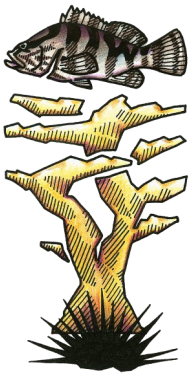
Caribbean Coral Reef Institute



CCRI NEWS

February 2010

CCRI Breaking New Ground with 1st Mesophotic Research Cruise

Mesophotic coral ecosystems (MCEs) exist at the lowest levels of light available for photosynthesis, extending down to 100 m (330 ft). Due to the limits of conventional scuba diving, little is known about these ecosystems, and specialized technology is required, such as technical, mixed-gas rebreather diving and the use of Remotely Operated Vehicles (ROVs). The declining health of shallow coral reefs leads to significant questions concerning the ecology and integrity of MCEs and their connectivity to shallow-water systems. For example, given the typically narrow insular shelves on Caribbean islands, what is the vulnerability and impact of land-based threats? Does overfishing of predators along the insular slope disrupt the ecology of food webs in a manner similar to shallow reefs? Are deep corals susceptible to coral diseases? What is the connectivity between shallow and deep ecosystems? Can MCEs act as refugia for threatened shallow water species, or are MCEs sustained by input from shallow areas? The answers to these questions will affect management decisions on conservation strategies, including the appropriate design for deep sewage outfalls, and location and various rationales for implementing marine reserves.

Commercial dive vessel *Nekton Rorqual* (above) and scientific crew (below). (E. Figueroa)

The Caribbean Coral Reef Institute, with the collaboration of the Cooperative Institute for Ocean Exploration, Research and Technology, conducted the first research cruise ever to study the structure and connectivity of MCEs at a large spatial scale across a longitudinal gradient. Funded by NOAA's CSCOR and OER, the research cruise ran from January 9-23 aboard the commercial dive vessel *Nekton Rorqual*. The cruise investigated mesophotic coral ecosystems at Mona Island and Vieques Island in Puerto Rico, and the U.S. Virgin Islands of St. Croix and St. Thomas. Activities included quantitative sampling of deep habitats using high resolution photographic transects, visual fish transects and video photography. Conventional SCUBA diving was used in shallower areas, while mixed-gas rebreather diving was used for work at mesophotic depths. Additional ROV dives were used to increase the depths and areas sampled, and to view geomorphology at a broader spatial scale. Specimens of algae, corals and other invertebrates were collected for identification and subsequent analyses.

Crewmember, Doug Kesling, filming during a deep dive at ~50m. (M. Nemeth)

The scientific crew, led by principal investigator/CCRI Executive director, Dr. Richard Appeldoorn, consisted of 17 scientists, including 6 deep re-breather divers led by Dr. Clark Sherman, 2 ROV operators and 9 support scientists and graduate students and 2 for film documentation. The majority of crewmembers were from the Department of Marine Sciences, UPR-Mayagüez, but additional crewmembers came from the University of North Carolina-Wilmington and Florida Atlantic University.

During the cruise, about 100 man-hours of deep, rebreather dives were conducted to depths of 250 ft, with an additional 8 ROV dives to depths of 420 ft. Specific accomplishments include the documentation of corals to depths of 308 ft., the discovery of new areas with significant mesophotic coral development at all islands (but not all locations), and the documentation of mesophotic coral ecosystems in areas of various geomorphologies and exposures to waves and currents, which will be used to model the conditions promoting mesophotic coral development. Collected samples will be analyzed for population structure and connectivity across the region and depths, stress levels in corals, and coral health. Collections include potential new species of algae, corals and invertebrates. Sclerosponges will be analyzed for evidence of rising ocean temperatures as a result of global increases in CO_2. Post-cruise analyses are expected to take over 2 years to complete.

Corals from the genus *Agaricia* were the most abundant found on mesophotic reefs and walls throughout the cruise. (H. Ruíz)

Urban Development Increasing Sediment Runoff into Coral Ecosystems

Disturbance associated to rural, suburban, or urban uses of the land results in the removal of its vegetation cover and the creation of impermeable surfaces, which typically lead to an increase in both the magnitude and frequency of freshwater runoff and sediment delivery into marine habitats. The threat imposed by increased sediment loading rates ranks among the most important stressors affecting coral reef ecosystems throughout the Caribbean Region. Ongoing research led by CCRI-affiliated hydrologist Dr. Carlos Ramos-Scharrón (*Island Resources Foundation & Univ. of Texas-Austin)* focuses on the development and application of GIS-based models to assess the impact that land development has on the rates of sediment loading into the marine environment. Application of these models to watersheds in the islands of Vieques, Culebra, and St. John-USVI relate an alarming story. Current sediment yields into coastal waters are 10 to 100 times higher than those expected during undisturbed conditions. Additional applications are being used in two CCRI-funded projects that aim to estimate how sediment yield rates from La Parguera and the Río Fajardo watershed have varied as a result of changing land use patterns over the past seven decades. A combination of these types of research activities and community involvement has led to the development of erosion mitigation strategies on the islands of St. John and St. Croix as part of a NOAA-ARRA funded project. With the appropriate funding these efforts could be imported to areas of much needed mitigation work in Puerto

Disturbance by urban development in the Río Fajardo watershed. (C. Ramos)

Cyphoma Outbreaks & Invasive Lionfish Threaten Reef Resources

Pacific red lionfish (*Pterois volitans*) are voracious predators with poisonous spines that have invaded the Caribbean and are now becoming abundant in PR waters. Elsewhere, they have severely altered the trophic structure of coral ecosystems, and no effective means of eradication has been demonstrated. News is spreading around PR as fast as their settlement. Local news and radio stations reported sightings off the coast of San Juan close to the hotel district. Commercial fisher, Fred Lentz, of Rincón, is spearing up to 10 per week along Puerto Rico's northwestern coast. Since his first sighting/catch in April 2009, Fred has caught 114 lionfish and has been assisting the DNER Fish Lab with samples to test for gonads and size/age structure. He finds them to be more prevalent under overhangs and on walls of caves in areas were currents mix, and their distribution is gradually moving from the north toward the west/southwest of Puerto Rico. Lionfish have been observed from shallow to deep waters with the current record in Puerto Rico being 260 ft at Mona Island, where they were observed by divers and in ROV dives during the recent CCRI Mesophotic Coral Expedition. Observations by Fred Lentz of lionfish spines near the dens of eels and octopuses suggest these as possible predators, but the most effect potential predator may be man. In the Bahamas, where lionfish are omnipresent, the government is promoting a fishery to help control the invasion. Despite their poisonous spines, lionfish are safe to eat and quite tasty.

Dr. Craig with lionfish from Carabinero, southern side of Mona Island. (H. Ruíz)

Cyphoma snails completely predating a purple sea fan at Mona Island. (M. Scharer)

In shallow areas of Mona Island, an outbreak of the flamingo tongue (*Cyphoma gibbosum)*, a gorgonian (sea fan)-eating snail, is significantly impacting the abundance and distribution of gorgonian populations on coral reefs. In the Caribbean, localized *C. gibbosum* outbreaks have been known since the 1980's. At Mona, these snails have decimated over 90% of shallow water gorgonians since 2008. A recent survey of the area confirms the infestation is widespread and gorgonian mortality is massive. At least 8 species of gorgonians were observed colonized by aggregations of *C. gibbosum* at depths up to 40 meters, with the purple sea fan being the most affected. The average number of snails per colony was 34.4 at four shelfedge sites, with the maximum being 190 snails. Predation completely deteriorates live tissue, exposing the axes to fouling by cyanobacteria and algae.

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