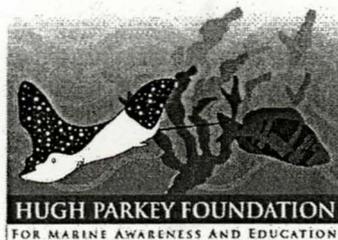


# Belize National Marine Science Symposium

Venue: Best Western Belize Biltmore Plaza

Date: January 19 & 20, 2006

Time: 8:00 am – 5:00 pm



*“The Foundation is dedicated to keeping Hugh’s legacy alive by increasing marine awareness & conservation through education, sustainable tourism and research. Our model focuses marine stewardship within the Belizean community and facilitates international outreach.”*

# CARIBBEAN CORAL REEF ECOSYSTEMS: 30-YEARS OF SMITHSONIAN MARINE SCIENCE IN BELIZE

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## INTRODUCTION

In the late 1960s, a group of eight marine scientists from the Smithsonian National Museum of Natural History, Washington (USA) established a long-term Caribbean coral-reef field program that is now known as Caribbean Coral Reef Ecosystems (CCRE). The core group consisted of specialists in the fields of Botany, Zoology, Paleobiology, and Geology, who were looking for a field location of high geological and biological diversity and with minimal anthropogenic disturbance, suitable for long-term research on biodiversity, ecological processes, historical development, and change over time. The tiny (<1 acre) sand island, Carrie Bow Cay, on the Mesoamerican Barrier Reef off Dangriga in Southern Belize was chosen as the base for a field station to enhance the CCRE Program's scientific focus and operational economy; it was established in February 1972.

The laboratory was co-sponsored by the Bowman family of Dangriga who own the cay and operate Pelican Beach Motel on the mainland, thus being able provide logistical support. A great variety of habitats, from mangrove islands to fore-reef slope, with a highly diverse fauna and flora, occurs within a distance of less than one mile (1–3). The Belize mainland coast and three off-shore atolls are in easy reach by small boats. A new custom-designed but local-style laboratory building was completed, equipped, and dedicated as Carrie Bow Marine Field Station in August 1999.

Each year, up to 120 Smithsonian staff and postdoctoral scientists, invited collaborators from academic institutions worldwide, and assisting students and technicians engage in the study of reefs and associated ecosystems, such as mangrove and seagrass. Our expertise is "whole-organism" biology, involving disciplines such as systematics, evolution, paleobiology, ecology, and ecophysiology. Our field research is complemented by study of the rich collection and use of extensive laboratory resources at the Smithsonian home base. Today, the CCRE program is a member of the Smithsonian's Marine Science Network, which includes costal laboratories in Panama, Florida, and Maryland (Chesapeake Bay).

## METHODS AND RESULTS

Field studies are conducted by snorkeling, free-diving, and scuba, and observations documented by conventional and digital photography and cinematography. Three small boats with outboard engines provide transportation to research sites. Several quantitative and statistical methods are being applied to monitor diversity, biomass, and population dynamics and changes. An oceanographic-meteorological monitoring station is established at Carrie Bow Cay and records parameters such as tide, salinity, air and water temperatures, solar radiation, wind, precipitation, and others; data are radio-transmitted to Dangriga and made accessible through the Web (4). Additional sensors and recorders are applied in situ where required. We are also following the CARICOMP protocol for monitoring reef, mangrove, and seagrass communities. Data on reef and mangrove historical development and community changes are generally obtained through vibracoring, followed by laboratory analyses back in Washington. The Carrie Bow laboratory has a photovoltaic solar system to provide electricity for microscopes, computers, battery charging, and other needs. Refrigeration and heating (kitchen, drying ovens) are partly powered by solar power, partly by propane gas. Microscopes, on loan from the Washington home base, include stereo and compound models with camera systems. Other scientific equipment, such as electronic balances, computers, salinometers, and temperature monitors are part of the laboratory equipment or taken there by investigators as needed.

The decline of reefs worldwide is accelerating and focus and resources are urgently needed to improve our understanding of biodiversity, community structure and dynamics, and environmental processes that control the coral-reef ecosystem. The Caribbean is "our" American tropical sea, to which we are connected by weather, ocean currents, and marine resources, as well as by cultural and economic exchange. Fortunately, we were able to document the diversity and complexity of the originally pristine barrier reef complex near Carrie Bow Cay for more than 30 years and in nearly 750 publications (see our progress reports (e.g., 5, 6); a complete publication list is available from the author). Many of the studies were initiated by individuals or small teams but all were evaluated, in the proposal stage, by the CCRE steering committee (including a delegate from the Belize Fisheries Department) to ascertain academic excellence, suitability to program objectives, and approval by Belizean authorities. Others were coordinated multidisciplinary investigations of entire systems, such as the Carrie Bow reef complex (1), the Pelican Cays (7), and the Twin Cays mangrove (8).

The outreach and educational component of our study includes a mangrove education video (9), and a mangrove-conservation workshop and virtual exploration trail (10).

## CONCLUSIONS

Despite considerable progress made by the CCRE research group and many other scientists associated with Caribbean marine laboratories, there are still many gaps in understanding the components and processes of coral reefs and related systems. Newly advanced methods, such as molecular techniques, can be applied to biodiversity studies. Research on larval development and recruitment, on climate change and other stress factors, and on the increasingly common occurrence of algal blooms and devastating invertebrate diseases needs our full attention to help guide resource management and conservation efforts and preserve the esthetical and economic value of our reefs.

## ACKNOWLEDGMENTS

Our thanks go to the late Henry T. A. Bowman of Dangriga, Belize, and his extended family and heirs who shared their island with us. We are also grateful to Belizean Government officials (the Department of Fisheries staff, in particular), colleagues, and friends who assisted us and made our program a continuing success. There is no space to list the countless Smithsonian administrators, program associates, and volunteers who sponsored and helped our research but we wish to single out Mike Carpenter, program operations manager, who led and conducted the logistical operation of the Carrie Bow Marine Field Station for more than 20 years.

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