

About Coral Reefs

What is a coral reef?

Coral reefs are massive structures made of limestone that is deposited by living things. Although thousands of species inhabit coral reefs, only a fraction produce the limestone that builds the reef. The most important reef building organisms are corals.

Coral reefs support over twenty-five percent of all known marine species. As one of the most complex ecosystems on the planet, coral reefs are home to over 4,000 different species of fish, 700 species of coral and thousands of other plants and animals.

A good way to imagine a coral reef is to think of it as a bustling city or community, with the buildings made of coral, and thousands of inhabitants coming and going, carrying out their business. In this sense, a coral reef is like a metropolis under the sea.

What is coral?

Although coral is often mistaken for a rock or a plant, it is actually composed of tiny, fragile animals called coral polyps. When we say "coral" we are actually referring to these animals and the skeletons they leave behind after they die. Although there are hundreds of different species of corals, they are generally classified as either "hard coral" or "soft coral".

Hard corals grow in colonies and are the architects of coral reefs. They include such species as brain coral and elkhorn coral. Their skeletons are made out of calcium carbonate (also known as limestone) which hard and eventually becomes rock. Hard corals are hermatypes or reef-building corals and need tiny algae called zooxanthellae (pronounced zo-zan-THEL-ee) to survive. Generally, when we talk about "coral" we are referring to hard corals.

Soft corals such as sea fingers and sea whips, are soft and bendable and often resemble plants or trees. These corals do not have stony skeletons, but instead grow wood-like cores for support and fleshy rinds for protection. They are referred to as ahermatypes or non-reef building corals and they do not always have zooxanthellae. Soft corals are found in both tropical seas and in cool, dark regions.

What is a coral polyp?

A coral polyp is a spineless coral animal. Coral polyps can be the size of a pinhead while others are larger, sometimes a foot in diameter. One coral branch or mound is covered by thousands of these animals. They are invertebrates (spineless animals) and are cousins of anemones and jellyfish. When thousands of these animals are grouped together, they are referred to as coral colonies. Each coral "tree" or "mound" is one colony of coral polyps. A polyp has a sac-like body and an opening or mouth encircled by stinging tentacles called cnidae. The polyp uses calcium carbonate from seawater to build itself a hard, cup-shaped skeleton. This limestone skeleton protects the soft, delicate body of the polyp. Coral polyps are usually nocturnal, meaning that they stay inside their skeletons during the day. At night polyps extend their tentacles out to feed.

Where do corals live?

Coral reefs are found in over 100 countries. Most reefs are located between the tropics of Cancer and Capricorn, in places such as the Pacific Ocean, the Indian Ocean, the Caribbean, the Red Sea and the Arabian Gulf. Corals are also found farther from the equator in places where warm currents flow out of the tropics, such as Florida and southern Japan. Worldwide, coral reefs cover an estimated 284,300 square kilometers (110,000 square miles).

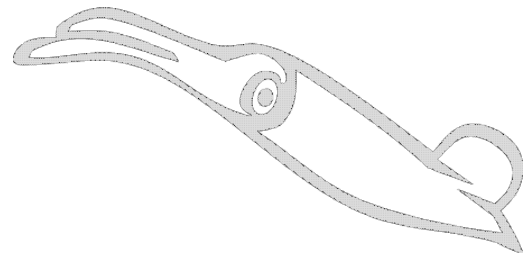
Coral reefs grow best in waters with a temperature of between 21 and 29 degrees Celsius (70 and 85 degrees Fahrenheit). It is possible for soft corals to grow in hotter and colder places, but growth rates under these conditions are very slow. Corals prefer clear and shallow waters, where lots of sunlight filters through to their symbiotic algae. It is possible to find corals at depths of up to 91 meters (300 feet), but reef-building corals grow poorly below 18-27 meters (60 to 90 feet). Corals also grow poorly near river openings or coastal areas with excessive run-off, because corals need salt water to survive.

How old are coral reefs?

The geological record indicates that the ancestors of modern coral reef ecosystems were formed at least 350 million years ago. The coral reefs existing today began growing as early as 50 million years ago. Most established coral reefs are between 5,000 and 10,000 years old. Although size sometimes indicates the age of a coral reef, this is not always true. Different species of coral grow at different rates, depending on water temperature, oxygen level, amount of turbulence, and availability of food.

How is a coral reef constructed?

Coral reefs are complex, multi-story structures with holes and crevices shared by various creatures. If a coral reef can be thought of as a metropolis of the sea, then a coral colony can be thought of as an apartment building with many different rooms and hallways that house different marine species. Not all coral species build reefs. The actual architects of coral reefs are hard or stony corals, which are referred to as hermatypic or reef-building corals. As the polyps of stony corals grow, they produce limestone for their skeletons. When they die, their skeletons are left behind and are used as foundations for new polyps, which build new skeletons over the old ones. An actual coral mound or tree is composed of layer upon layer of skeletons covered by a thin layer of living polyps.



