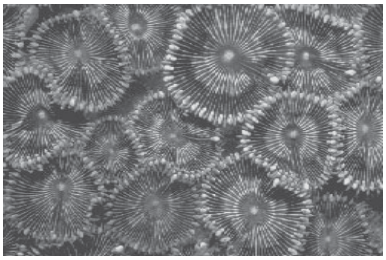
CORAL REEFS

Coral reefs are one of the Earth's most beautiful, ancient and complex ecosystems. They play an essential role in sustaining life in the sea and serve as a source of food and protection for human communities. But, coral reefs face an uncertain future. As a result of growing human and environmental assaults, reefs are among the most threatened ecosystems on earth. Ecological research provides information fundamental to understanding and combating this trend.

Ecological Society of America

WHAT ARE CORAL REEFS?



Coral reefs are the most diverse communities on the planet. These tropical marine communities occupy less than 1% of the ocean floor, but are inhabited by at least 25% of all marine species. Scientists estimate that more than 25,000 described species from thirty-two of the world's thirty-three animal phyla live in reef habitats - four times the number of animal phyla found in tropical rain forests.

Coral reefs are one of the oldest continuous environments on Earth. Similar marine communities have existed for hundreds of thousands of years. Most of the reefs we see now have been growing for over 5,000 years. Coral reefs are found within the jurisdiction of more than 100 countries and occupy more than 600,000 square kilometers of tropical oceans. They generally require clear, warm water and high light intensity for survival. This limits them to shallow water, with maximum diversity occurring between 10 to 30 meters below the surface. Reefs exist in nutrient-poor environments and for that reason small changes in the nutrient content of the water can adversely affect their survival.

ECOLOGICAL ROLE OF CORAL REEFS

In addition to their high diversity, coral reefs are very productive marine communities. They play a critical role as habitat and nursery grounds for 10% to 20% of the world's fisheries. They are intimately connected to other marine communities such as mangrove forests, sea grass beds, and the open seas as water currents transport larvae, plants, animals, nutrients, and organic materials. Coral reefs play a significant role in the development of other ecosystems such as mangroves and wetlands and protect coastlines from wave and storm damage and erosion. Life-saving medicines, such as anticoagulants, and anticancer agents, such as prostaglandins, come from coral reefs.

The rocky framework of coral reefs is formed from the calcium carbonate deposited mainly by calcareous algae and the stony corals, most of which are colonial animals resembling tiny, interconnected sea anemones. Reef-building corals contain symbiotic algae in their tissues, enabling them to develop the large, massive, branching, or encrusting carbonate skeletons that provide habitat and food resources for support of other reef organisms, such as fish, lobsters, giant clams, and sea urchins to name but a few. Reefs maintain a network of intimate ecological relationships and delicate food webs. Disruption of coral reef communities can break up these ecological bonds. Under natural conditions, a healthy coral reef can recover from natural disturbance such as hurricanes, within 10 to 20 years. But when subjected to chronic human-induced stress, recovery from even natural disturbance may be impossible.

"Globally, best estimates suggest that about 10% of coral reefs are already degraded, many beyond recovery, and another 20% are likely to decline further within the next 20 years. At least two-thirds of the world's coral reefs may collapse ecologically within the lifetime of our grandchildren, unless we implement effective management of these ecosystems as an urgent priority."

IOC/UNEP/IUCN Global Coral Reef Monitoring Network Strategic Plan, preface by Gunnar Kullenberg, Executive Secretary of the Intergovernmental Oceanographic Commission, Elizabeth Dowdeswell, Executive Director of UNEP, and David McDowell, Director General of the IUCN-World Conservation Union.

MAJOR THREATS

Human activities, both direct and indirect, are driving the loss of coral reefs, including:

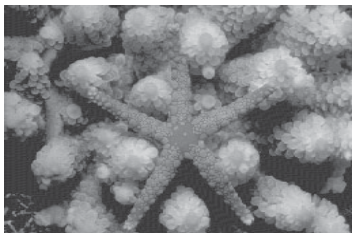
- **Over-fishing,** particularly of long lived, low density fish such as grouper, and **destructive fishing practices** such as the ubiquitous use of cyanide and dynamite to capture fish.
- **Pollution,** especially from increased sedimentation (from poor land use) that smothers the coral tissue and nutrients (from runoff) that promote algae growth which, in turn, suffocates the corals.
- **Physical damage** from tourists damaging the reefs, anchors dropped in coral beds, and ships colliding with reefs.
- **Alteration of coastline habitats,** such as cutting of mangroves, and other coastal habitats.
- **Harvesting live aquarium fish and coral** for food, traditional medicine, and aquaria. These bring high prices and have resulted in destructive fishing practices that destroy the reefs, as well as their inhabitants. The United States is one of the top importers of live coral for aquaria.

Ecologically-based management can provide important steps to restore reef ecosystems by addressing some of these threats. For example, improved water quality and fisheries management are necessary to restore reef ecosystems. Protected areas such as sanctuaries, reserves, and no-fishing zones (where reef populations can remain unharvested and protected) can allow damaged ecosystems to recover and enable baseline studies on natural reef conditions to be conducted.

IMPORTANCE OF ECOLOGY

Ecology is the study of interconnectedness. By their very nature, coral reef ecosystems are complex and are not always easy to understand. Ecological research provides valuable insights into the workings of coral reefs and how these can be disrupted.

- Ecological research has helped identify some of the causes of reef degradation. Recent studies suggest that the loss of large predatory fish and other key components of the ecosystem, such as snappers and lobsters, have caused major disruptions of reef food webs. These disruptions have lead to the loss of coral and increases in algae. Ecologists have discovered diseases such as black-band disease and white plague that can kill coral in less than 1/100th of the time it takes for coral to grow. The causative agents of these diseases are still not fully understood.
- Alternatives to destructive fishing practices can be obtained through information collected on the life and breeding cycles of threatened reef species, such as groupers, can lead to reduced stress through commercial breeding.
- Ecological knowledge is key to reef management and restoration, and ongoing monitoring and evaluation of the status of reefs are essential components of these efforts.
- Ecology can play a role in the development of new environmental technologies that integrate ecology, economics, technology, and social science.



Corals around the world have been adversely affected by bleaching and diseases such as cyanobacterial infections. These affect growth, reproduction, productivity and survival of coral. Recent studies indicate that both the variety and extent of coral diseases are increasing dramatically.

FOR MORE INFORMATION

- National Oceanic and Atmospheric Administration (NOAA) Coral Reef Information: http://www.coralreef.noaa.gov/
  NOAA's Coral Health and Monitoring Program (CHAMP): http://coral.aoml.noaa.gov/index.html
  NOAA's Global Coral Reef Monitoring Network: http://coral.aoml.noaa.gov/gcrmn
- ICLARM - The World Fish Center, PO Box 500, GPO, 10670 Penang, Malaysia. Phone: (604) 626-1606. Fax: (604) 626-5530. www.iclarm.org; Reefbase, ICLARM's web-based coral reef information system: www.reefbase.org.
- U.S. Coral Reef Task Force: http://coralreef.gov

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Spring 2000