



3 *State and Territory Coral Reef Monitoring Grants*

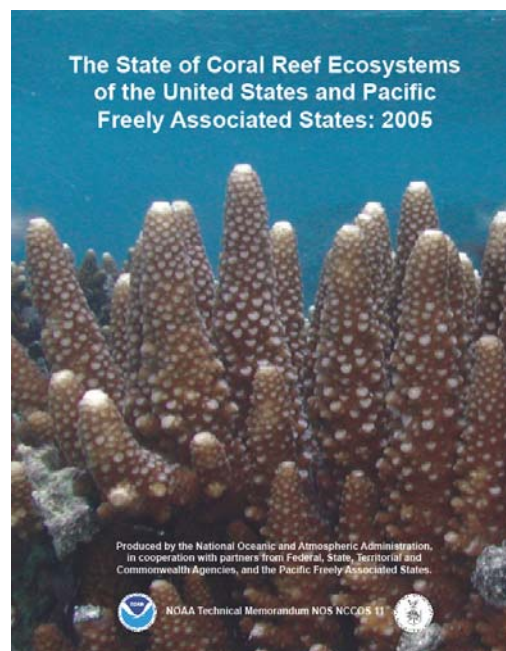
Introduction

The CRCP State and Territory Monitoring Grant Program, referred to as the National Coral Reef Ecosystem Monitoring Program, provides annual funding to Governor-appointed point of contact (POC) agencies in U.S. states and territories and the Pacific Freely Associated States (FAS).

The goal of this program is to provide support for jurisdictional partners towards implementing a nationally-coordinated, comprehensive, long-term monitoring program to assess the condition of U.S. shallow water coral reef ecosystems, evaluate the efficacy of coral reef ecosystem management approaches, and communicate progress toward conservation of coral reef ecosystems. To accomplish this goal, focus is directed towards two objectives:

1. Development of long-term monitoring programs in each location to periodically collect and analyze information within three broad categories of inquiry: water quality and oceanographic conditions, seafloor or benthic habitats, and biological communities associated with coral reef ecosystems.
2. Communication of, based on the results of quantitative monitoring data, the condition of shallow water coral reef ecosystems in a periodic report entitled *The State of Coral Reef Ecosystems of the United States and Pacific Freely Associated States* with emphasis on threats to coral reefs worldwide (including climate change and coral bleaching, coral disease, tropical storms, coastal development, pollution, overfishing, and others).

This grant program began in 2000 and initially provided annual funding for coral reef ecosystem monitoring to six jurisdictions in the first two years. Between 2002 and 2006, this grant program provided approximately \$4M in grants and expanded the number of jurisdictions being funded to 10 (including the FAS), the number of sites monitored, and the types of information collected. Grant awards range from \$30,000 per year (for the FAS) to \$130,000 per year (for the jurisdictions of Florida, Puerto Rico, U.S. Virgin Islands [USVI], Hawai'i, American Samoa, Guam, and the





Commonwealth of the Northern Mariana Islands [CNMI]). All jurisdictions are moving toward consistent application of standardized monitoring methods in order to generate data that can be used to analyze trends in key ecosystem parameters over time.

a. Eligibility

Eligible applicants are limited to the Governor-appointed POC agencies for the jurisdictions of Puerto Rico, USVI, Florida, Hawaii, Guam, CNMI, American Samoa, the Republic of Palau, the Federated States of Micronesia (FSM; including Kosrae, Pohnpei, Yap, and Chuuk), and the Republic of the Marshall Islands.

b. Activities, Outputs, and Outcomes

Information generated through this program has increased our understanding of the current state of coral reefs in the U.S. and FAS, generated a baseline against which future measurements can be compared, enabled scientists to evaluate the efficacy of management approaches (such as MPAs), and in many instances helped managers reduce threats to coral reefs. Most importantly, results of the monitoring surveys have provided crucial information for management about trends in the condition of coral reef ecosystems, so that effective measures can be implemented to conserve them.

