Coral Reef Overview

Issue

Coral reef ecosystems and associated seagrass and mangrove communities are among the most complex and diverse ecosystems on earth. They support important fishing and tourism industries, protect coasts from wave and storm damage, build tropical islands, contain an array of potential pharmaceuticals, and provide local communities with a source of food, materials and traditional activities. As shallow-water, near shore communities, coral reef ecosystems are ecologically closely linked to adjacent watersheds and are highly vulnerable to human activity. Anthropogenic stressors include pollution (i.e., poor water quality from runoff, inadequate sewage treatment) and land and resource use (i.e., over-harvesting of reef resources, sedimentation, shoreline development, and damage from tourists and divers). Larger-scale global climate change can potentially affect coral reef ecosystems through changes in sea temperature, sea level, irradiance, wind and precipitation patterns, and frequency and severity of extreme events such as tropical storms. Invasive species can also impact coral reefs by displacing or smothering native organisms.

Natural and human-induced forces act separately and in combination to degrade coral reef ecosystems. Symptoms of stress include mass bleaching (loss of symbiotic algae) of corals, regional reductions of certain reef framework corals, and disease outbreaks leading to mass mortalities of reef-building corals and associated organisms. According to the 2000 report by the Global Coral Reef Monitoring Network, the world has lost an estimated 11 percent of coral reefs and a further 16 percent are not fully functional. Significant further reductions in coral reef health, accompanied by major losses in biological diversity, are expected to continue for the next few decades unless coordinated action to manage and conserve these ecosystems is undertaken soon. The 1998 Executive Order on Coral Reef Protection (E.O. 13089) and the Coral Reef Conservation Act of 2000 direct Federal agencies to map, research, monitor, manage, and restore coral reef ecosystems. In response to E.O. 13089, the U.S. Coral Reef Task Force established interagency working groups to address six areas: (1) Coastal Uses, (2) Ecosystem Science and Conservation, (3) Mapping and Information Synthesis, (4) Water and Air Quality, (5) International Dimensions, and (6) Education and Outreach.

Approach

- The Center for Sponsored Coastal Ocean Research (CSCOR) Coral Reef Research Program has embraced this mandate by providing guidance and funding support to long-term, ecosystem-wide, multi-investigator research projects. CSCOR strives to deliver the highest quality science in time for important coral reef policy decisions by following CSCOR's proven research strategy of targeting the critical issues, translating findings into accessible information and transferring it to coastal managers, planners, lawmakers, and the public. The approach involves:

- Competitive peer-review to involve best scientists in academia and government;
- Involving scientists and managers in synthesizing science for management decision making;
- Tough project requirements that include: clear project goals, a standard project structure such as a Lead Principal Investigator, a Program Manager, and a Technical Advisory Committee, clear deliverables, and achieving specific objectives within a finite lifecycle.

CSCOR's Coral Reef Research Program currently supports coral reef research through two types of initiatives:

- Coral Reef Research Institutes and Programs – since 1998, CSCOR has administered funds appropriated by Congress to support coral reef research and monitoring programs that are directly managed by state and territorial jurisdictions. The programs are implemented by selected academic institutions and appropriate governmental agencies in collaboration with other agencies, universities and non-profit organizations.
- Competitive Coral Research Programs – CSCOR initiated two long-term Coral Reef Ecosystem Studies (CRES) in Fiscal Year 2002 that focus on reefs of Puerto Rico, U.S. Virgin Islands, and Guam. The CRES research program was developed in response to the continued decline of U.S. coral reef ecosystems, and the clear need to define and understand causes and effects of reef degradation on a regional scale. This coral reef ecosystem research is a part of the CSCOR mission to provide timely and high-quality scientific results that can be readily used to develop alternative management strategies to restore and protect coral reef ecosystems. The CRES programs are designed to address research priorities of NOAA, the U.S. Coral Reef Task Force and the Coral Reef and Marine Conservation Act of 2000. The CRES studies were prioritized by geographic area and selected through a competitive process.

Ecological Forecasting

CSCOR's coral reef research emphasizes the development of coral reef ecological forecasts (i.e., the capability to predict the effects and interactions of environmental variability and anthropogenic stressors on coral reef ecosystems, and the impacts of management actions on coral reef ecosystems and related coastal economies). Ecological forecasting can lead to better decision-making, better communication between scientists and managers, and help to set science priorities for the future.

Research to Applications

Coral reef ecosystems face a suite of common threats, and some that are region-specific. CSCOR's goals are to 1) fill in information gaps on the underlying processes that regulate the health of coral reef ecosystems; and, 2) to provide resource managers with tools such as models to evaluate alternative management strategies to protect healthy reefs and reverse the decline of degraded ones. Specific programs have more focused goals, such as performing ecological studies on coral reefs; studying coastal water characteristics of flow, residence time and spatial extent of watershed discharge; quantifying the societal costs to island communities resulting from watershed and related reef degradation; and testing reef restoration techniques coupled with established MPA's and land-based remediation. CSCOR-sponsored research integrates ecological studies, physical oceanographic research and social science to deal with problems identified as priorities by NOAA and the U.S. Coral Reef Task Force. It focuses on the anthropogenic disturbances of greatest impact on coral reefs, and translates this information for managers and for the general public through regional educational outreach. The unifying theme of future CSCOR projects will reflect a significant shift towards coral reef ecosystem prediction, which will be vetted and integrated through a series of planning activities as NCCOS develops its coral reef research plan.

Accomplishments

CSCOR currently has a portfolio of coral reef projects that include three Congressionally-directed institutes and two competitive projects. Fiscal Year 2005 funding for the institutes totals $3 million and will likely continue for the foreseeable future. The competitive Coral Reef Ecosystems Studies (CRES) in Micronesia and the Caribbean will be ongoing through Fiscal Year 2005 and Fiscal Year 2006, respectively. These programs are described briefly here. The two long-term CRES studies were initiated in Fiscal Year 2002 and are focusing on coral reef ecosystems in Puerto Rico, U.S. Virgin Islands, and Guam. The CRES research program was developed in response to the continued decline of U.S. coral reef ecosystems, and the need to define and understand causes and effects of reef degradation on a regional scale. The first two CRES projects were prioritized by geographic area and selected through a competitive process.

Note: CSCOR's coral reef programs are carried in contribution to the mission of NOAA's Coral Reef Conservation Program.

Additional CSCOR accomplishments can be found at: http://www.cop.noaa.gov/aboutus/accomplishments.html

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