

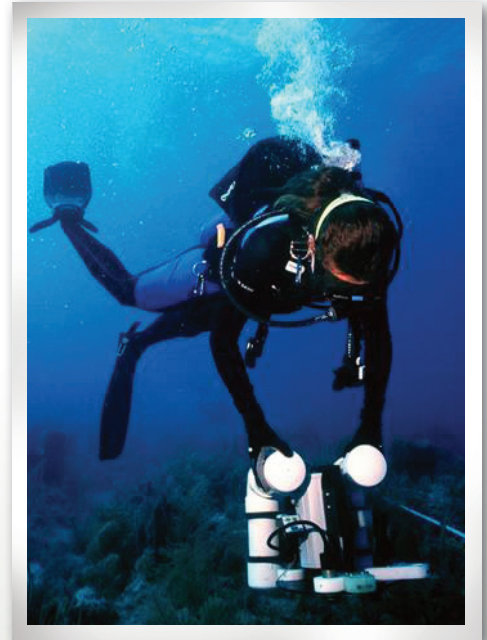
CORAL REEF EVALUATION & MONITORING

FLORIDA KEYS NATIONAL MARINE SANCTUARY

Sanctuary Managers Rely on Research Results to Protect Coral Reef

North America's only barrier coral reef is adjacent to the Florida Keys within the Florida Keys National Marine Sanctuary. Located on the ocean side of the island chain, the reef is bathed by the warm, clear waters of the Florida Current flowing from the south. The coral reef of the Florida Keys lies only a few miles from shore and experiences both natural and human impacts. Hurricanes and storms overturn large coral colonies and wastewater and stormwater degrades nearshore waters, potentially affecting corals and other marine life. Keys reefs, along with reefs throughout the Caribbean, have also experienced bleaching events and disease outbreaks over the years. Sanctuary managers rely on the findings from research and monitoring programs to aid them in protecting and managing this world-renowned coral reef for future generations.

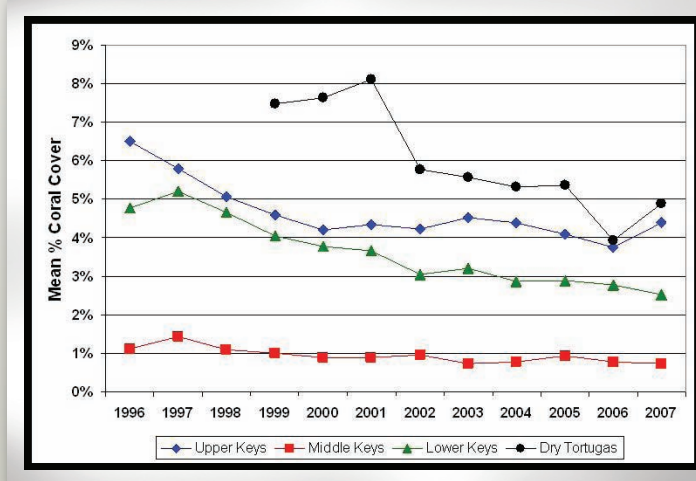
To collect valuable information about the reef ecosystem, scientists from Florida's Fish and Wildlife Conservation Commission began systematically monitoring coral reefs throughout the sanctuary in 1996. This research program, called the Coral Reef Evaluation & Monitoring Program (CREMP), studies various aspects of reef ecology and health and employs numerous survey methods and analyses. CREMP is part of the Water Quality Protection Program, which was established by Congress to track the status of natural resources within sanctuary waters and is jointly managed by the U.S. Environmental Protection Agency and the state of Florida.



A scientist digitally records benthic species.
Photo: Florida Fish and Wildlife Conservation Commission

Systematic Monitoring of Coral Reef Ecosystem Reveals Trends

CREMP scientists have conducted systematic inventories of species and recorded digital video at sampling stations throughout the Keys since 1996. The sampling stations fall into four habitat types: hardbottom, patch reef, offshore shallow and offshore deep, and cover four regional areas: Upper Keys, Middle Keys, Lower Keys and Dry Tortugas. The species inventory data allow scientists to determine species richness, or the number of different coral species present at each station, and the digital video data is used to quantify coral cover and species composition of the benthic (bottom) community.



All regions in the Keys showed declines in coral cover.
Image: Florida Fish and Wildlife Conservation Commission

Since monitoring began, an average of 3.3 species have been lost per station throughout the sanctuary, with 76% of all stations showing a decrease in the species richness. Declines in 13 of the 43 species account for most of the losses observed. However, between the years 2006 and 2007, there was a slight increase in species richness observed in some regions and habitats, with the greatest increase seen at the patch reefs and Tortugas stations. Trends in coral cover, a measure of how much living coral exists in an area, have also been analyzed. Cover for stony corals declined in the late 1990s, but increased slightly from 2006 to 2007 in the Upper Keys and Dry Tortugas.

