

15 YEARS OF WATER QUALITY PROTECTION

FLORIDA KEYS NATIONAL MARINE SANCTUARY

Long-term Studies Focus on Seagrass, Corals and Water Quality

For 15 years, the Water Quality Protection Program has been the guiding force for water quality improvements in the Florida Keys. Recognizing the importance of water quality for sustaining the coral reef ecosystem, the Florida Keys National Marine Sanctuary and Protection Act called for the implementation of the program with the establishment of the sanctuary in 1990.

The purpose of the Water Quality Protection Program is to recommend actions that maintain and restore water quality needed to sustain healthy native plant and animal populations, using science as a basis for decision-making. As part of the program, scientists have been conducting three long-term monitoring studies in sanctuary waters: the Water Quality Monitoring Project*, Seagrass Monitoring Project* and the Coral Reef Evaluation and Monitoring Project**. In keeping with the principles of adaptive management, the program has undergone two independent scientific reviews over the years to improve coordination and meet managers' information needs.

Monitoring Tracks Changes and Supports Wastewater Upgrades

Monitoring programs track and describe changes within the Florida Keys marine ecosystem, providing information needed to better manage sanctuary natural resources. The Water Quality Monitoring Project, which has over 150 sampling sites, has detected

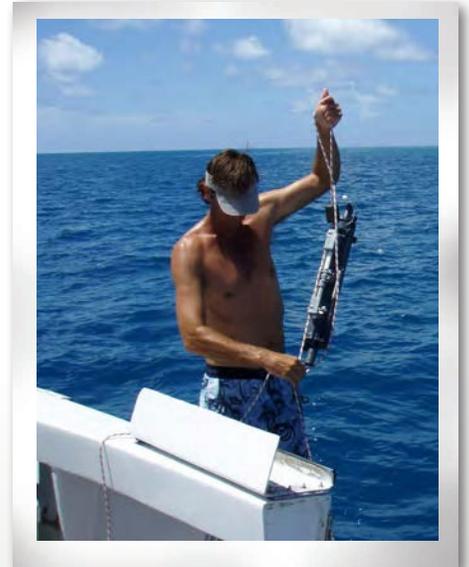
The Water Quality Protection Program is guided by an interagency water quality steering committee and is jointly administered by the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection. Scientific support and expertise is provided by a technical advisory committee composed of water quality professionals and other scientists who are familiar with the natural resources in the sanctuary. A management committee composed of resource administrators advises the steering committee and acts as the liaison to the technical advisory committee.

elevated nitrates in nearshore waters since sampling began in 1995. Nitrate is a form of nitrogen commonly found in sewage and plant fertilizer. The presence of nitrate in the highly populated Keys and its absence in the unpopulated Dry Tortugas region suggests that land-based nutrients are still entering and persisting nearshore. While most of the Keys islands have undergone wastewater upgrades, the upgrades are not yet complete and nutrients from sewage still exist and can impact the system.

Water quality project data have been essential in supporting wastewater upgrades to protect nearshore marine communities from nutrient enrichment. Information from the project supported the authorization by Congress of up to \$100 million in federal funds to implement the Florida Keys Water Quality Improvement Program. Administered by the U.S. Army Corps of Engineers, the program has awarded nearly \$42 million to local governments to implement county-wide advanced treatment systems in the Florida Keys.

Water Quality Trends in Sanctuary Influenced at Regional Level

The large scale of the Water Quality Monitoring Project has allowed scientists to assemble a broader view of the physical, chemical and biological factors affecting the South Florida marine landscape. It is now known that some of the water quality trends observed within the sanctuary are strongly influenced by hydrological and climatological conditions occurring outside sanctuary boundaries. Currents and tides can transport river waters from the Gulf of Mexico and Florida's southwest shelf to the sanctuary. According to chlorophyll-a data collected throughout the region, the most intense and persistent phytoplankton (algae) blooms originate outside of the sanctuary on the shelf, where elevated phosphate levels fuel the blooms.



