

**- Congressional Policy Brief -**  
**Coral Reefs: For Health, For Wealth, For Life**

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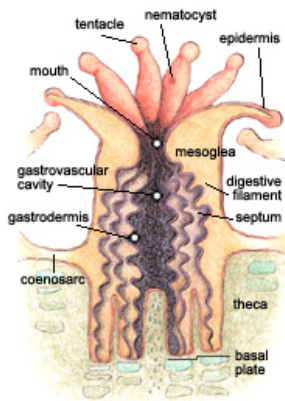
*“The International Coral Reef Initiative has designated this year as IYOR 2008, or the International Year of the Reef. IYOR 2008 is a worldwide campaign to raise awareness about the value and importance of coral reefs, threats to their sustainability, and to motivate people to take action to protect them. In the United States, IYOR 2008 activities are being coordinated through NOAA and the U.S. Coral Reef Task Force. NOAA, on behalf of the Department of Commerce, is honored to serve as Co-Chair of the U.S. Coral Reef Task Force, along with the Department of the Interior. The Task Force serves as an important forum for bringing the resources and expertise of the federal agencies together, working with our state and territory partners to conserve and better understand our nation’s valuable coral reef ecosystems.”*

- *Tim Keeney*  
 Deputy Assistant Secretary for Oceans and Atmosphere, NOAA  
 and U.S. Coral Reef Task Force Co-Chair

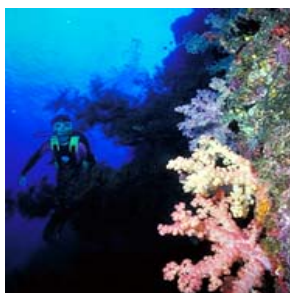
The information contained in this brief is summarized from NOAA’s Coral Reef Information System, or CoRIS.  
<http://www.coris.noaa.gov/>

**Introduction**

Healthy coral reefs are among the most biologically diverse and economically valuable ecosystems on earth, providing food, jobs, recreational opportunities, coastal protection, and other important services. Unfortunately, increasing human effects, climate change, and other factors have damaged many of the world’s coral reefs. According to the Global Coral Reef Monitoring Network’s *Status of Coral Reefs of the World: 2004*, 70 percent of the world’s coral reefs are threatened, and 20 percent of those are damaged beyond repair. The decline and loss of coral reefs have significant social, economic, and ecological effects on people and communities in the United States and around the world.



Structure of a typical coral polyp.



**What are Corals and Coral Reefs?**

Appearing as solitary forms in the fossil record more than 400 million years ago, corals are extremely ancient animals that evolved into modern reef-building forms over the last 25 million years. Coral reefs are unique (e.g., the largest structures on earth of biological origin) and complex systems. Rivaling old growth forests in longevity of their ecological communities, well-developed reefs reflect thousands of years of history (Turgeon and Asch, in press).

Corals are anthozoans, the largest class of organisms within the phylum Cnidaria. Comprising over 6,000 known species, anthozoans also include sea fans, sea pansies and anemones. Stony corals (scleractinians) make up the largest order of anthozoans, and are the group primarily responsible for laying the foundations of, and building up, reef structures. For the most part, scleractinians are colonial organisms composed of hundreds to hundreds of thousands of individuals, called polyps (Barnes, R.D., 1987; Lalli and Parsons, 1995).

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## Coral Reef Biology

Thousands of corals species exist worldwide. Stony (hermatypic) corals are the best recognized because of their elaborate and colorful formations. One trait of stony corals is their capacity to build reef structures that range from tens, to thousands of meters across. As they grow, reefs provide structural habitats for hundreds to thousands of different vertebrate and invertebrate species.

Although corals are found throughout the world, reef-building corals are confined to waters that exhibit a narrow band of characteristics. The water must be warm, clear, and saline. These waters are almost always nutrient-poor as well. Physiologically and behaviorally, corals have evolved to take advantage of this unique environment and thrive.

Not only are reef-building corals confined by a specific range of environmental conditions, but as adults, almost all of them are sessile. This means that for their entire lives, they remain on the same spot of the sea floor. Thus, reef-building corals have developed reproductive, feeding, and social behaviors that allow them to gain the maximum survival benefit from their situation.



A wide variety of corals in this small view is evidence of a healthy coral reef.

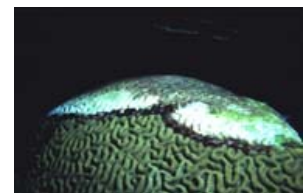


Major coral reef sites are seen as red dots on this world map. Most of the reefs, with a few exceptions are found in tropical and semitropical waters, between 30° north and 30° south latitudes.

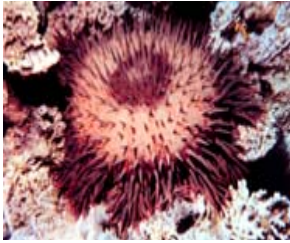
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## Hazards to Coral Reefs

Coral reefs face numerous hazards and threats. As human populations and coastal pressures increase, reef resources are more heavily exploited, and many coral habitats continue to decline. Current estimates note that 10 percent of all coral reefs are degraded beyond recovery. Thirty percent are in critical condition and may die within 10 to 20 years. Experts predict that if current pressures are allowed to continue unabated, 60 percent of the world's coral reefs may die completely by 2050 (CRTF, 2000). Most scientists believe reef degradation occurs in response to both natural and anthropogenic (human-caused) stresses. Reefs are now, and always have been, vulnerable to destructive natural events. In fact, weather-related damage occurs frequently. The large, powerful waves that accompany hurricanes and cyclones can break apart or flatten large coral heads and scatter fragments (Barnes & Hughes, 1999; Jones & Endean, 1976).