<http://floridakeys.noaa.gov/>



Bleaching and Disease Impact Caribbean Corals

Bleaching impacted corals in the Caribbean, including those in the Keys, in 1997 and 1998 and is a likely contributor to the declines in coral cover recorded in the late 1990s. Bleaching is a stress response to high seawater temperatures that takes place when corals expel the beneficial microscopic algae living within their coral polyps. These microscopic algae, known as zooxanthellae, provide nutrition for the coral colony and give the coral its characteristic color. Without zooxanthellae, stony corals appear white, or “bleached.” Corals that have bleached are more susceptible to disease, but some do regain their zooxanthellae and recover from bleaching.

Diseases also contributed to declines seen in coral cover and species richness. CREMP scientists record the presence or absence of disease for each species at each station during field sampling. In general, from 1996 to 2002, increases were documented in the number of diseased corals per station, the number of stations with diseased corals, and the different types of diseases recorded. Blackband, a disease that attacks many species of corals worldwide, peaked in 1998, but has remained relatively stable during the study. “White” diseases, such as white plague, affected the major reef-building corals like boulder star coral (*Montastrea annularis*), while white-band disease targeted elkhorn (*Acropora palmata*) and staghorn (*Acropora cervicornis*) corals. The category of diseases grouped as “white” peaked in 2002.

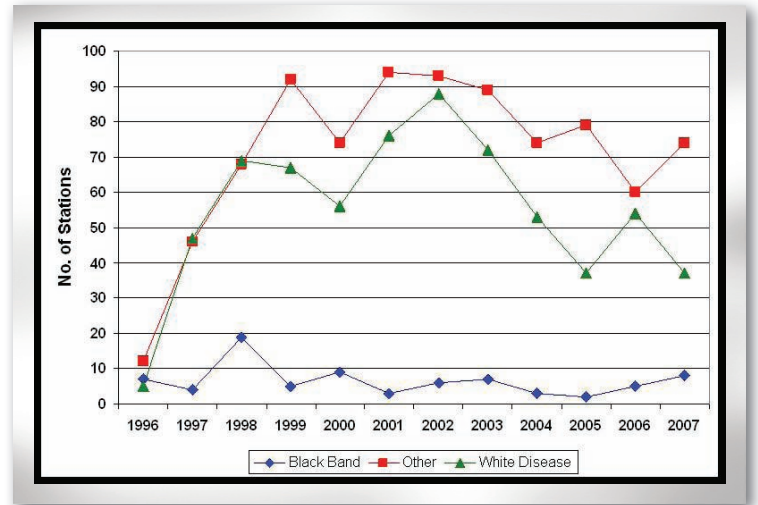
Multiple Stressors Affect Coral Cover and Species Richness

In 2007, staghorn coral and elkhorn coral were listed as threatened species under the Endangered Species Act and awarded new protections. Based on CREMP surveys, staghorn cover has been historically low throughout the sanctuary, but elkhorn coral cover was much higher at the inception of the study than it is today. After 1999, elkhorn cover declined significantly as a result of disease, but in recent years has remained relatively stable. The heavy losses of staghorn corals seen in the Tortugas between 2002 and 2004 were brought about by multiple disease and thermal stress events.

Reductions in coral cover and species richness in the Florida Keys have been largely attributed to multiple recurring stressors, including disease outbreaks, hurricanes and fluctuations in major weather patterns, all of which cause coral mortality. For example, the El Niño weather pattern of 1997-1998 caused high sea surface temperatures, which brought about widespread coral bleaching, followed by severe losses of coral cover in 1998 and 1999. Subsequent bleaching events have occurred during warmer summers when high seawater temperatures and calm seas have prevailed (for example, in 2005). Diseases were also highly prevalent from 1999 through 2003, with different diseases targeting different species of coral. Hurricanes and intense storms like those of the 2004 storm season have had detrimental effects on sanctuary reefs by causing direct physical damage to corals.

Research and Monitoring are Critical to Managing Reefs for the Future

The health of the coral reef ecosystem in the Florida Keys depends on the quality of water in which the corals live. Because of the nature of corals, even slight deterioration in water quality can be stressful to the reef. CREMP scientists have begun to analyze water quality data in conjunction with coral data to tease out connections and correlations between water quality and coral health whenever possible. Continued study into the causes and nature of disease outbreaks, along with rigorous monitoring of coral reefs and their inhabitants, will facilitate in managing coral reefs for the future. Coral reef research and monitoring are especially important for tracking the effects of increasing seawater temperatures and sea level rise associated with the Earth’s changing climate. They are also critical in evaluating the impacts of changing freshwater flows on the Florida mainland as part of the Comprehensive Everglades Restoration Plan. For more CREMP results, visit http://ocean.floridamarine.org/fknms_wqpp/pages/cremp.html.



Coral diseases have been tracked since 1996 by CREMP.
Image: Florida Fish and Wildlife Conservation Commission



Unbleached elkhorn coral growing next to bleached fire coral.
Photo: FKNMS