Pacific

- **Hawai'i**—Hawai'i's Division of Aquatic Resources (DAR) has supported two primary monitoring efforts in the Main Hawaiian Islands. After initially channeling support to the Coral Reef Assessment and Monitoring Program (CRAMP), DAR directed subsequent funding toward monitoring fish populations that are exploited by the aquarium trade, particularly along the west coast of the Island of Hawai'i. This work helped the state to implement Fish Replenishment Areas to ensure the sustainability of both the fish populations and the lucrative industry. In 2006, the state redirected support towards implementation of a comprehensive and consistent integrated monitoring framework that operates at multiple scales and complements both CRAMP and several other existing efforts. Because monitoring under the new program occurs at some of the same locations used by CRAMP, trends in ecosystem health and community structure will be available after the first year's activities have been completed and analyzed. Quantitative results of these efforts are forthcoming.
- **American Samoa**—Monitoring work in American Samoa varied somewhat during the early years, but developed into the American Samoa Coral Reef Monitoring Program in 2005. At that time, 11 permanent survey locations around the main island of Tutuila were chosen to represent different reef types and exposures, management strategies, and gradients of human disturbance. Monitoring there focuses on detecting change and trends in the condition of benthic habitats and targeted reef fish species. This project is expected to complement the





monitoring efforts of other agencies, as well as provide essential staff to coordinate activities and share results via a centralized database. Results of the recent monitoring activities are forthcoming and will be presented in the next *State of the Reefs* report in 2008.

- **Guam**—Guam’s monitoring varied in the first years of the program, due to shifting management priorities and limited monitoring capacity within the government. At Guam’s request, in 2003 the grant was structured to provide funding for hiring an additional staff member to work with other territorial agencies to design an overall monitoring program for the island. This “experiment” was extremely successful and resulted in the development of a comprehensive and integrated monitoring strategy that has been in place since 2005. Results of the monitoring under this new structure will be available soon and will complement the results of past work, which has focused primarily on using photo quadrants and transects to monitor fish, benthic communities (e.g., corals, algae, seagrass beds), and invertebrates at permanent sites around the island and at MPAs.
- **CNMI**—Monitoring has been relatively consistent over time. Since 2003, three-year grants have been in place to fund work conducted by the CNMI Inter-Agency Marine Monitoring Team (MMT), which is composed of staff from the Department of Environmental Quality, the Department of Fisheries and Wildlife, and the Coastal Resources Management Office. Each of these organizations conducts monitoring of various parameters independently in addition to surveying fish and benthic communities at 19 MMT sites on Saipan, Tinian, and Rota. Results of the monitoring efforts to date do not show major trends in benthic community composition at most sites. However, variation present at some sites was attributed to ongoing negative impacts from sedimentation, crown-of-thorns starfish (*Acanthaster planci*) predation, bleaching, and recreational use. Across all sites, there was an apparent decline in community evenness between 1991 and 2004 that is believed to be a result of the increasing dominance of disturbance-resistant coral species such as *Porites spp.* Fish community monitoring showed a general decline in abundance of major families, except in the case of wrasses (family *Labridae*). No significant within-site changes were noted in invertebrate populations, but some sites exhibited variation in sea urchin abundance.
- **Palau**—Palau launched a nationwide coral reef monitoring program in 2001 and first applied for and received funding in 2002. In addition to conducting rapid assessment of 217 sites around the main island cluster in 2001-2002, the Palau International Coral Reef Center (PICRC) established 14 permanent monitoring sites to assess reef condition, track changes in benthic and fish communities over time, and document the recovery of reefs from a massive bleaching event in 1998. PICRC gradually expanded their monitoring program to encompass 22 sites by 2006 and represent the variety of reef types present in Palau. Monitoring results show that many sites have recovered from the 1998 bleaching event, but that recovery is uneven. Coral community structure and recruitment varied with reef type and level of exposure, and in some cases with depth. Monitoring of the most prevalent fish families revealed that surgeonfish are the most common fish at all sites, but that rabbitfish, parrotfish, and snappers are also highly abundant; reef type was a main factor in the distribution patterns





of these four main fish families. In many locations, little change to the composition and distribution of benthic and fish communities has been observed over time. More focus is now being put on documenting the impacts of MPAs and communicating those results to local leaders and communities to generate support for additional protection of the marine environment.

