this activity and will undertake assessment and evaluation when resources permit.

(6) Determine and Establish Appropriate Zones for High-Impact or User-Conflict Activities. Special-use Areas support research and monitoring and may also be designated to recover injured or degraded resources, facilitate access or use, prevent conflicts, and confine or restrict activities. Based on the issues identified and information developed in Activity 5, and after public review, additional Special-use Areas may be developed for high impact or user conflict activities.

Status: The establishment of appropriate zones to address high impact or user conflict activities has not been undertaken.

Implementation: NOAA is the agency responsible for this activity. This activity will be undertaken after Activity 5 is completed and when resources permit.

(7) Monitor, Evaluate, and Report on Effectiveness of Zones. In order to assess the effectiveness of Special-use Areas, zone monitoring focuses on detecting changes due to the cessation of consumptive activities. Zone monitoring is on-going in all Special-use Areas and the dissemination of results is described in the Science Management and Administration Action Plan. Zone monitoring is also required in order to ascertain the effects of non-consumptive activities on resources. NOAA is responsible for this activity; however, partnerships, contracts, and agreements with academic, other-agency, or non-governmental programs are required for full implementation.

Status: Scientific monitoring is currently underway in all Special-use Areas and is further described in the Research and Monitoring Action Plan.

Implementation: NOAA is the agency responsible for this activity and will continue to monitor the Special-use Areas in conjunction with other programs or agencies.

(8) Determine Permitting Process. A process for issuing permits that allows scientists access to Special -Use/Research-Only Areas has been fully implemented (See Strategy R.1 in the Regulatory Action Plan). If additional Special-use Areas are designated for purposes other than research, monitoring, and education, an appropriate permitting process will be determined and implemented.

Status: A permitting process has been fully implemented.

Implementation: NOAA continues to be the agency responsible for this activity.

(9) GIS and NOAA/NOS Chart Revisions. NOAA will use GIS to accurately site and establish legal boundaries for zones and ensure these are provided to the NOAA/NOS Charting Division to be placed on all relevant navigational charts.

Status: This is a new activity.

Implementation: NOAA is responsible for this activity.

STRATEGY Z.4 WILDLIFE MANAGEMENT AREAS

Strategy Summary

Wildlife Management Areas typically include bird nesting, resting, or feeding areas, turtle nesting beaches, and other sensitive habitats including shallow flats that are important feeding areas for fish. Regulations governing access seek to protect endangered or threatened species or habitats, while providing opportunities for public use. Access restrictions include no-access buffer zones, no-motor zones, idle-speed only/no-wake zones, and closed zones. Some restrictions specify time periods when use is prohibited.

There are currently 27 WMAs in the Sanctuary. The Sanctuary and USFWS jointly manage 20 of the areas as part of their plan for managing backcountry portions of the Key West, Key Deer, Great White Heron, and Crocodile Lake National Wildlife Refuges. The USFWS administers these 20 areas, including marking the areas with buoys and signs as appropriate. These areas are part of this plan as an integrated ecosystem management approach to resource protection. NOAA continues to mark and manage the remaining seven WMAs.

Since 1997, several new municipalities have been incorporated in the Florida Keys. Some of the new municipalities have jurisdiction over nearshore waters. The Sanctuary acknowledges these municipalities and their authority to establish managed areas in the nearshore waters of the Sanctuary. If additional WMAs are established, NOAA or the responsible agency or government will ensure that the zones are implemented and managed as appropriate.

Activities (7)

(1) Continue to Place and Maintain Buoys and Signs Along Zone Boundaries. Boundary buoys and/or signs have been and will continue to be placed along the boundaries of each WMA. NOAA continues to work with the USFWS to place and maintain buoys or markers at the Crocodile Lakes WMA.

Status: Buoys and signs continue to be added, removed, or shifted in exact location to clearly distinguish zone boundaries and clarify channels of access routes.

Implementation: NOAA is the agency responsible for this activity.

