Predicting and Mapping Metrics of Fish Community Structure over Large-scales Assists Managers in Enacting Spatially Explicit Management Decisions

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Managers of tropical marine ecosystems must frequently enact spatially explicit management decisions at scales larger than that at which research is typically conducted. To address this issue, NOAA's Caribbean reef fish monitoring program, lead by the Biogeography Team, has utilized its partnerships with the National Park Service, University of Puerto Rico, and the Virgin Islands Government to develop predictive, large-scale, spatial models of fish community metrics to be used in affecting these decisions. The foundation for this effort is the nearshore benthic habitat maps developed by the Biogeography Team and coastal bathymetric information. Using a random stratified sampling approach, over 1400 surveys have been conducted in the last three years around the nearshore waters of Puerto Rico and the US Virgin Islands. Utilizing canonical correlation analysis to examine the relationship between metrics of fish community structure and physiographic characteristics (bathymetry, bathymetric variation, habitat type, and proximity to other habitat types) provides a mapable surface of community metrics within a Geographic Information System (GIS). This talk will discuss how spatial models created to predict basic metrics in fish community structure in one location can be invoked in other areas and to discuss the success to which that has been done. The ability to invoke these models over large areas (the scale of a Caribbean island) provides reason for optimism at predicting regions that should be thought of as candidates for Marine Protected Area selection or in assisting managers with other spatially explicit management decisions. Further exploration of the patterns found in the model, necessarily provides a more intimate comprehension of how these species are influenced by their surrounding environment and these models can then be deconstructed to assess the primary factors influencing these communities.

The Nature Conservancy's Approach to Delineation of the Area Harboring the Richest Reefs on Earth, the Coral Triangle

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The world's center of marine biodiversity is known to zoogeographers as the Coral Triangle. This area includes a major part of Southeast Asia's most pristine coral reefs, which are severely threatened by over-fishing, destructive fishing practices, coastal development, pollution and mass bleaching events. Conservation of marine biodiversity in the Coral Triangle's geographic sub-units necessitates a comprehensive approach to site selection, resulting in resilient networks of Marine Protected Areas. The Conservancy's framework for priority setting is Ecoregional Conservation Assessment. This methodology aims to capture all nature values within an ecoregion by selecting a portfolio of sites for conservation action. To use the Coral Triangle as a unit for ecoregional conservation assessment its boundaries must be delineated. For this purpose, The Nature Conservancy's South East Asia Center for Marine Protected Areas (SEACMPA) convened a group of experts at its office in Bali Indonesia over the period April 30 - May 2, 2003. The experts were asked to apply best available science to get to a degree of consensus on the boundaries of the Coral Triangle and its sub-units (ecoregions and functional seascapes). The boundaries of the Coral Triangle, ecoregions and functional seascapes identified in this process were not intended to provide new biogeographic insights. Rather, these units were designed specifically for conservation planning. This paper presents the findings of this experts workshop, and explains The Nature Conservancy's approach to designing networks of Marine Protected Areas.

A GIS-based Dynamic Decision Support System for Florida's Coral Reefs

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Spatial Information is playing an increasingly important role in the analysis and management of coral reef systems, however frequently data are dispersed across the large number of agencies and organizations that maintain them. We, at the National Center for Caribbean Coral Reef Research (NCORE) have assembled a number of spatially referenced data sets pertaining to coral reefs of the Florida Keys, and have developed an Internet-based Dynamic Decision Support System (DDSS) to assist coral reef managers and scientists in identifying and accessing spatial data sets of interest to them. The relevant data sets identified using the DDSS are assembled together as a map collection, and are queryable and customizable through an ArcIMS-based web interface. The data layers have associated metadata which users can access through the web interface, in addition to a 'data bibliography'; which concisely summarizes the data sources, authors, and how the data may be obtained. We also hope that any interested researchers will submit additional information for incorporation into the DDSS. This will greatly facilitate data sharing and co-ordination of coral reef research in the Caribbean.

Ecological Economic Modeling and Valuation Meta-analysis for Coral Reefs as Tools for Marine Protected Area Management

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This paper presents two recent developments in decision making on coral reef management. First is an new ecological-economic coral reef model aimed to assist scientists and managers in evaluating ecological and economic impacts effectively. The model is applied to case studies on tourist overuse, algae blooms and MPA management in Hawaii and on climate change impacts on selected reefs in the Caribbean. The integrated model, referred to as SCREEM (Simple Coral Reef Ecological Economic Model), links ecology and economy in a dynamic manner. SCREEM incorporates the relevant ecological-economic relations by following pathways, linking the coral reef ecosystem and its uses and location with the physical goods and services provided by this reef type and the economic value of these values. The results show that coral reef management, though sometimes costly, tends to be justified in economic terms based on the large economic benefits provided by coral reef ecosystems.
The second supplementary development is a meta-analysis for coral reef valuation. This overview study is based on over 100 coral reef valuation studies from around the globe. Using regression analysis to synthesize the results, the methods enables the estimation of the economic value of a coral reef area based on limited local information on the ecological and economic situation in an area. . This method is groundtruthed with results from the Hon Mun Marine Protected Area in Vietnam. By comparing the results of the primary valuation of Vietnam's coral reefs with the values estimated using a value transfer function derived through the existing meta-analysis, the so-called 'transfer error' was measured and explained. This technique facilitates valuation studies and cost benefit analyses of marine protected areas and coral reef threats in areas with limited data availability and financial resources.