

# Application of ROV-Based Video Technology to Complement Coral Reef Resource Mapping and Monitoring

## Background:

Recent declines in coral reefs across the globe underscore the need for new scientific tools to better understand ecological patterns and rates of change. Given that numerous factors are typically responsible for changes within reef ecosystems, the monitoring of reef health must be performed at multiple spatial and temporal scales. Comprehensive assessment of coral reefs demands a hierarchical mapping strategy involving micro- to macroscale measurements. Of immediate interest to the Department of Defense (DoD) are types of changes within reef systems that can be monitored at the mesoscale level.

## Objective:

This project will develop a technology based on the use of a remotely operated vehicle (ROV) to increase the speed and repeatability with which reef plots can be mapped and inventoried. Specific objectives include: (1) apply an advanced two-dimensional (2-D) digital video processing technique to construct georeferenced photo-mosaics of small habitat patches; (2) extract ecological indices of reef condition from mosaics and validate them using independent diver-based methods; and (3) assess the influence of water quality (e.g., turbidity) on the ability of the video-based ROV system to systematically characterize coral communities.

## Summary of Process/Technology:

The ROV-based, 2-D digital, video mosaic technology will be used to construct photo-mosaics of 10 meter by 10 meter plots on coral reefs. The image mosaics will be processed and analyzed to extract a number of standardized metrics that will be used to monitor coral condition over time. Validation of the mosaic maps and assessment of the system's ability to quantify changes within test plots over time will be performed independently using standardized, diver-based monitoring methods. In addition, this research will explore development of tools to automate or assist classification of underwater imagery. This will involve 3-D reconstruction of specific reef features from stereo video data and high resolution multi-spectral imaging.

## Benefit:

This research will lead to the development of efficient methods for mapping and monitoring coral reefs under a range of conditions. The ROV-based mosaic technology offers numerous advantages over traditional, diver-based video transects, producing single, plot-scale, high-resolution images that are georeferenced and undistorted. These

georeferenced images can be easily integrated with other data sets using Geographic Information Systems (GIS) to inventory reefs under DoD purview. This is an essential component of the legally mandated environmental documentation necessary for conducting military operations and will provide decision-makers with critical information to maintain compliance with relevant statutes, regulations, and executive orders.



**Changes in live coral cover over a four-year period, Andros Island, Bahamas. Monitoring changes such as this will provide a scientific basis for management decisions.**

## Accomplishments:

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

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