

Encyclopedia of Earth

Threats to coral reefs

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Introduction

Coral reefs have been experiencing damage from a number of sources. It is estimated that 10% of all coral reefs are already degraded beyond repair, with 30% estimated to be in critical condition and at risk of death within 10 – 20 years. If current pressures continue then 60% of the world's coral reefs may be severely damaged by 2050. The damage/degradation can be due to natural events and or anthropogenic effects.

Natural Events

Storms

Coral reefs can be damaged by natural events such as hurricanes, cyclones, and tsunamis. Wave activity can break apart corals; branching corals are more susceptible to storm damage than mound-building corals. Storms rarely kill all corals, and because storms are a natural part of coral reef ecosystems, coral species should be adapted to this type of disturbance and be able to recover following storms. However, human alteration to the environment may make recover more difficult. For example, the addition of nutrients or removal of herbivores might favor the growth of algae that is able to overgrow coral before they are able to recover.

Temperature Changes

Coral reefs require particular environmental conditions for growth and water temperatures from 23–29 °C are optimal for growth. Increasing temperature too much can cause the coral polyps to expel the zooxanthellae and lead to coral bleaching where the zooxanthellae are expelled from the coral by the polyps. The El Niño Southern Oscillation (ENSO) event of 1997-1998 caused server coral bleaching in the Indo-Pacific with 70-80% of shallow-water corals killed in some regions.

Coral Diseases

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Sri Lankan reefs damaged by a tsunami. (Source: National Aquatic Resources Research and Development Agency)



Black Band Disease. (Source: USGS)



Over the last 30 years scientists have identified about 30 diseases of corals. The causes and effects of coral disease are still poorly understood. Coral diseases can be caused by bacteria, fungi, algae and worms. Coral disease has had a major impact on Caribbean reefs, where 80% of coral has been lost to disease in the last 20 years. Only about seven diseases have been recorded from corals on the Great Barrier Reef and disease is not considered a major threat to the Reef.

The frequency of coral diseases appears to have increased significantly over the last 10 years, causing widespread mortality among reef-building corals. This increase may be related to deteriorating water quality associated with anthropogenic pollutants and

increased sea surface temperatures which may allow for the proliferation and colonization of disease-causing microbes. Thus the effect of coral diseases may have been made worse by human activity.

Anthropogenic Effects

Pollution

Coral reefs can be damaged by a variety of pollutants that are produced by a variety of sources. Agricultural runoff can contain herbicides, pesticides, and nutrient fertilizers. Nitrogen and phosphorus addition can fertilize algae and result in algal blooms. Because algae can potentially grow so much faster than coral, they can out-compete corals.

Human sewage, often untreated, can add nutrients, microorganisms, and other pollutants to coral reefs. Nutrients in sewage can cause eutrophication. Bacteria added by sewage pollution are suspected causes of increased incidences of coral diseases such as white band disease.

Chemical pollution can also harm coral reefs. For example, oil spills, the result of spills from drilling or discharge of oil from vessels can harm reefs. They can be especially harmful if they occur during coral spawning because the oil can kill eggs and sperm.

Solid pollution such as plastics and discarded fishing nets (ghost nets) can also damage reefs.

Sedimentation

Human activities on land such as the clearing of forests, road building, and other development can lead to increased rates of sedimentation. High sediment load can reduce light penetration and reduce the photosynthetic activity of zooxanthellae. The problem of sedimentation of coral reefs has been increased by the removal of mangrove and seagrass communities that naturally filter out sediments.

Destructive Fishing Practices

Many fishing practices harm the reef by physically damaging the reef or by killing non-targeted reef fish or other reef organisms. Blast fishing, a method of fishing in parts of the Caribbean, East Africa, and Southeast Asia, uses underwater explosions to damage the swim bladders of fish so that they float to the surface where they are easily captured. The blast of the explosions destroys coral and flattens the reef structure. In some places fishermen use cyanide to stun fish so that they can be captured alive. Small fish and coral polyps may be killed by the cyanide. A style of fishing called *muro-ami* involves scaring fish into a net by pounding on the reef with sticks or other heavy objects that severely damage the coral reef.



Dynamite fishing. (Source: ATN)



Unsustainable Fishing

In 1950 no fisheries were reported as being overexploited whereas by 1996 35% of fisheries were reporting overexploitation and an additional 25% were reported as being near overexploited. Overfishing can have a variety of negative effects on the environment. Overfishing can reduce genetic variation in a population making it harder for species to adapt to environmental change and mate. In addition, overfishing can alter trophic interactions and cause unexpected indirect effects on the environment. For example, in areas where predators have been removed increases in population size of their prey have resulted in unintended effect on the environment.

Global Change

Global Warming and Coral Bleaching

Proposed increases in ocean temperatures caused by global warming could increase the rate and extent of coral bleaching. Rates of coral bleaching have increased since 1979.

Increased Atmospheric Carbon Dioxide Content

The amount of carbon dioxide in the air has increased by over one-third over the last 50 years due to the burning of fossil fuels. Increasing the amount of carbon dioxide that dissolves into the water lowers pH and appears to be dissolving the skeletons of corals. Thus, corals may form weaker skeletons, making them more susceptible to damage from storms, waves, etc.

Indirect Ecological Effects

A species may affect another species directly by eating them or by serving as food. In addition, species may affect each other indirectly. For example, removing a predator might harm the competitor of a prey species because fewer predators results in a larger population size of its prey which can in turn decrease the population size of its competitor.

Loss of Herbivores



Long spined urchins (*Diadema antillarum*) grazing.
(Source: USGS)

Because of their much higher growth rates, algae should be superior competitors to corals. Thus, the presence of herbivores should be very important in allowing corals to exist. The importance of herbivory in allowing the co-existence of coral and algal species has been well demonstrated by examining what happens when herbivores are removed.

In 1983-1984 populations of the long-spined urchin (*Diadema antillarum*) were decimated by the attack of some unknown pathogen. The sequence of infection suggested that the mortality was caused by a pathogen that entered the Caribbean through the Panama Canal. Mortality was so severe that in some locations populations decreased to less than 2% of their normal

size. Over twenty years later, populations have still not recovered in some parts of the Caribbean. The fact that algal cover increased and coral cover decreased when the *Diadema* were removed and that algal cover has decreased and coral cover has increased in areas where *Diadema* has recovered suggests that herbivory by the urchin allows coexistence between the algae and corals.

Herbivore populations may also be reduced by overfishing. For example, in Jamaica, high population pressures have led to the overfishing of herbivorous fishes which has caused the cover of corals to decrease from 50-60% in the 1970s to less than 10% today.

Further Reading

- Reefs at risk, UN Atlas of the Oceans.
- Threats to Coral Reefs, CORAL.
- Threats to Coral Reefs, WWF.

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