Corals weakened by a combination of natural and anthropogenic stresses may be unable to recover from disease outbreaks.



The crown-of-thorns sea star (*A. planci*) consumes and ingests corals' soft tissues as it slowly crawls over the reef. In high concentrations, these organisms can quickly decimate a reef system, leaving it a barren wasteland.



Damage caused by a single feeding parrotfish. The polyps have been killed and eaten, and the underlying skeleton is exposed. The polyps adjacent to the exposed skeleton are vulnerable to algal colonization.

Following destructive natural events such as hurricanes, cyclones or disease outbreaks, reefs can be damaged or weakened, but healthy ones generally are resilient and eventually recover. In many cases, however, natural disturbances are exacerbated by anthropogenic stresses, such as pollution, sedimentation and overfishing, which can further weaken coral systems and compromise their ability to recover from disturbances. Conversely, a reef directly or indirectly affected by anthropogenic stresses may be too weak to withstand a natural event. In addition, many scientists believe that human activities intensify natural disturbances, subjecting coral reefs to stronger, more frequent storms, disease outbreaks and other natural events.

Natural phenomena, such as the El Niño weather pattern, can have lasting, and sometimes devastating, effects on coral reefs. During an El Niño season, easterly trade winds weaken, which depresses normal oceanic upwelling processes and affects the climate. Rainfall increases along the eastern Pacific, while Indonesia and Australia experience drought conditions. El Niño can lead to increased sea-surface temperatures, decreased sea level, and altered salinity due to excessive rainfall (Forrester, 1997). During the 1997-1998 El Niño season, extensive and severe coral reef bleaching occurred, especially in the Indo-Pacific region, and the Caribbean. Approximately 70 to 80 percent of all shallow-water corals were killed on many Indo-Pacific reefs (NMFS, 2001). In 2005, coral reefs in the wider Caribbean suffered a widespread and severe bleaching event, which resulted in extensive coral death in much of the region. Persistent elevated sea surface temperatures caused this bleaching event, resulting in severe stress to coral communities, many of which were later killed by disease.

Corals are also vulnerable to predation. Numerous species, including parrotfish, polychaetes, barnacles, crabs and gastropods, prey on coral polyps, destroying the substrate in the process and preventing other corals from settling (Jones & Endean, 1976). Recent outbreaks of one predator, the crown-of-thorns starfish (*Acanthaster planci*), devastated reef systems in Guam, along Australia's Great Barrier Reef and others.

## Major Reef-Building Coral Diseases

Coral diseases and syndromes generally occur in response to biotic stresses such as bacteria, fungi and viruses, and/or abiotic stresses such as increased sea water temperatures, ultraviolet radiation, sedimentation and pollutants. One type of stress may exacerbate the other (Santavy and Peters, 1997).

The frequency of coral diseases appears to have increased significantly over the last 10 years, causing widespread mortality among reef-building corals. Many scientists believe the increase is related to deteriorating water quality associated with anthropogenic pollutants and increased sea surface temperatures. This may, in turn, allow for the proliferation and colonization of disease-causing microbes. However, exact causes for most coral diseases remain elusive.



Sea fan with red band disease. Photo: A. Bruckner

The onset of most diseases likely is a response to multiple factors (Peters, 1997). The most prevalent coral diseases and syndromes currently known and under study include black-band disease, coral bleaching, dark-spots disease, red-band disease, white-band disease, white-plague disease, white pox and yellow-blotch disease. Additional information on these, and other diseases, can be found on NOAA's [Coral Disease Identification and Information](#) website.

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## Coral Bleaching

Healthy tissue of most stony corals ranges from yellow to brownish in color, a function of the photosynthetic pigments of their symbiotic zooxanthellae. When corals are inordinately stressed, they often expel their zooxanthellae, or the concentration of photosynthetic pigments declines. This response is known as bleaching (Glynn, 1996).

During a bleaching event, a coral's coloration disappears or becomes pale, and the white of the coral skeleton shows through the translucent coral tissue. In some species, such as the massive starlet coral *Siderastrea sidereal*, the tissue can appear pinkish or bluish, due to pigments within the animal tissue. Localized bleaching has been observed since at least the beginning of the 20th century. However, beginning in the 1980s, regional and global bleaching affecting numerous species has occurred on reefs worldwide. To learn more about coral bleaching and other coral issues, please visit NOAA's Coral Reef Information System, or CoRIS, <http://www.coris.noaa.gov/>.



Coral bleaching.  
Photo: A. Bruckner

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## Resource Links

To learn more about coral reefs, and their importance to the United States as vital ecosystems, please visit:

- NOAA's Coral Reef Information Service (CoRIS) – <http://coris.noaa.gov>
- NOAA's Coral Reef Conservation Program – <http://coralreef.noaa.gov>
- The United States Coral Reef Task Force – <http://www.coralreef.gov>
- International Coral Reef Initiative – <http://www.icriforum.org>
- International Year of the Reef 2008 – <http://www.iyor.org>

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