- **Marshall Islands**—The Marshall Islands recently joined this grant program, focusing on fish and benthic communities around the heavily populated island of Majuro. The CRCP will work with them through the recently formed Coastal Management Advisory Council to develop a comprehensive monitoring program for Majuro that can be expanded to other atolls in the Republic of the Marshall Islands. No project results are available yet.
- **FSM**—Limited monitoring activity was funded in the FSM state of Kosrae from 2003-2005 and in the state of Yap in 2006 to look at some basic parameters related to the condition of fish and coral communities. Although there is a shortage of trained monitoring personnel in the region, the Micronesia Conservation Trust will be building on a series of CRCP-sponsored capacity building monitoring workshops held in the region and working to develop basic monitoring programs in each of the four states of the FSM in the coming years. Work in Kosrae has focused on a coral fragmentation study and continued monitoring of coral and fish at five sites. The results of the monitoring work were shared locally at four community meetings. No monitoring activities have been initiated in the rest of the FSM under this grant program yet, but the projects are scheduled to begin shortly.

Atlantic

- **Florida**—Florida, through the Florida Department of Environmental Protection, joined the program in 2002. Since then, the CRCP has funded expansion of data collection efforts (primarily benthic habitat characterization from video transect data) under the Coral Reef Evaluation and Monitoring Project to coral reef ecosystems in Southeast Florida. The project was designed as a region-wide, long-term effort to provide a minimum suite of parameters at sites within the network and yield consistent information about benthic cover at four stations within each of 13 monitoring sites along the southeastern Florida coastline. Project results indicate that southeastern Florida reefs are colonized primarily by octocorals, macroalgae, and sponges; and except in a few locations, hard coral cover is limited to 0.5-2% of benthic cover. Analysis of four years of data indicates that little change in the composition of the reefs has occurred over time. The study also continues to document the status of reefs at two sites with unusually high-coral cover, including one site with patches of the threatened staghorn coral, *Acropora cervicornis*.
- **Puerto Rico**—Since 2000, Puerto Rico's Department of Natural and Environmental Resources has received funding. The initial years funded surveys of coral diseases until a program to characterize and monitor Puerto Rico's natural reserve system was put in place. Once baseline data had been collected at nature reserves across Puerto Rico, monitoring of





the locations was initiated to document the trends in resource condition. In 2006, monitoring at 12 sites in six reserves showed that while one reef changed little in terms of percent live coral cover, most of the other sites experienced drastic declines in live coral cover—up to 59% at one location—that are believed to be a result of the 2005 bleaching event. The decline in live cover was largely a result of mortality of the highly dominant boulder star coral (*Montastrea annularis* complex) and was accompanied by an increase in the abundance of turf algae. It also showed that coral mortality was more pronounced at shallow, nearshore sites than at deeper sites. The project also documented a decline in the abundance of reef fish at seven of the 12 locations, although little change to the overall fish assemblage was observed.

- **USVI**—The monitoring work in USVI initially focused on sites within the “St. Croix Coral Reef System Area of Particular Concern” before being expanded to include sites throughout the territory. Currently, 19 monitoring sites represent the variety of reef types present, management approaches, and gradients of natural and anthropogenic processes. Results show that the *Montastrea annularis* complex dominates the coral community in USVI and that its dominance is even more pronounced at offshore sites. Coral diversity also exhibits a gradient, with high diversity nearshore that declines gradually at mid-shelf sites and offshore reefs. Benthic composition overall in USVI is dominated by macroalgae and turf algae. Monitoring of the fish community reveals a very low abundance of commercially important snappers and groupers with the vast majority of individuals of these species being juveniles (83-94%). Other data suggests a shift in fish community structure towards more herbivorous species.

d. Challenges

Implementing a program of this scope and technical complexity involves many challenges. The primary challenges identified to date include:

- A lack of well-trained monitoring personnel who can collect information repeatedly over many years.
- Inconsistency in methods over time.
- Lack of standardized methods that would enable comparisons of data across jurisdictions.
- Very restricted ability to mobilize scientists in response to extreme events (i.e., bleaching or disease outbreaks).
- Lack of adequate spatial and/or temporal coverage, which in turn reduces statistical power to detect trends in monitoring results.