(2) Assess Existing Zone Boundaries and Adjust as Needed. The placement of existing WMAs requires periodic evaluation and adjustment as new scientific data, socioeconomic information, local user group knowledge, and other information become available. Boundaries of some areas may need to be shifted, expanded, or reduced to protect key species or populations, capture important habitats or ecological features, facilitate public uses, or address user conflicts. For example, if new scientific data identifies a regular breeding area for a particular species just outside the boundary of a zone, the boundary may be shifted or expanded to offer protection to that important biological feature.

Status: Boundaries of the WMAs have been marked, but they need to be assessed and adjusted as necessary.

Implementation: NOAA is the agency responsible for this activity and will undertake boundary assessments when resources permit.

(3) *Evaluate Allowable Activities in Existing Zones and Make Regulatory Changes as Needed.* Each of the existing WMAs has specific regulations that allow and disallow certain activities. Allowable activities for each area require periodic evaluation and may need to be changed to address issues of concern. For example, if public input indicates conflicts with wildlife in an area that has allowed idle-speed-only/no-wake access, the possibility of changing the zone to no-motorized access will be evaluated.

Status: The activities currently allowed within the WMAs have yet to be evaluated.

Implementation: NOAA is the agency responsible for this activity and will undertake regulatory assessments and associated changes when resources permit.

(4) *Identify and Evaluate Areas for Additional Marine Zoning, and Establish and Implement Where Appropriate.* The 27 existing WMAs in the Sanctuary were established based on information on the locations of sensitive wildlife populations and habitats available at the time of the Draft Management Plan process in 1995. As new scientific data, socioeconomic information, local user group knowledge, and other information become available to Sanctuary managers, areas or regions in the Sanctuary for new areas will be identified, evaluated and implemented through a regulatory process.

Status: The establishment of new WMAs will occur through a process separate from this management plan review.

Implementation: NOAA is the agency responsible for this activity.

(5) *Monitor, Evaluate, and Report on Effectiveness of Zones.* In order for NOAA to assess the effectiveness of WMAs in protecting sensitive wildlife populations and habitats, specific monitoring will occur. NOAA is responsible for this activity; however, partnerships, contracts, and agreements with other academic, agency, or non-governmental programs will likely be required for full implementation (see also Strategy Z.6, Research & Monitoring Action Plan).

Status: Scientific monitoring is currently not performed within the WMAs.

Implementation: This activity will be undertaken in conjunction with the support of other programs or agencies when resources permit.

(6) *Evaluate Uses of Existing and New Zones and, if Appropriate, Manage Impacts as Needed.* NOAA recognizes that marine vessels, equipment, technology, and patterns of use change over time. Changes and fluctuations in marine populations and habitats will be observed and as needed, existing and new impacts will be assessed, evaluated, and managed.

Status: An evaluation of use patterns in the WMAs has not been undertaken to date.

Implementation: NOAA is the agency responsible for this activity and will undertake use evaluations and associated management changes when resources permit.

(7) *GIS and NOAA/NOS Chart Revisions.* NOAA will use GIS to accurately site and establish legal boundaries for zones and assure these are provided to the NOAA/NOS Charting Division to be placed on all relevant navigational charts.

Status: This is a new activity.

Implementation: NOAA is the agency responsible for this activity.

STRATEGY Z.5 EXISTING MANAGEMENT AREAS

Strategy Summary

This zone type simply identifies areas managed by other agencies where restrictions already exist or officially incorporate the regulations of two previously designated sanctuaries (Key Largo and Looe Key NMS). These zones delineate existing jurisdictions of state parks, aquatic preserves, sanctuaries, and other restricted areas. The purpose is to recognize established management areas, complement existing programs, and ensure cooperation and coordination among agencies. Because some Existing Management Areas are managed by other agencies, regulations already exist under those authorities. Sanctuary regulations supplement these authorities. If management of existing areas within the Sanctuary requires additional regulations or restrictions, the measures would be developed and implemented in coordination with the agency. Regulations for some existing areas, including those for Key Largo and Looe Key NMS, are contained in Appendix C.

