

# **Ecological Processes and Coral Reef Recovery in the Florida Keys**

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The coral reefs of the greater Caribbean region including the Florida Keys have declined markedly over the past few decades manifested by decreases in coral cover and diversity and increases in benthic algae. In 1990 Congress created the Florida Keys National Marine Sanctuary (FKNMS) and NOAA and EPA, in cooperation with the state, developed a management plan which was implemented in 1997. One of the key features of the management plan is a number of Fully Protected Zones (FPZs), now encompassing nearly 6% of the 9600 km<sup>2</sup> Sanctuary. The team has identified two critical process-based questions relating to the recovery of the coral reef benthos: 1) Will the coral assemblages recover and will they revert to their composition prior to disturbance, and 2) Can scientifically informed management, specifically FPZs, influence the reef recovery process. In October of 1997, the team began a hypothesis-based study of the ecological processes involved in reef recovery comparing shallow and deep sites at three pairs of FPZs and adjacent reference sites in the Upper and Lower Keys. The elements of the study were: 1) coral cover and diversity through time, 2) the importance of herbivory in controlling the biomass of benthic algae, 3) the relationship of herbivory and coral recruitment, 4) mortality rates of juvenile corals, and 5) the relationship between juvenile and adult coral assemblages.

Analysis of data from 1998-2000 shows stable coral populations at all sites but no increases in coral cover or diversity. Coral recruitment has been generally increasing with significant mortality associated with storms. Algal biomass and herbivory are highly variable and do not appear to affect coral recruitment rates. As the study was originally conceived as a five-year program, this proposal continues and modifies that study. The team will increase the geographic coverage and power of the hypothesis-test design by adding new sites in the Dry Tortugas and in the Upper Keys. This project will increase the resolution of the algal community dynamics component by linking observations more closely to coral recruitment processes and to the abundance, population structure, and recruitment of herbivores at the shallow sites.

It is well known that coral reef fish population respond readily to local fishing protection. In contrast, the reef benthos is affected over a longer term by local, regional, and global influences. An understanding of the fundamental processes governing coral reef recovery under management is essential for our hopes for sustainable use of this biologically diverse and economically valuable marine resource.