Deep Coral Reef Ecosystem Studies (DeepCRES) Caribbean: Ecology, Integrity & Status of Deep Caribbean Coral Reefs

Institutions: Department of Marine Sciences, University of Puerto Rico, Mayaguez (UPRM); and Universidad Nacional de Colombia (UN Colombia)

Principal Investigators and Management Team: Richard Appeldoorn (UPRM, Lead PI), David Ballantine (UPRM), Paul Yoshioka (UPRM), Ernesto Weil (UPRM), Clark Sherman (UPRM), Francisco Pagan (UPRM), and Sven Zea (UN Colombia)

Deep Caribbean reefs are largely unexplored mainly due to the limitations of submersibles, ROV's and AUV's. This program grows from expertise developed under CRES 2002 and consists of a multidisciplinary team (biology, geology, chemistry, and physics) to study the biology and ecology of deep reefs off La Parguera, PR. ROV surveys will guide initial work, but key to the program is the development of deepdiving (300fsw) capability for detailed manipulative work and sampling. Research is driven by 24 specific hypotheses within 3 objectives: **Characterization** – species compositions and changes in space and time, disease prevalence and dynamics, genetic variability, reproduction and recruitment, plus the current and historical environment affecting reef distribution and function. Work includes still/video photography, specimen collection, repeat sampling and experimental manipulations. **Connectivity** – the relationship and ecological flow between deep and shallow reefs using taxonomic, genetic, reproductive and recruitment studies, and simulation modeling. Can deep reefs seed threatened shallow species, or are deep reefs dependent upon larval import from shallow reefs? **Vulnerability** – new/different species, small populations, slow growth and close proximity to land potentially make Caribbean deep reefs unique yet vulnerable to anthropogenic stress. A scientific management committee ensures proper scheduling and completion of all activities.

Deep Coral Reef Ecosystem Studies (DeepCRES) Hawaii: Investigating the Deep (50-100 m) Coral Reefs of Hawai'i

Institutions: Bishop Museum; Division of Aquatic Resources, Department of Land and Natural Resources, State of Hawai'i (DLNR-DAR); NOAA Pacific Islands Fisheries Science Center (PIFSC); Department of Ecology and Geophysics, University of Hawai'i (UH-Geology); and Botany Department, University of Hawai'i (UH-Botany).

Principal Investigators and Management Team: Richard Pyle (Bishop Museum, Lead PI and Management Team Chair), Anthony Montgomery (DLNR-DAR), Frank Parrish (PIFSC), Brian Popp (UH-Geology), John Rooney (PIFSC), Celia Smith (UH-Botany).

This project directly addresses the DeepCRES priorities of understanding the fundamental processes that regulate deep hermatypic reef ecosystems, the potential of deep reefs to serve as refugia from over-exploited or otherwise threatened shallow reef

stocks, the habitat-specific vulnerabilities of deep reef to exploitation and disturbance, and NOAA's challenge to produce models and tools for ecological forecasting.
The DeepCRES Hawai'i effort consists of a series of investigations of a recently discovered deep coral reef complex in the southern Au'au Channel at depths ranging from approximately 76-85 m. Coral cover on this complex is believed to exceed 90% at these depths. This project leverages the expertise of an outstanding team of researchers and resource managers with extensive experience investigating deep coral reef environments, and a robust array of available equipment and relevant infrastructure, to understand the biological communities (fishes, invertebrates, and macroalgae) inhabiting the deep (50-100 m) reefs of Hawai'i. Thirteen hypotheses have been defined and clustered into five categories: **Geophysical Habitat Characterizations** (mapping and physical/ecological characteristics of deep reefs); **Biodiversity Inventory** (cataloging the basic diversity inhabiting these environments); **Population Structure and Dynamics** (comparing deep and shallow reef communities, especially in terms of the deep reef potential as refugia); **Broad Ecological and Physiological Characterization** (trophic dynamics and energy budget among predators, prey, and primary producers); and **Spatially-based Predictive Modeling** (developing predictive models about the abundance and positions of deep reef systems and the factors that shape them). The project engages K-12 students, science and Hawaiian culture educators, and the general public in the first-time exploration and documentation of deep water hermatypic coral reef ecosystems in Hawai'i.