



Coral Reefs

Coral reefs are important marine ecosystems that are found in clear, shallow, tropical waters around the world. They provide habitat for diverse communities of marine animals and plants. Coral reefs consist of individual animals called coral polyps and their hard exoskeletons. These small animals have soft, cylindrical bodies and a ring of tentacles surrounding a mouth. The coral polyp is a member of the phylum *Cnidaria*, which also includes anemones, jellies, sea whips, sea fans and siphonophores. All members of this phylum, including coral, have tentacles which they use to catch prey. The tentacles are covered with stinging cells called nematocysts, which can stun or even kill small animals called zooplankton that drift too close to the coral. After the zooplankton have been stung, the tentacles direct them toward the central mouth where they are digested.

Since coral polyps are soft-bodied animals, the bulk of a coral reef ecosystem comes from the hard exoskeleton polyps create around themselves. The exoskeleton is composed of calcium carbonate (CaCO_3) found in sea water, and provides protection for polyps. Since polyps occur in groups called colonies, coral reefs consist of a colony's collective calcium carbonate exoskeleton in addition to the living polyps.

Coral reefs exist where all the environmental factors necessary for coral growth coincide. The major areas of reef development are in the Caribbean and the Indo-Pacific regions. The largest reef in the world, the Great Barrier Reef, is located off the east coast of Australia and spans 1,200 miles.

WHERE DO REEFS GROW?

Reef-building corals have very specific requirements for growth that limit their distribution. The water must be clear, shallow and warm, with an optimum temperature of 24 degrees Celsius (75 degrees Fahrenheit). This temperature requirement generally limits coral growth to tropical areas. Coral reefs tend to occur along the eastern margins of continents where warm water from the equator arrives with the currents. Consequently, coral reefs form off the coast of Florida, but not off the coast of California, where the water is much colder.

However, not all water along tropical coastlines is suitable for coral reefs. Other environmental factors, such as the amount of salt in the water, or salinity, can limit coral growth. Corals require a salinity of at least 25 parts per thousand (ppt) and do best in full sea water (35 ppt). Areas with high freshwater runoff, like the mouth of the Amazon River, lack coral reefs because the salinity is too low.



KEY TERMS

Coral Bleaching

Occurs when poor water quality kills coral, leaving behind a colorless skeleton.

Polyp

A soft animal resembling an anemone that creates a hard exoskeleton around itself.

Zooxanthellae

Single-celled, golden-brown algae that live in the tissues of a variety of organisms, including hard and soft corals. Provide the host with energy from photosynthesis.

FAST FACTS

- Coral reefs only take up 0.7 percent of the ocean floor, but they provide important habitat for 25 percent of all marine species on the planet.
- Coral reefs grow less than one centimeter per year.
- Coral reefs are the most diverse ecosystems on earth, containing 30 of the 34 known phyla.

CORAL REEF ECOSYSTEM

In addition to corals, many other animals feed, hide and rest in the complex reef habitat. Sponges in brilliant colors grow as both encrusting patches and as freestanding shapes, including vase and basket sponges. Some mollusks live on the corals themselves, but many more live in the sandy areas and grass beds around the reef. Arthropods such as crabs, shrimp and spiny lobsters hide in many nooks and crannies of the reef.

Fish are the most prominent animals of the reef. They exhibit a variety of colors and fascinating ways of living. Many of them have seemingly strange body designs and social behaviors. These specializations provide efficient means of feeding, schooling and protection for a variety of fish, and enable all areas of the reef to be used as feeding, resting or hiding places during the day and night.

CORAL REEF FISH

The rock-hard skeletons of coral do not protect them from all of the fish that inhabit the reef. Parrotfish have a special adaptation, consisting of a bony “beak” with teeth that are fused together into upper and lower plates. This allows these fish to graze on algae that grow on dead coral—as well as zooxanthellae in live coral—by crunching pieces of the hard coral to

get to the attached vegetable matter. The coral bits are then ground in a bony mill in the throat and returned to the sediment in fine-grained form. This feeding strategy of parrotfish creates much of the coral-derived “sand” in and about the reefs. In fact, one parrotfish can make up to a ton of this coral sand per year.