A total of 21 Existing Management Areas occur in the Sanctuary. Fifteen of these areas are administered by DEP, and include: Bahia Honda State Park, Curry Hammock, Fort Zachary Taylor State Historic Site, Indian Key State Historic Site, John Pennkamp Coral Reef State Park, Key Largo Hammocks State Botanical Site, Lignumvitae Key State Botanical Site (includes Shell Key State Preserve), Long Key State Recreation Area, San Pedro State Underwater Archaeological Site, Windley Key State Geological Site, Biscayne Bay and Card Sound Aquatic Preserve, Coupon Bight Aquatic Preserve, and Lignumvitae/Indian Key Aquatic Preserve. Four remaining areas are managed by FWS (Crocodile Lake National Wildlife Refuge, Great White Heron National Wildlife Refuge, Key West National Wildlife Refuge, and National Key Deer Refuge), and two by NOAA (Key Largo National Marine Sanctuary and Looe Key National Marine Sanctuary). Since 1997, several new municipalities have been incorporated in the Florida Keys. Some municipalities have jurisdiction over nearshore waters. Additional managed areas established under these new authorities would be considered Existing Management Areas.

Activity

(1) *GIS and NOAA/NOS Chart Revisions.* NOAA will use GIS to accurately site and establish legal boundaries for zones and ensure these are provided to the NOAA/NOS Charting Division to be placed on all relevant navigational charts.

Status: This is a new activity.

Implementation: NOAA is responsible for this activity.

3.4.2 Mooring Buoy Action Plan

Introduction

Sanctuary Biologist John Halas first implemented the mooring buoy system used in the Key Largo National Marine Sanctuary in 1981. This simple yet effective tool for reducing anchor damage to coral reefs and seagrass beds was later implemented in Looe Key National Marine Sanctuary (1984) and eventually in other areas. Sanctuary staff worked with Reef Relief, a grassroots conservation group in Key West, and other groups to install mooring buoys at popular dive sites along the reef tract. Today, Sanctuary staff travels worldwide, assisting groups with mooring buoy installations that protect natural resources from anchor damage. While mooring buoys are excellent management tools, other management programs must accompany a mooring buoy program, including education, outreach, research and monitoring.

Concerns have been raised that mooring buoys may negatively impact marine resources by attracting boaters, divers, and fishermen to the areas. This plan establishes a methodology for identifying areas appropriate for mooring buoys and managing boating activities near coral reefs so that negative impacts are minimized. By allowing or directing access at selected locations, a Mooring Buoy Program can limit resource-use conflicts and damage to the resources.

The Mooring Buoy Action Plan seeks to minimize anchoring impacts to sensitive marine habitats, specifically coral reef formations, to provide reasonable access to Sanctuary resources, consistent resource protection, and to manage or restrict activities that have a detrimental impact on resources. To accomplish these goals, the Mooring Buoy Action Plan seeks to:

- Assess the characteristics of boater and diver use in coral reef areas.
- Maintain a database of boater and diver use and existing mooring buoy locations.
- Develop criteria for determining the location of additional mooring buoys to meet demand.
- Assess the impact of boater and diver use in coral reef areas.
- Develop a standard marking system for mooring buoys.
- Determine the impact of large vessels on mooring buoys and determine optimum vessel size for a variety of buoys.
- Implement vessel-size restrictions on the use of mooring buoys.

Organization of the Mooring Buoy Program

Developing a comprehensive mooring buoy plan has been a high priority since the beginning of the initial management plan and continues as an on-going strategy for protecting coral reef resources.

Responsible Institutions

The Sanctuary is to be the lead agency responsible for implementing the activities within this action plan. However, the mooring buoy program works in partnership with local government agencies, FWC, FWRI, ACOE, USCG, NPS, and Monroe County; non-government organizations, including The Nature Conservancy, Mote Marine Laboratory, and The Ocean Conservancy also play an important role in this plan.

Prioritization of Implementation

The implementation of a mooring buoy system has been shown to be an effective management tool worldwide, especially in coral reef ecosystems. It is a simple, relatively non-controversial, and extremely visible action that will protect delicate reef structures. Accordingly, the Mooring Buoy Action Plan is ranked among the three highest groups for management action.

