

**LONG TERM MONITORING
OF CORAL REEFS
IN
GREAT LAMESHUR BAY
ST. JOHN, U.S.V.I.**

**A COOPERATIVE AGREEMENT PROPOSAL
TO THE NATIONAL PARK SERVICE**

SUBMITTED TO: Dr. Caroline S. Rogers
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INTRODUCTION

Coral reefs are perhaps the most valuable marine resources in the tropics because they provide critical habitat structure for many species of commercially important fishes and because they are centers of biotic diversity. In recent years the structural integrity of the framework of Caribbean reefs has been severely threatened by diseases and environmental perturbations. For example, white band disease eliminated many elkhorn corals, *Acropora palmata*, from the fore-reef off St. Croix (Gladfelter 1982), and the bleaching phenomenon of 1987 caused total or partial mortality of corals, sponges, and gorgonians across the Caribbean (Williams et. al. 1987). Excess sedimentation from construction activities may kill more corals than any other anthropogenic pollutants.

Such recent perturbations to coral reefs in the Caribbean has emphasized the need to assess the current "health" of coral populations to determine whether the reefs are declining or simply undergoing normal changes. However the detection of human-induced changes in coral reefs requires that impact effects be separated from normal inter-annual fluctuations in the growth, recruitment and mortality of corals. At present our understanding of natural fluctuations in coral reef communities is strictly limited by the lack of long-term studies of reef community dynamics.

PROPOSED RESEARCH

A long-term photographic monitoring program was begun in April 1985 to quantify the dynamics (including growth, mortality, recruitment and competitive overgrowth) of reef communities at Cabritte Horn, located at the entrance of Great Lameshur Bay in St. John, V.I. Thirty-two 0.25 m² permanent quadrats have been photographed annually to semi-annually with a camera frame ("quadrupod" described in Witman 1985) for the past four years. Sixteen of the quadrats are located at shallow (5 m) depth while the other half are located at 13 m, for a total monitored area of 8.0 m². The monitoring period documented the effects of the last year's bleaching event and indicated that many milleporid hydrocorals (*Millepora* spp.) and brain corals (*Diploria* spp.) were severely bleached. Unfortunately, none of the photo-monitoring data have been analyzed due to the lack of funding and the large sample size (> 192 photo quadrats).

It is my intent through this co-operative agreement with the National Park Service to analyze the four year baseline on reef change in Great Lameshur Bay and to continue photographic monitoring of permanent quadrats on a semi-annual basis during FY 1988 - 1989. Photographic prints will be made of each quadrat so that they can be digitized on a Numonics digitizer. This involves tracing the outline of each organism in the photo with a stylus attached to the digitizer. Data on the size (area) of individual corals, sponges, ascidians, corallimorphs and other cnidarians is then transferred to an Excel™ worksheet via a program developed in my lab called "Caribbean Numonics". The program assigns a number and one of 80 species names to each data point to facilitate tracking the same individual or colony over time. Growth (and de-growth) is measured as the percent change in surface area between sampling periods. The following information will be available for each quadrat:

- 1) abundance of each species, expressed as percent cover and density

- 2) species richness, or the number of species
- 3) overgrowth of one organism by another
- 4) recruitment, determined by the appearance of colonies
- 5) mortality, determined by the disappearance of colonies

The information on competitive overgrowth interactions will be used to rank the species in terms of their competitive ability. An impact to a competitively dominant species will clearly have a greater influence on community dynamics than an impact to a lower ranked species.

The proposed research will provide baseline information on the population dynamics of corals, sponges, ascidians and hydrocorals comprising the fringing reef at the entrance to Great Lameshur Bay in Virgin Islands National Park , St. John. The information will help park managers identify and interpret the effects of environmental perturbations on the fringing reefs in addition to providing data on the impact of the 1987 bleaching phenomenon on reef community structure.

BUDGET

SALARIES AND WAGES

(1) graduate student research assistant 2 academic quarters (3 mo/ quarter) @ \$2500. per quarter	\$5000.
Northeastern University overhead on Salaries and Wages (19.6%)	980.

TRAVEL

Airfare: Boston-St.John return for PI and diving research assistant @ 480./trip	960.
Lodging on Great Lameshur Bay at Virgin Islands Ecological Research Station (VIERS) @ 15.00/night for 4 nights x 2 people	120.
Jeep Rental @ 45.50/day x 4 days	182.

SUPPLIES

192 color prints (11" x 14") of photo quadrats for digitizing @ 3.95/ print	<u>758.</u>
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TOTAL BUDGET	\$8000.
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BUDGET JUSTIFICATION

Salaries and wages are requested to support one graduate student research assistant for 20 hours per week to digitize the quadrat photographs comprising the four year baseline on reef community change in Great Lameshur Bay. This is a time consuming task, but there is presently no other way to obtain the data. We have a proposal in to the National Science Foundation to support the development of a fully automated image analysis system but this system will not be available for approximately one year.

Funds are requested to cover the cost of travel to the research site once during the latter half of 1988. I estimate that all the quadrats can be photographed and labeled for long term monitoring in four days of diving. Therefore funds are required for a four day stay at VIERS. It is necessary to rent a Jeep for transportation to Great Lameshur Bay because it is a remote area with very limited taxi service. I have requested funds to make 192 color prints from the 35 mm transparencies of the photo quadrats. This is a necessary step of the image analysis because the organisms are traced from the photo "maps" of each quadrat.

In the spirit of the Co-operative agreement with the National Park Service, matching support will be provided by the Marine Science Center of Northeastern University in the following manner:

- Dr. Witman will supply the photographic equipment valued at \$3000 needed to photograph the permanent quadrats and a pneumatic drill valued at \$500. The drill is needed to drill out existing marks in around the permanent quadrats to emplace stainless steel screws for long-term monitoring.
- There will be no charge for the use of the Numonics digitizer linked to the MacIntosh Plus computer (system valued at \$7500).
- Dr. Witman will not charge for his time in the field, nor for the time required to write reports for the National Park Service.
- Dr. Witman will make the second trip of FY 1988-1989 to Great Lameshur Bay at his own expense, unless additional funds become available from the National Park Service.

LITERATURE CITED

Gladfelter, W.B. 1982. White band disease in *Acropora palmata*: implications for the structure and growth of shallow reefs. *Bulletin of Marine Science*. 32: 639-643.

Williams, E.H., Jr., Goenaga, C. and Vicente, V. 1987. Mass bleaching on Atlantic coral reefs. *Science*. 238: 877-878.

Witman, J.D. 1985. Refuges, biological disturbance, and rocky subtidal community structure in New England. *Ecological Monographs*. 55: 421-445.