

## Coral Colonies

From a distance, corals appear to be one organism. When we take a closer look however, we see that corals are colonies of tiny organisms called polyps. The polyps make up the coral colonies, and many corals make up structures called reefs.

The polyp lives in a pit or hole inside the coral skeleton that it builds. This skeleton is composed of calcium carbonate ( $\text{CaCO}_3$ ) crystals that are secreted by the lower half of the polyp. The live tissue lies entirely along the surface of the skeleton. As long as the colony is alive, it deposits calcium carbonate beneath its living tissues. The live tissue lies entirely at the upper edge of the skeleton, covering it with a network of interconnected polyps.

As a polyp grows outward it leaves behind a skeleton made of calcium carbonate. This process forms the skeleton of corals, which forms the structure of the reef.

Reef-building corals contain algae called zooxanthellae that live within the tissues of the coral polyps, supplying food and oxygen through photosynthesis. These algae give living corals their vibrant color.

The NOAA Coral Information System (CoRIS) reports that coral diseases have been on the rise over the last 10 years, causing widespread deaths among reef-building corals. Many scientists believe the increase is related to low water quality associated with pollution and increased ocean temperatures. This may, in turn, encourage the spread of disease-causing microbes.

See <http://www.coris.noaa.gov> for more.

## Web Resources

### NOAA

Coral Reef Information System (CoRIS)- <http://www.coris.noaa.gov>

### NOAA's Paleoclimatology Program

What can corals tell us about climate?-

<http://www.ngdc.noaa.gov/paleo/outreach/coral>

Coral and Sclerosponge Data-

<http://www.ngdc.noaa.gov/paleo/corals.html>

### National Oceanographic Data Center

Coral Reefs and Associated Ecosystems-

<http://www.nodc.noaa.gov/col/projects/coral/Coralhome.html>

NOAA Research: Coral Health & Monitoring Program-

<http://coral.aoml.noaa.gov>

### Other Coral Resources

ReefBase- <http://www.reefbase.org>

Reef Relief- <http://www.reefrelief.org>

Reef Check- <http://www.reefcheck.org>

Global Coral Reef Monitoring Network-

<http://www.coral.noaa.gov/gcrmn>

Handout produced in September, 2002 by Mark McCaffrey of the NOAA Paleoclimatology Program

## Coral Reef Biology

Based on text from "About Coral Reefs" on the [www.coris.noaa.gov](http://www.coris.noaa.gov) web site.

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 ability 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 ocean waters that exhibit certain characteristics. The water must be warm and clear, and are almost always low in nutrients. Physiologically and behaviorally, corals have evolved to thrive in this unique environment.

## Corals and El Niño

El Niño is a climatic event that significantly transforms the weather in the Pacific Ocean. The average occurrence is every 3-7 years and it lasts for an average of 1-2 years. During El Niño parts of the Pacific ocean are much warmer than in other years, causing dramatically different regional climate patterns.

The stress due to warmer than normal ocean temperatures can cause some of the coral polyps to bleach. Although bleaching after El Niño is normal, the amount of coral bleaching occurring seems to be on the rise, and El Niño events appear now to be affecting areas that have not been affected in the recent past.

Scientists can detect the past occurrences of El Niño by looking at the past sea-surface changes in corals. El Niño affects the growth and chemistry of the coral bands, and analysis of the annual bands reveals information about the frequency and duration of past El Niños.

## Paleoclimatology at NOAA

NOAA and its various labs and affiliates serve the nation by observing changes in climate and the environment, and by providing estimates of future change. Coral reefs are one of the sources of information on the large climatic changes (temperature, drought, and the hydrologic cycle) that have occurred over decades to thousands of years. The information obtained from these natural recorders of earth history play an essential role in helping societies understand and live with our changing environment.



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# CORAL REEFS

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## Fragile Treasures of Climate Clues & Biodiversity

Coral reefs are the largest structures on earth of biological origin, rivaling old growth forests in the longevity of their ecological communities. There are thousands of corals species including the stony corals which are the "reef builders" renown for their elaborate and colorful formations.

Coral reefs are the homes and nurseries for almost a million species of plants, animals, bacteria and other organisms, including many that we rely on for food. Reefs also provide important protection for coastal communities from storms, wave damage and erosion.

Well-developed reefs can reflect thousands of years of history.



### Collecting Coral Cores

Like trees, many corals deposit a new ring or band of growth each year. A core is taken from the top to the bottom of the coral in order to capture a sample of as many bands as possible. While drilling does kill the tissue living on the core surface, it does little damage to the colony as a whole.



### Coral Bleaching

Coral reefs are one of the most diverse habitats in the world, but these sensitive ecosystems can easily be destroyed. One dramatic sign that a coral is living under stressful conditions is coral bleaching. The process does not involve bleach and occurs when resident algae are forced out of the living coral, which are actually animals known as polyps. Corals can bleach when they encounter water that is unusually hot or cold, when they are exposed above the sea surface for too long, or when they encounter waters that are clouded with silt or pollution.

Some scientists predict that as much as 20% of the reefs around the world will collapse within 10-20 years. The reefs at greatest risk are those in Southeast Asia, East Africa, and the Caribbean.



### Analyzing Coral Data

Cores taken from certain types of corals allow scientists to analyze information they contain in their annual bands. Some scientists study the growth rates of the annual bands while others study their chemicals which reveal past changes in temperature of the sea surface. Changes in evaporation and precipitation over the ocean are also preserved in the chemical make-up of the coral bands.

To the right is an x-ray showing just over 50 years of a coral core (*Porites lutea*) collected in Malindi Marine Park, Kenya by Dr. Robert Dunbar. Below is a reconstruction of sea surface temperature (SST) between 1726 and 1997 AD by Brad Linsley and colleagues from Rarotonga in the eastern Pacific.

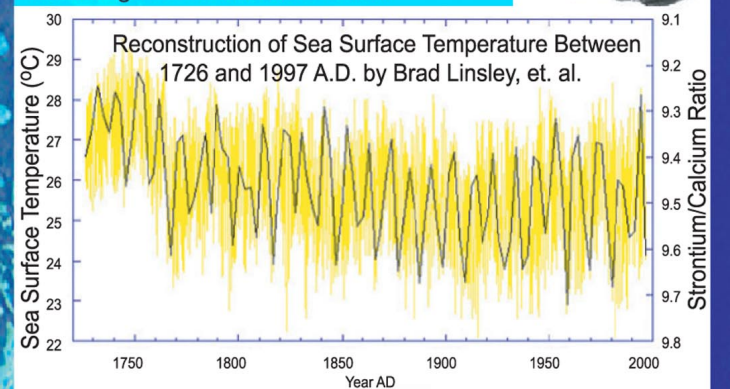
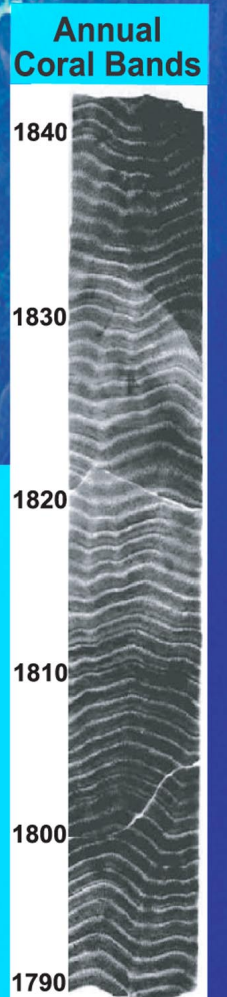


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