Staff

A minimum of nine full-time personnel are needed to maintain the mooring buoys. Currently there are six full-time staff assigned to the Mooring Buoy Program.

Equipment

Sanctuary staff, using Sanctuary vessels, maintain the mooring buoys. The Tortugas Ecological Reserve has substantially increased logistical and manpower needs. Because of the additional mooring buoy sites, a third vessel and crew are needed. Each vessel should be at least 25 to 50 feet long, and equipped with standard navigational equipment. At least one vessel should have a built-in hydraulic winch for servicing the large boundary buoys. The Sanctuary currently owns two complete sets of hydraulic installation equipment. One additional backup system may be required in the future.

Contingency Planning for a Changing Budget

To the extent possible, the Sanctuary will encourage other volunteers and private and nonprofit organizations to assist the Mooring Buoy program. The Sanctuary will also consider alternative funding sources, including an "Adopt-a-Buoy," volunteers, and other innovative funding mechanisms.

If an adequate budget is not available and alternative funding sources are not feasible, mooring buoy maintenance costs can be reduced by cutting the number of buoys in the system. However, the use of mooring buoys is one of the most basic and cost effective mechanisms for reducing physical impacts in sensitive areas, and reducing the number of buoys will only be considered after all other cost-saving actions have been explored.

Accomplishments

There have been several accomplishments relative to Sanctuary mooring buoys since implementation of the 1997 management plan, including:

- Sanctuary staff has completely refitted all mooring buoy systems in the Sanctuary.
- Two 39-foot mooring buoy vessels, (*R/V Rachel Carson* and *R/V Agassiz*) have been acquired and equipped. New mooring buoy staff has been hired and trained.
- Sanctuary staff have developed a mooring buoy installation and maintenance manual.
- The Sanctuary has increased the number of mooring buoys within its boundaries from 175 to 400 by taking responsibility for mooring buoys previously installed by other organizations in Key West, Marathon, and Islamorada.
- The four outer boundary buoys for the Looe Key Existing Management Area continue to be maintained.
- Sanctuary staff installed 118 yellow boundary buoys (30-inch diameter) for marine zones.
- Sanctuary staff installed 120 Wildlife Management Area boundary buoys.

- Sanctuary staff installed two mooring buoys on the *Thunderbolt* (Marathon) and *Cayman Salvager* (Key West) and Adolphus Busch (Lower Keys) shipwrecks.
- Sanctuary staff installed mooring buoys and information buoys along Shipwreck Trail.
- Sanctuary staff installed five new mooring buoys in the Lower Keys and 36 new mooring buoys in the Tortugas Ecological Reserve.
- Sanctuary staff has implemented a monitoring program at mooring buoys in the Tortugas Ecological Reserve.
- A 1993-1994 survey assessed public and private boat access throughout the Sanctuary and sought to develop a low-impact access plan and direct new public access to low-impact areas. The plan's purpose is to modify as appropriate, any access affecting sensitive areas throughout the Sanctuary. This strategy is described in detail in the Waterway Management Action Plan and included in the Volunteer Action Plan.

Goals and Objectives

The goals of the Mooring Buoy Action Plan are to:

- Minimize anchoring impacts to sensitive marine habitats (specifically coral reef formations);
- Provide reasonable access to Sanctuary resources,
- Provide consistent resource protection, and
- Manage or restrict activities that have a detrimental impact on resources.

To achieve these goals, the Sanctuary seeks to achieve the following objective:

- To limit resource-use conflicts and damage to Sanctuary resources by allowing or directing access at selected locations.

Strategies

There is one management strategy in this Mooring Buoy Action Plan.

- B.15 Mooring Buoy Management

This strategy is detailed below. Table 3.12 provides estimated costs for implementation of this strategy over the next five years.

Table 3.12 Estimated Costs of the Mooring Buoy Action Plan.

