CCRI Seeds Key Research on Climate Change for Threatened Corals

In 2006 CCRI sponsored research on the larval development, settlement and survival of elkhorn coral, *Acropora palmata*. This species was once one of the primary reef building corals in the Caribbean, but is now listed as threatened under the US Endangered Species Act. Headed by Dr. Alina Szmant of the University of North Carolina – Wilmington, the project collected fertilized eggs from the field during the annual mass spawning event that occurs each summer. Eggs were brought to the laboratory, and large numbers of larvae were successfully reared to settlement. The rearing techniques developed during this work have allowed Dr. Szmant to conduct additional work on factors affecting larval development and survival related to expected environmental stresses due to global climate change. Initial studies investigated the impact of higher temperatures (30°C and 31.5°C) on larval survival. Results show that, at present, larvae during the summer are at their thermal maximum, and increases in temperature lead to marked declines in survival. More recent experiments are investigating the potential impacts of ocean acidification due to global increases in atmospheric and oceanic concentrations of CO₂. To date, however, the predicted pH levels for 2050-2100 show no impact on larval development.

CCRI Helps Deploy NOAA Buoy for Acidification Studies

One of the principal threats of global climate change is the increase in CO₂ concentrations in the ocean, making the environment more acidic and potentially impacting the growth of organisms that use calcium carbonate for support, such as corals. During January 2009, and as part of NOAA’s Coral Reef Conservation Program, CCRI personnel helped to coordinate the logistics and deployment of the MAPCO2 buoy at Enrique Reef off La Parguera, PR. The instruments on the buoy form the backbone of the Atlantic Ocean Acidification Test-bed, a prototype system for NOAA’s planned Coral Reef Ocean Acidification Monitoring Network. Since its inception, this project has served as a collaboration of federal agency, academic monitoring and research activities. Data from the buoy, particularly CO₂ concentrations (pCO₂), are coupled with weekly geochemical surveys and ancillary observations along Enrique Reef by Dr. Jorge Corredor of UPRM’s Department Marine Sciences. Together, these data will be used to monitor community-scale metabolism along the forereef and help to establish methodologies for monitoring, assessing, and modeling the impacts of ocean acidification on coral reef ecosystems. A long-term goal of the project is to characterize the variability in carbonate chemistry in coral reef environments that would identify critical pCO₂ thresholds, their impacts, and trends necessary for developing forecasts and an early alert system for ocean acidification stress to coral reef ecosystems.
Ornamental Fish Trade as a Management Tool

One of the first projects sponsored by CCRI was an analysis of the populations of key species in the ornamental fishery, which showed that reported catch rates were very low compared to wild populations. As a follow-up and expansion to that study, Antares Ramos is carrying out an interdisciplinary study to understand user needs and resource use impact under the scenario of commercial fishers becoming involved in the ornamental fishery on a seasonal or permanent basis as an alternative source of income, as well as a useful management tool. Fifty-one commercial (i.e., non-ornamental) fishers were interviewed during Spring of 2008 throughout the island inquiring mainly about their knowledge on ornamental fisheries and their possible interest to get involved in this fishery during the closed seasons of certain commercial species. It was found that small-scale commercial fishers would, in fact, consider ornamental fisheries as an alternative income. General trends found in this study include the following:

- Fishers that used diving for fishing tended to be more inclined to consider ornamental fisheries than those that fished from their boats or using traps.
- Younger fishers tended to be more inclined to consider ornamental fisheries.
- Fishers who knew about ornamental fisheries tended to be more inclined to consider ornamental fisheries.

This section of the study shows that a temporal ‘switch’ to ornamental fisheries could be a management tool for commercial fisheries. However, further understanding of the ornamental trade is needed before any such measure can be considered. As part of this, CCRI is supporting additional field assessments to determine the impact from this potential increase in fishing effort.

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No Bleaching in 2009, but Reproductive Failure from 2005 Continues

In mid-July, the Coral Bleaching Thermal Stress Outlook from NOAA’s Coral Reef Watch indicated a significant potential for high levels of thermal stress in the Caribbean for 2009 that could trigger another large scale bleaching event as observed in 2005. Fortunately, temperatures for the region did not reach the extremes originally predicted and no mass bleaching occurred. However, impacts from the 2005 bleaching/disease event are still apparent. From 2006-2008, the mass spawning events for boulder (Montastraea) and elkhorn (Acropora palmata) corals, the major reef building species, did not occur in areas severely impacted in 2005. There was only slight improvement in 2009 when at least sporadic egg releases were observed off eastern and southwest Puerto Rico. No staghorn (A. cervicornis) corals were observed spawning in 2009. Instead, CCRI researcher, Edwin Hernández, commented that there was a widespread White Band Disease outbreak affecting approximately 60% of wild populations at some areas around Culebra. Environmental or physiological stress may have prevented spawning in Acroporid corals this year. Prospects for future recovery will depend on the probability of continued low summer temperatures in the coming years and a reduction in the local stressors that enhance coral susceptibility.

Limited to no spawning occurred around Puerto Rico this year. (E. Hernández)

Egg release of boulder coral (Montastraea annularis) from previous spawning events in Puerto Rico. (E. Weil)

Blue chromis are among the highly popular species in the ornamental trade industry. (A. Ramos)

Limited to no spawning occurred around Puerto Rico this year. (E. Hernández)