



6 *Coral Reef Ecosystem Research Grants*

Introduction

The NOAA Coral Reef Ecosystem Research Grants Program provides funding for one- to two-year research projects that address one or more of the following threats facing coral reefs: overfishing, pollution, invasive species, disease, climate change, and coral bleaching. Funded projects are geared towards management-oriented research that develops a better understanding of the role of these threats in coral reef ecosystem decline; predicts the impacts from and responses of reef communities to these anthropogenic and natural stressors; and designs, tests, and evaluates the effectiveness of specific reef management measures. Coral reef research activities supported under this program are in waters under U.S. jurisdiction, the Freely Associated States (FAS), and the Bahamas.

In FY 2002, the NOAA Coral Reef Ecosystem Research Grants Program was administered by NOAA's National Centers for Coastal Ocean Science. Beginning in FY 2003, the strategic decision was made by the CRCP to partner with NOAA's Undersea Research Program (NURP) because of shared research priorities and NURP's existing peer-review infrastructure. NURP administers the program through three NURP Centers based on geographical region: Southeast U.S. and Gulf of Mexico (Southeast U.S. and the Gulf of Mexico NURP Center), U.S. Caribbean (Caribbean Marine Research Center), and Hawai'i and the Western Pacific (Hawai'i Undersea Research Laboratory). The Centers solicit three separate requests for proposals.

By working with NURP, the CRCP benefits from NURP's experience with competitive grants and high standards of peer-review, program planning and field operation, and from the potential leveraging of NURP dollars towards projects of mutual interest. Since 2002, the CRCP has provided \$2.2M in grants to support projects and leveraged an additional \$1.2M in non-Federal match and \$1.9M in NURP funds for a grand total of \$5.3M for coral research projects. This funding supported a total of 27 projects (12 one-year projects and 15 two-year projects); and \$600K was set aside from FY 2005 and 2006 for a 2007 proposal process for Hawai'i and the Western Pacific.

a. Eligibility

Eligible applicants are U.S. institutions of higher education, not-for profit institutions, and state, territory, and local governments. Proposals may include Federal researchers as collaborators with a researcher who is affiliated with a U.S. institution, non-Federal agency, or any other non-





profit organization. Federal organizations may not charge Federal salary, travel, or overhead, but other categories are appropriate.

b. Activities

The NOAA Coral Reef Ecosystem Research Grants Program has funded external partners to conduct targeted research that cuts across several of the CRCP spend plan categories.

Southeast U.S. and Gulf of Mexico

The projects conducted in this region were administered by the Southeast U.S. and Gulf of Mexico NURP Center at the University of North Carolina at Wilmington. The Center ran three proposal processes between 2003 and 2006. In 2003 (for field season 2003), the Center and the CRCP partnered with U.S. Environmental Protection Agency (Region 4) and the Sanctuary Friends of the Florida Keys to jointly conduct a competitive, peer-review proposal process for coral reef research in the Florida Keys National Marine Sanctuary. In 2003 (for field seasons 2004 and 2005) and 2005 (for field seasons 2006 and 2007), the Center and the CRCP ran a joint peer-review proposal process. Research projects included:

- Developing new tools for reef monitoring to help distinguish local from global stresses.
- Investigating sponge production and recycling of new nitrogen in coral reef ecosystems.
- Assessing threats to *Acropora palmata* in the Florida Keys.
- Determining colony-based survivorship across environmental gradients.
- Investigating recruitment dynamics of gorgonian corals and the effects of macroalgal cover.

Caribbean

The projects conducted in this region were administered by the Caribbean Marine Research Center at the Perry Institute for Marine Science. The Center operates a field station located on Lee Stocking Island, Bahamas. Lee Stocking Island is an isolated island in the southern Exuma Cays surrounded by extensive patch reefs, seagrass meadows, and mangrove forests. These habitats have minimal anthropogenic impacts making them good reference sites to more heavily impacted U.S. reefs. The Center ran two proposal processes between 2003 and 2006. In 2003 (for field seasons 2004 and 2005) and 2005 (for field seasons 2006 and 2007), the Center and the CRCP ran a joint peer-review proposal process. In field seasons 2004 and 2005, 37% of the projects were located in the U.S. Caribbean and 63% in the waters surrounding Lee Stocking Island. No projects were conducted during 2006 (see challenges section for more information). Research projects focused on evaluating MPA network design and the spillover effect by using the Exuma Land and Sea Park (established 1959) as a study site; the recovery of *Diadema antillarum* inside and outside MPAs in St. Croix, USVI; the effects of globally transported





African dust on coral reefs; and bacterial communities associated with geographically separated corals infected with white plague type II.

Hawai'i and the Western Pacific

The projects conducted in this region were administered by the Hawai'i Undersea Research Laboratory at the University of Hawai'i, Manoa. Between 2003 and 2006, the Center ran one proposal process in 2003 (for field season 2004) and participated in two grants workshop for Guam and CNMI in 2006. Four research projects were funded from the 2003 proposal process focusing on Hawaiian black coral populations and the invasive snowflake coral, *Carijoa riisei*; the ecology of invasive and native deep water macroalgae; and genetic connections among Pacific staghorn coral populations. The limited number of projects funded from the 2003 proposal process was a result of the limited number of proposals received (11 total). To improve the geographic distribution of applicants from the Western Pacific, plus bring awareness about the peer-review proposal process for coral reef research grants, the Center participated in two grants workshops held in Guam and CNMI. Funds were set aside in FY 2005 and 2006 (totaling \$600K) to amass a larger amount of funding for a 2007 proposal process. The 2007 proposal process received 2.5 times the number of pre-proposals (28 in total) received during the 2003 process.

