SERDP
Strategic Environmental Research and Development Program

Analysis of Biophysical, Optical and Genetic Diversity of DoD Coral Reef Communities Using Advanced Fluorescence and Molecular Biology Techniques

Conservation
CS-1334

Background:

The Department of Defense (DoD) maintains numerous facilities in tropical and subtropical environments that are adjacent to coral reefs. The development of advanced technologies for monitoring benthic communities under DoD jurisdiction requires an understanding of how different environmental factors affect the key elements of the ecosystems and the selection of specific monitoring protocols that are most appropriate for the identification and quantification of particular stresses. Documenting the environmental state of reef communities is critical to developing remediation strategies that can both reduce anthropogenic impact and distinguish between natural and anthropogenic stress.

Objective:

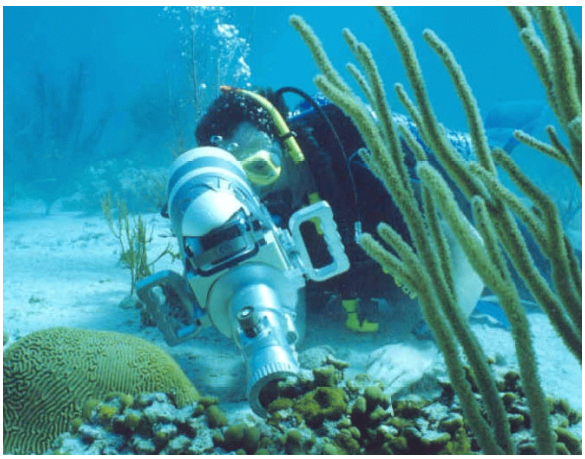
Specific objectives of this project include: (1) develop advanced techniques for rapid and non-destructive assessment of the viability and health of coral reef communities with the capabilities of identification and quantification of natural and anthropogenic stresses, (2) develop prototypes of Fast Repetition Rate (FRR) Fluorosensors for permanent underwater monitoring stations and Remotely Operated Vehicles (ROV), and (3) collect a library of baseline data on physiological, biophysical, bio-optical and genetic diversity of coral reef ecosystems near DoD installations in three geographic areas.

Summary of Process/Technology:

Rapid and non-destructive assessment of the health and viability of benthic photosynthetic organisms is based on the use of FRR Fluorometry. This technique relies on the relationship between the efficiency of photosynthetic processes and chlorophyll fluorescence and derives a comprehensive suite of fluorescent and photosynthetic parameters of the target. The impact of common natural stresses (e.g., elevated temperature, excess irradiance, and nutrient load) and specific anthropogenic stresses (e.g., toxic pollutants and turbidity) on the physiological status of coral will be studied in laboratory and field experiments. The molecular biology and genetic aspects of the project will be focused on identification as well as spectroscopic and genetic characterization of color proteins, which are an important indicator of the health of coral reef ecosystems. Instrument development will include design of an advanced FRR fluorometer for permanent monitoring stations and a prototype fluorosensor for ROVs.

Benefit:

This research will provide a set of quantitative baseline data as well as advanced methods and technology for the assessment of benthic ecosystems near DoD installations. The FRR fluorometry is based on the same biophysical principles as several other active fluorescence techniques, but it provides a significantly greater quantity of parameters. This information is valuable in the identification and quantitative assessment of specific environmental stresses.



Non-destructive assessment of the health of benthic photosynthetic organisms using an underwater FRR fluorometer.

Accomplishments:

This project began in FY 2003. Accomplishments will be noted upon completion of the project.

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