Scientists sample water quality at 150 stations.
Photo: Bernie Altmeier for FKNMS

*Based at Florida International University's Southeast Environmental Research Center

**Based at Florida Fish and Wildlife Conservation Commission's Florida Fish and Wildlife Research Institute

Phytoplankton blooms also occur in nearby Florida Bay. When the tidal currents move through the channels between the Keys, algae-rich bay waters can reach the reef tract on the ocean side where they may block out sunlight needed by reef-building corals—animals adapted to warm, clear, low-nutrient waters.

Seagrasses Detect Increasing Nutrients

The Seagrass Monitoring Project uses a variety of methods to track the condition of seagrass and other benthic plants in the sanctuary. One method involves analyzing seagrass leaves for their nutrient concentrations. Leaves are good indicators for nutrients in the water column because as the plant grows, it absorbs nutrients from the surrounding water. Nutrient enrichment can lead to the degradation or loss of seagrass habitat. Under such conditions, nutrient-loving plants like seaweeds are favored in place of seagrass. At this time, monitoring of seagrass coverage in the sanctuary has not detected any overall loss of seagrass habitat. However, in many places changes occurring in seagrass species are consistent with increased nutrient availability in the water column, indicating that the once-dominant turtle grass is gradually being replaced by plants that are tolerant of higher nutrient conditions.



Vessels are required to dispose of sewage at pumpout stations on land.
Photo: FKNMS

Coral Monitoring Tracks Corals, Octocorals, Algae and Sponges

Nearly 15 years of coral reef monitoring data have shown declines in live coral cover and species diversity within the sanctuary. Multiple stressors have contributed to these declines, including high sea surface temperatures, coral disease, bleaching and damage from hurricanes. The El Niño years in 1997 and 1998 resulted in high seawater temperatures, which caused widespread coral bleaching and subsequent mortality in reefs throughout the Caribbean, including the Keys. Cold fronts like those encountered during the winter of 2010 have also led to widespread loss of corals. Even so, the cover of live octocorals (sea fans, sea whips), macroalgae, and stony corals all increased between 2008 and 2009, while sponge cover remained about the same. This was the first time that an annual increase in stony coral cover (from 6.5% to 7.3%) was recorded since coral monitoring began in 1995.

Sanctuary is Protected from Harmful Vessel Sewage Discharge

The information provided by the Water Quality Monitoring Project and Coral Reef Evaluation and Monitoring Project provided the scientific justification for designating state waters within Florida Keys National Marine Sanctuary a “no discharge” zone in 2002. This EPA designation prohibits the discharge of sewage (untreated or treated) from all vessels. In December 2010, the National Oceanic and Atmospheric Administration implemented a similar rule to cover all sanctuary waters, federal and state, and added that all marine sanitation devices on boats be locked to prevent discharge when boating in the sanctuary.

Special Studies Contribute Toward Better Understanding of Ecosystem

Over the years, a wide variety of short-term studies called “special studies” have been supported by the Water Quality Protection Program. These projects have contributed greatly to a better understanding of the ecosystem by providing critical information on topics like groundwater flows, wastewater discharges, water circulation and canal water quality. Special studies have also provided sanctuary managers with much needed information on coral disease, coral population dynamics, queen conch reproduction, and the effects of mosquito control pesticides on non-target species.

Water Quality Protection Program is Basis for Management of the Marine Ecosystem

The extensive monitoring of coral reefs, seagrass meadows and water quality supported in Florida Keys National Marine Sanctuary allows managers to track the condition of sanctuary waters, including any changes that result from restoration of water flows in the Everglades and Florida Bay directly to the north. These scientific studies have also contributed to condition reports and other documents that help guide sanctuary management. The program has supported the conservation mission of the U.S. Coral Reef Task Force and program data are published regularly in task force reports. This program has been so successful in the Florida Keys that Monterey Bay National Marine Sanctuary has adopted its own Water Quality Protection Program. A comprehensive website supported by program funds makes all reports and long-term data sets available to resource managers, scientists and others. For more information, visit http://ocean.floridamarine.org/fknms_wqpp.