Since a coral reef houses so many different kinds of fish and invertebrate species, encounters between individual animals are common. Interactions between fish of different species are often observed in the reef habitat. One example of this is a cleaning station. Smaller animals may appear to be “picking” or “biting” a larger one, with the “victim” doing nothing to defend itself. This is actually cleaning behavior; the smaller fish is removing parasites, debris or infected tissue from the skin of the larger fish. The cleaner lives in a semi-permanent territory called a “cleaning station,” which other fish recognize. Both parties benefit from this relationship: the larger fish gets rid of an irritant, and the cleaner gets a meal without being harmed. Cleaners include small fish such as gobies, cleaner wrasses and young porkfish, as well as many of the shrimp that live in surrounding sponges, anemones and crevices.

Unique defense adaptations are also a very important feature among fish species living in coral reefs. For example, the four-eye butterfly fish are thought to use fake eyespots to direct enemies to the wrong end of the fish (the tail).

CORAL REEF CONSERVATION

While the coral reef is one of the most complex and diverse environments in the world, it is also one of the most delicate. Changes to the clarity, temperature or salinity of the water can cause corals to die, or bleach. Coral bleaching refers to the evacuation of zooxanthellae, the color-producing organism in coral reefs, when conditions become less than ideal. When zooxanthellae evacuate, coral polyps die, which leaves the white calcium carbonate exoskeleton behind. Without zooxanthellae and polyps, coral reef ecosystems cannot function properly. Though you may not live in a tropical area, there are still things that you can do to protect coral reefs. To prevent sedimentation, which keeps sunlight from reaching zooxanthellae, you can plant trees. Tree roots not only anchor trees to the ground, they keep soil in place so runoff does not carry it into waterways, and eventually the ocean. You can also limit sedimentation by slowing down the flow of rainwater, which will result in less dirt and silt being washed into waterways. This can be accomplished by installing a rain barrel to collect water as it flows off your roof via rain gutters. Gravel driveways also impede the flow of water before it exits your property.

Another cause of coral bleaching is algae blooms, which often result from fertilizer and excess nutrients entering tropical waters. Similar to sedimentation, algae blooms block sunlight, which starves zooxanthellae and results in coral bleaching. You can minimize fertilizer runoff by using little to no fertilizer on your lawn.





Of course “reduce, reuse, recycle” is another important conservation concept for the world’s oceans and coral reefs. You can reduce the amount of water used in your home by turning faucets off when not in use and taking shorter showers instead of baths. Reducing the amount of water we use means that less water has to be treated in sewage treatment plants or in septic systems. Also, you will conserve energy by reducing the amount of water that needs to be pumped. Conserving energy reduces the load on fossil fuel plants, thereby reducing the pollution they produce, which is beneficial to coral reefs.

Physical destruction by anchors and human contact are other dangers facing coral reefs. Boats that drop anchor in coral reefs can destroy decades of coral growth in an instant. Careless divers can achieve the same destruction by touching or removing pieces of coral reefs. You can prevent this destruction by anchoring your boat to a floating buoy instead of the ocean floor. If you visit a coral reef, be careful not to step on or touch coral, as any physical contact damages the fragile polyps. Instead, use your eyes and an underwater camera to observe and remember your visit.

For more information about the importance of protecting coral reefs, be sure to visit the *Atlantic Coral Reef*, the Level 3 *Occupying* exhibit, and the Level 4 *Pacific Reef* exhibit. Remember, even though you may not live in a tropical area, you can still help protect coral reef ecosystems, so be sure to ask your family, friends and neighbors to do their part in helping the coral reefs!



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