

Coral Reef Ecology

Tracking Changes From Natural Processes and Human Stresses

Coral reefs in the Caribbean and western Atlantic are deteriorating in response to hurricanes, coral diseases, anchor damage, sedimentation, and other stresses. USGS biologists at the Caribbean Field Station are documenting the current status of coral reefs and the effects of some of these stresses within Virgin Islands National Park (St. John), Buck Island Reef National Monument (St. Croix), and Dry Tortugas National Park (Florida). The primary objective is to detect change in benthic cover over time using a statistically rigorous protocol.



BRD biologist using digital video camera to record data on abundance and condition of reef

Caribbean Field Station scientists have designed a protocol for long-term research on coral reefs under the auspices of the National Park Service/USGS Inventory and Monitoring Program. This protocol represents a significant improvement over other techniques. The method involves the use of a digital video camera to film reef transects that have been selected randomly using a SONAR-based position locating system. The videotapes are then

analyzed to obtain quantitative data on cover by corals, algae, and other reef organisms. The protocol was developed for use in national parks in the US, but it is already being used in a number of Caribbean countries.

Some of the advantages of this approach include:

- ◆ A permanent visual record of the reef zone is obtained and can be archived digitally for future reference and for quality assurance purposes
- ◆ Selection of random locations for transects satisfies criteria for statistically rigorous analysis and allows the highest confidence in the data.
- ◆ Quantitative data on benthic cover are collected.

The video method has been used already at Virgin Islands National Park, Buck Island Reef National Monument, and Dry Tortugas National Park, and will soon be used in Biscayne National Park.

In March 1999, data were collected from randomly selected transects on Newfound Reef, off St. John, using this method. This reef is subject to little pressure from human activities. A year later, the same transects were resurveyed. The mean percent of living coral decreased from 18.0 ± 6.3 (SD) to 13.9 ± 6.1 (SD). This decline of 4% is statistically significant and represents a loss of over



Coral cover declined in Newfound Reef from March 1999 to March 2000

20% of the coral cover on this reef. The decline is most likely a result of damage from two hurricanes in the fall of 1999.

Diseases have had especially severe effects on corals within Virgin Islands National Park. Plague type II has affected over 12 coral species with the dominant coral, *Montastraea annularis*, exhibiting the greatest mortality. This disease has also had widespread effects on corals off Florida. Caribbean Field Station Scientists are monitoring coral diseases using quadrats and still photography on two different reefs off St. John.



Conspicuous white areas indicate presence of plague type II disease on a colony of *Montastraea annularis*

Tracking changes in reef fish assemblages

USGS biologists based at the Caribbean Field Station on St. John are collaborating with Dr. James Beets (Jacksonville University) and Dr. Alan Friedlander (Oceanic Institute, Hawaii) as well as biologists with NOAA's Center for Coastal Monitoring and Assessment in studies of coral reef fishes in and near Virgin Islands National Park, St. John. They are designing protocols for monitoring reef fishes under the auspices of the National Park Service/USGS Inventory and Monitoring Program. Due to overexploitation of fishes and detrimental changes in their habitats, most reef fish assemblages in the Caribbean have been severely altered, with some species such as Nassau groupers effectively eliminated. A stationary point count method is being used to monitor species richness and abundance of adult fishes. Belt transects are being used to monitor juvenile fishes as well as commercially important species such as groupers and snappers. Tracking trends in reef fish assemblages over time requires long-term data from a number of locations over appropriate temporal and spatial scales. The data set from the Virgin Islands dates back over ten years and is one of the longest available from the Caribbean.



Traditional trap fishing off St. John



Scarcity of Nassau groupers around St. John indicates heavy fishing pressure

Monitoring of reef fishes within Virgin Islands National Park has provided evidence of significant changes in reef fish assemblages from traditional fishing and illegal commercial fishing. Abundance and sizes of several important fisheries species are similar inside and outside park boundaries, indicating that the park is not serving as a refuge. Marine reserves need to be established to allow recovery of fishes and the benthic habitats, primarily reefs and seagrass beds, upon which they depend. Eventually it may be possible to correlate changes in reef fish assemblages around St. John with changes in coral cover or other reef characteristics detected with long-term monitoring.

Recent Publications

Rogers, CS, and G. Garrison. *in press*. Ten years after the crime: lasting effects of damage from a cruise ship anchor on a coral reef in St. John, US Virgin Islands. Proceedings of the National Coral Reef Institute Conference. April 1999.

Rogers, CS, and J. Miller. *in press*. Coral bleaching, hurricane damage, and benthic cover on coral reefs in St. John, US Virgin Islands: a comparison of surveys with the chain transect method and videography. Proceedings of the National Coral Reef Institute Conference. April 1999.

Miller, J, J. Beets, and C Rogers. *in press*. Temporal patterns of fish recruitment on a fringing coral reef in Virgin Islands National Park, St. John, US Virgin Islands. Proceedings of National Coral Reef Institute Conference. April 1999.



Fewer and smaller fishes are now caught intraps around Sr. John