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Marine Scientists Receive Multimillion-Dollar NSF Grants to Fund Long-Term Research

Two research groups at UC Santa Barbara's Marine Science Institute have received multimillion-dollar, multi-year grants from the National Science Foundation to fund their continuing long-term research into the ecology of kelp forests and coral reefs.

The Santa Barbara Coastal Long Term Ecological Research (SBC LTER) and the Moorea Coral Reef Long Term Ecological Research (MCR LTER) programs have each received close to \$1 million per year for the next four to six years -- money that will fund research opportunities, supplies, and salaries for researchers and interns working at the two UCSB-affiliated ecological research sites that are part of the National Science Foundation's Long Term Ecological Research Network.

The NSF flagship program in the environmental sciences, the Long Term Ecological Research Network is unique in that its research and funding focuses on current and ongoing issues that can't be covered within NSF's shorter grant cycles. Questions into the effects of events such as global warming, ocean acidification, or the impact of rainwater runoff on offshore ocean communities can take decades of data and analysis to answer. There are 25 sites funded by NSF in the U.S. LTER network -- each focusing on a unique terrestrial or aquatic ecosystem that serves as a living laboratory from which researchers collect and analyze data that informs ongoing research, as well as future management decisions. Two are led by UCSB scientists.

"This is an amazing thing," said Russ Schmitt, principal investigator at the MCR LTER, commenting on the receipt of \$960,000 per year for the next four years. The funds will go primarily toward research at the network of coral reefs around the French Polynesian island of Moorea. The MCR LTER is a partnership developed between UCSB and Cal State Northridge, with marine scientists from other UC campuses, including Davis, Santa Cruz, and San Diego. Researchers from Duke University and the University of Hawaii also participate in the research.

Established in 2004, the MCR LTER is the youngest of the LTERs, and the only one to focus on coral reef ecosystems, which are at once among the most productive ecosystems in the world, and among the most rapidly disappearing.

Coral reefs are estimated to take up only a tenth of a percent of the sea floor, said Schmitt, but are associated with a quarter to a third of all species of marine fish.

"From a biodiversity point of view, they are spectacularly important," Schmitt said. "They are literally the rainforests of the marine environment."

Research topics at the MCR LTER include questions into the effects of global warming, changes in seawater chemistry due to ocean acidification, and the human impacts of fishing, as well as the long-term impacts of major disturbances like cyclones, which are a regular event in the region.

According to Schmitt, in the almost nine years of research and monitoring of the coral reefs around the island and its inshore areas, along with legacy data acquired by the research group, it has become apparent that Moorea is rather unique for its ability not just to resist changes, but also to recover rapidly from potential disturbances that kill coral.

In 2008, said Schmitt, a couple of major events disturbed the coral reefs that surround the island. One was the invasion of the Crown of Thorns starfish, and the other, a cyclone that killed most of the coral on the offshore reefs outside the island. Historically, coral reefs are able to recover within a couple of decades, and repopulate their old habitat areas. However, he said, in recent times algae have been taking over, covering what was once a reef with seaweed, and making it impossible for coral to repopulate. It is a change that is affecting other areas like the Caribbean.

At Moorea, however, over the last four decades, the coral has consistently been able to recover to its former high coverage within a decade. "What is it about Moorea that allows it to be disturbed and still recover rapidly?" asked Schmitt. The answer, he said, lies in two things. One is a unique partnership with what may seem like an unlikely ally: the parrotfish.

Often named as a culprit in the process of bioerosion because of the hard beak that scrapes and breaks the coral when it eats algae, parrotfish all but came to the rescue of the damaged reef. By eating the turfing algae -- the fuzzy green algae one might find in aquariums -- that were colonizing the damaged reef habitat, the fish prevented the development of bigger seaweed forms that could lead to a permanent change of the reef by preventing the colonization of young corals.

The second factor is still something of a mystery, according to Schmitt. "Despite the fact that the reef has been literally wiped out, baby corals have been able to repopulate at an enormously high rate," he said. "That means adult corals somewhere else are producing coral larvae that are somehow ending up at Moorea."

Closer to home, the NSF funding of the Santa Barbara Coastal LTER will enable Dan Reed, principal investigator, to answer questions regarding environmental changes and human activities that impact kelp forests like the ones that exist just off the Santa Barbara coast.

"Kelp are what is considered by ecologists to be a foundation species," said Reed, "species that are of overwhelming importance to the community." While kelp may be considered something of a nuisance topside, with fronds getting tangled in the props of ocean-going craft, underneath the surface they provide habitat to numerous creatures, much like trees do. Also, according to Reed, kelp supports various human-related activities, from scuba-diving tourism to fisheries and other mariculture.

But with human activities intensifying along the coast over the past few decades, resulting in rainwater runoff and other pollutants, combined with the impact of acidification and a rise in sea temperature, it's important to understand the effects of such change on the health of the local kelp forest and all that depend on it. Work at the SBC LTER consists of recording the constant changes in the environment and the effects that these changes have on the kelp forest over time.

"We try to use those measurements to understand how the community is structured and how ecological functions in the kelp forest change over time in response to inputs," said Reed.

With the funding provided by the NSF grant, such research and data accumulation will continue as scientists of many disciplines -- from marine ecologists to oceanographers to hydrologists -- strive to uncover the impacts of the interactions between land and sea on kelp forest communities.

"I think UCSB is known for its very interdisciplinary research, open borders and collaborative spirit," said Reed. That culture, he said, has led to the campus's success in integrating research across many departments, which in turn has resulted in the strength of the 13-year-old LTER.

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