B.15: Mooring Buoy Management	316	332	348	366	384	1,746

STRATEGY B.15 MOORING BUOY MANAGEMENT

Strategy Summary

The purpose of this strategy is to continue a comprehensive mooring buoy maintenance program. Within this program, FKNMS mooring buoy teams perform several functions, such as siting and installing mooring buoys as needed; inspecting mooring systems regularly and replacing components as necessary; and installing heavy-duty anchor systems in areas frequented by larger vessels. As part of this action plan, Sanctuary managers will establish vessel size limits and the teams will continue to evaluate developing technology and implement environmentally sound, cost effective, and efficient installations.

Activities (10)

(1) Maintain Existing Mooring Buoys. The existing system of mooring buoys must be maintained. Mooring buoy teams use volunteers when available to supplement the mooring buoy maintenance program.

Status: There are currently over 400 mooring buoys within the Sanctuary that are maintained through a combination of government agencies and private organizations; managing these existing buoys is an on-going activity.

Implementation: NOAA, in cooperation with existing agencies and Non-governmental Organizations (NGOs) that maintain mooring buoys, is the lead agency. NOAA also assists, both financially and through logistical support, other organizations that install and maintain mooring buoys. Volunteers are used to assist in some aspects of the maintenance of mooring buoys to the maximum extent feasible.

(2) Assess Current Mooring Buoy Technology. The various types of mooring buoy designs available for use will be continually reviewed, based on substrate type, boat size, water depth and sea state. Methods of limiting resource damage through mooring buoy installation will be assessed, as will vessel impacts on mooring buoys.

Status: On-going. Many components of this activity have been through an on-going analysis of mooring buoy systems in the Sanctuary and research on visitor impacts to patch reefs. Vessel impacts on mooring buoys remain to be addressed.

Implementation: NOAA will be the lead agency responsible for implementing the assessment of vessel impacts. NOAA will work with the SAC, other sanctuaries and marine protected areas, and nongovernmental organizations that have experience with mooring buoy systems used by larger vessels.

(3) Review Visitor-use and Boating Data. Boating activity and visitor-use data collected by various surveys are used for mooring buoy planning. This includes targeting data on diving activity around major coral reef systems and considering the impact of special events, such as holidays and lobster season, on boating patterns. On-the-water surveys are correlated with available aerial data to determine peak usage and turnover rates in high-use areas. To enable recommendations for mooring buoy additions or deletions, visitation data will be compared with existing mooring buoy locations.

Status: On-going. A report entitled "An Evaluation of Mooring Buoys in the Florida Keys National Marine Sanctuary Based on Boating Patterns" has been produced, which addresses some of the items identified in this activity.

Implementation: NOAA is the lead agency. Using available sources to update visitor use data, NOAA works with the SAC and the working group established in Activity 4 to review the information. Team Ocean volunteers help gather visitor data.

(4) *Develop Siting Criteria.* Sanctuary staff will continue to develop criteria for future mooring buoy sites within the Sanctuary. Workshops will be conducted as needed, with representatives of the Sanctuary Advisory Council, affected agencies, NGOs and other interested parties to identify criteria for allocating existing buoys and placing new ones. A working group has been established to advise and facilitate the development of the mooring buoy action plan.

Status: On-going.

Implementation: NOAA is the lead agency responsible for implementing this activity by organizing the working group and facilitating workshops.

(5) *Recommend New Sites for Mooring Buoys.* Areas where new mooring buoys should be installed are identified based on local knowledge, local dive industry input, visitor-use data, resource management concerns, level of demand and other relevant information. Priority areas for installation are determined.

Status: On-going.

Implementation: NOAA is the lead agency responsible for implementing this activity. The working group established in Activity 4 will make recommendations.

(6) *Conduct Site Assessments of Proposed Locations.* Areas identified for the installation of new mooring buoys are surveyed to determine: 1) the health of the habitat in relation to visitor use, 2) types of use and use patterns (e.g., size of vessels, glass-bottom boat use, unusual features, etc.), and 3) the number, location, and concentration of specific mooring buoys on the reef.

Status: On-going.

Implementation: NOAA is the lead agency. DEP biologists and the SAC are consulted for the resource survey.