c. Outputs

The following outputs were generated by projects supported by this grants program:

- Administered eight separate peer-review proposal processes patterned after the National Science Foundation process.
- Participated in two grants workshops to build capacity and applicants in the Western Pacific.
- Newspaper articles:
 - *Washington Post*. "In Hawaii, alien species launches underwater invasion: snowflake coral colonies threaten the future of the state gemstone." July 5, 2004.
 - *New York Times*. "Ban on black coral from Hawaii urged." May 22, 2005.
- A sampling of significant publications:
 - Kahng, S.E. and R.W. Grigg. 2005. *Impact of an alien octocoral (Carijoa riisei) on black corals in Hawaii*. *Coral Reefs* 24(4): 556-562.
 - Mumby P.J., C.P. Dahlgren, A.R. Harborne, C.V. Kappel, F. Micheli, D.R. Brumbaugh, K.E. Holmes, J.M. Mendes, K. Broad, J.N. Sanchirico, K. Buch, S. Box, R.W. Stoffle and A.B. Gil. 2006. *Fishing, trophic cascades, and the process of grazing on coral reefs*. *Science* 311: 98-101.
 - Nipper, M., J.W. Tunnell, R.S. Carr, V.H. Garrison, D. Griffin and G. Smith. 2006. *Final report: effects of globally transported African dust to Caribbean*





marine ecosystems. Available at:

http://www.sci.tamucc.edu/ccs/publications/Technical/TAMUCC_0601_CCS.pdf

- Steele M.A. and G.E. Forrester. 2005. *Small-scale field experiments accurately scale up to predict density dependence in reef fish populations at large scales*. Proc. Nat. Acad. Sci. 102(38):13513-6.
- Tarrant, A.M. 2005. *Endocrine-like signaling in Cnidarians: current understanding and implications for ecophysiology*. Integrative and Comparative Biology 45(1): 201-214.
- Walters, K.D. and J.R. Pawlik. 2005. *Is there a trade-off between wound-healing and chemical defenses among Caribbean reef sponges?* Integrative and Comparative Biology 45: 352-358.

d. Outcomes

The following outcomes resulted from projects supported by this grants program:

- May 22, 2005 – Data results, which indicated a decline in younger black coral populations, were presented to the Scientific and Statistical Committee, an advisory body of the Western Pacific Regional Fishery Management Council. Based on these results, the Committee recommended a five year ban on harvesting Hawai'i's black coral, a species prized by the jewelry trade, in both state and Federal waters.
- Research into the effects of globally transported African dust to Caribbean marine ecosystems revealed that seawater solutions inoculated with dust dramatically impaired sea urchin fertilization success and embryological development. Microbial analyses of African dust samples indicated the presence of viable bacteria and fungi, including some potential coral pathogens. It remains unclear as to whether the combination of contaminants and pathogens from the dust lead to weakening of the immune system of coral reef organisms and subsequent increased susceptibility to disease.
- Research on the Exuma Cays Land and Sea Park, the oldest reserve of its kind, demonstrated that there could be negative impacts on parrotfish (the primary grazers of Caribbean reefs since the 1983 die off of the urchin, *Diadema antillarum*) by establishing reserves to restore large predatory fish. The study suggested that the restoration of large predatory fish stocks could lead to increased predation of parrotfish and less grazing on macroalgae, the primary competitor for space with corals.
- Results from an investigation of Hawai'i's deep and shallow water algal communities has shed light on many aspects of these communities. Hawai'i's deep water algal assemblages are taxonomically distinct from shallow water assemblages, with many species exhibiting a high standing biomass and complex distributional patterns. About 30% of the species surveyed were observed for the first time in the Hawaiian Islands. Additionally, the ecological distribution of the invasive algae (*Avarainvillea amadelpha*) was compared to that of native algae (*Halimeda kanaloana*) and seagrass (*Halophila* sp.) populations. Results showed that the spread of *Avarainvillea* should be of concern to





managers because of the impacts it has on soft sediment dynamics and the general ecology of these environments.

- Preliminary results from an assessment of the recovery of the urchin *Diadema antillarum* inside and outside St. Croix, USVI MPAs show that the recovery of *Diadema* is widespread, but not universal. In particular, northeastern reefs lag behind other St. Croix reefs. In contrast, recovery of *Diadema* is poor in most of the Buck Island National Wildlife Refuge. In general, persistence of juvenile *Diadema* is significantly higher where adult *Diadema* densities are also high.

e. Challenges

The FY 2006 Congressional appropriation for NURP had a significant impact on the CRCP Research Grants Program. The appropriation provided no funding for the four east coast NURP Centers and associated facilities, two of which administer the CRCP Research Grants Program. As a result of the reduction in funding, the CRCP was only able to fund four projects in the Atlantic through the Southeast U.S. and Gulf of Mexico Center, which remained partially operational in FY 2006. The reduction in projects was a result of the lost leverage of NURP funds that matched those contributed by the CRCP. No projects were conducted in the Caribbean. As a result of decreased appropriations and a change in programmatic priorities, NURP decided to discontinue funding the Caribbean NURP Center and the infrastructure at Lee Stocking Island in the Bahamas. The Lee Stocking Island facility has been a very important site for conducting coral reef ecosystem research because of its location, lack of anthropogenic impact, history of research, and high quality facilities. These characteristics made this field station a tremendous resource to furthering the Nation's understanding of coral reefs and other undersea environments. The loss of this facility and NURP partnership has had significant impacts on the CRCP's research capacity.