(7) *Determine Costs of Implementation and Maintenance.* After establishing the number of mooring buoys suitable for each primary area, installation and maintenance costs will be determined. Maintenance costs will be based on past costs at the Key Largo and Looe Key National Marine Sanctuaries and relevant NGOs (e.g., Reef Relief, etc.). The ability to fund adequate maintenance activities will be a primary factor in determining the priority areas where new mooring buoys will be installed.

Status: Complete.

Implementation: NOAA will be the lead agency responsible for implementing this activity. Other agencies and NGOs with mooring buoy experience (e.g., the DEP, Reef relief, etc.) will be consulted to determine installation and maintenance costs.

(8) *Install Additional Mooring Buoys.* Based on the recommendations developed in Activities 5 and 6, new mooring buoys will be installed at the locations identified.

Status: On-going.

Implementation: The Sanctuary is the lead agency.

(9) *Implement Vessel Size Limits in High-Use and Sensitive Areas.* The Mooring Buoy Working Group recommends that staff use education and outreach rather than regulations for this activity. The Working Group recommends determining vessel size using a combination of length and tonnage. Mooring buoys in the Sanctuary are designed for vessels less than 60 feet. Vessels using mooring buoys in the Sanctuary have increased in size over the past five years, requiring stronger and heavier duty mooring systems. Based on vessel-impact information, staff observations, and load tests, it has been determined that vessels using mooring buoys located between Key Largo and the Marquesas Keys should not exceed 60 feet in length. Vessel-size limits in the Tortugas Ecological Reserve are 100 feet in length or a combined length of 100 feet.

Sanctuary staff will install large boat mooring sites on selected reef areas located throughout the Sanctuary. These designated sites will be designed for vessels larger than 60 feet in length up to 100 feet. A program to educate the public on size and weather condition limits should be implemented under the education action plan. Aesthetic and recreational crowding factors will be considered as well. The size limits will be incorporated into the Federal Regulations established for the Sanctuary after the supporting data has been gathered.

Status: On-going.

Implementation: NOAA will be the lead agency responsible for implementing this activity.

(10) *Evaluate effectiveness and influences of mooring buoy placement and make necessary changes.* Volunteer monitoring and in-house staff monitor mooring buoy sites and compare them to similar nearby areas without mooring buoys. A monitoring program will be established in the Tortugas Ecological Reserve to compare mooring sites prior to and after the installation of mooring buoys, and in areas without mooring buoys that have little or no diving or boating. Mooring buoys will be removed from areas found to be detrimentally impacted by the presence of mooring buoys.

Status: On-going.

Implementation: NOAA will be the lead agency responsible for implementing this activity. DEP/FWC will provide support.

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. Other 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

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

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.

Status: 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.

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.

Amanda Bourque
03/07/2005 03:56 PM
EST

To: Sarah Bellmund/BISC/NPS@NPS
cc:
Subject: Fw: References, salary history

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----- Forwarded by Amanda Bourque/BISC/NPS on 03/07/2005 03:56 PM -----



"david boyd"
<dboyd351@earthlink.net>

To: "Amanda Borque" <Amanda_Bourque@nps.gov>
cc:
Subject: References, salary history

03/07/2005 03:52 PM
EST
Please respond to
dboyd351

Amanda,

Here are the references you asked for.

	David		
Position	Supervisor	Salary Range	Additional reference
August 1999 - present Environmental Specialist II FL Park Service	Dr. Renate Skinner 305 446-5794	\$32,000 begin \$35,500 end	Ernest Cowan - Environmental Specialist II (772) 546-0900 - office
March 1998 - July 1999 Fish and Wildlife Biologist U.S. Fish and Wildlife Service	Paula Golightly (707) 822-7201	\$27,000 begin \$34,000 end (promoted to GS - 9)	Paul Zedonis (722) 822-7201
February 1994 - February 1998 Stock Assessment Program Director	Roy Insley (757) 247-8052	\$26,000 begin \$32,500 end	Ellen Cosby 757-247-2245

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