Other types of animals and plants also contribute to the structure of the reef. Many types of algae, seaweed, sponge, sediment and even mollusks like giant clams and oysters, add to the architecture of a coral reef. When these organisms die, they also serve as foundations for new corals.

How long does it take for coral to grow?

Corals grow at different rates, depending on water temperature, salinity, turbulence, and the availability of food. The massive corals are the slowest growing species, adding between 5 and 25 millimeters (.2 inches to an 1 inch) per year to their length. Branching and Staghorn corals can grow much faster, adding as much as 20 centimeters (8 inches) to their branches each year.

How do corals get their shape?

The variety of shapes and sizes of coral colonies largely depends on their species. Some form hard, pointed shapes, while others form soft, rounded shapes. The shape of coral colonies also depends on the location of the coral. For example, where there are strong waves corals tend to grow into robust mounds or flattened shapes. In more sheltered areas the same species may grow in more intricate shapes such as delicate branching patterns.

How do coral polyps eat?

Coral polyps eat in two different ways, depending on their species. Many coral polyps are nourished in a unique way by a tiny algae called zooxanthellae (pronounced zo-zan-THEL-ee). The algae live within coral polyps, using sunlight to make sugar for energy, just like plants. Zooxanthellae process the polyp's wastes to retain important nutrients and in turn provide the polyp with oxygen. Meanwhile, the coral polyps provide the algae with carbon dioxide and a safe, protected home. Zooxanthellae living within the tissue of hard corals can supply them with up to 98 percent of their nutritional needs.

Another way that corals eat is by catching tiny floating animals known as zooplankton. At night the polyps come out of their skeletons to feed, making the reef look like a "wall of mouths". The polyps stretch out their long, stinging tentacles to capture the zooplankton that are floating by. The captured plankton are then put into the polyps' mouths and digested in their stomachs.

How do corals get their color?

Most coral polyps have clear bodies and their skeletons are white, like human bones. Most corals get their color from the zooxanthellae inside them. Several million zooxanthellae live in just one square inch of coral and produce pigments. These pigments are visible through the clear body of the polyp and give the coral its beautiful color.

How do corals reproduce?

Coral reproductive methods vary, depending on the species. Some species such as brain and star corals are hermaphrodites, meaning they produce both sperm and eggs at the same time. Other corals, such as Elkhorn and boulder corals, are gonochoric, meaning that they produce single-sex colonies. In these species, all of the polyps in one colony produce only sperm and all of the polyps in another colony produce only eggs.

Coral larvae are formed in two different ways. The larvae are either fertilized within the body of a polyp or outside the polyp's body in the water. Fertilization of an egg within the body of a coral polyp is achieved from sperm that is released through the mouth of another polyp. The sperm and egg merge and form a planula larvae, which matures inside the body of its mother. When the larva is ready, it is "spit" into the water through the mouth of its mother. Other species of coral reproduce by ejecting large quantities of eggs and sperm into the surrounding water. When this happens, the eggs and sperm fertilize in the water. This process is called coral spawning. In some areas, mass coral spawning events occur on one night a year and scientists can predict exactly when this will happen. Trillions of eggs and sperm are simultaneously released into the water in one of the most astounding acts of synchronicity in the natural world!

Once in the sea, larva are naturally attracted to the light. They swim to the surface of the ocean, where they remain for days or even weeks. If predators do not eat the larva during this time, they fall back to the ocean floor

and attach themselves to a hard surface. An attached planula metamorphasizes into a coral polyp and begins to grow and divide itself in half, making exact genetic copies of itself. As more and more polyps are added, a coral colony develops. Eventually the coral colony becomes mature, begins reproducing and the cycle of life continues!

What do corals need to survive?

- * *Sunlight:* Corals need to grow in shallow water where sunlight can reach them. Since corals depend on the zooxanthellae (algae) that grow inside of them and this algae needs sunlight to survive, corals too need sunlight to survive. Therefore, corals rarely develop deeper than 50 meters (165 feet).
- * *Clear Water:* Corals need clear water to survive and don't thrive well when the water is opaque. Sediment and plankton can cloud the water which decreases the amount of sunlight that reaches the zooxanthellae.
- * *Temperature:* Reef building corals require warm water conditions to survive. Different corals living in different regions can withstand different temperature fluctuations. However, corals generally live in water temperatures ranging from 20 to 32 degrees Celsius (68 to 90 degrees Fahrenheit).
- * *Clean Water:* Corals are sensitive to pollution and sediment. Sediment can settle on coral, blocking out sunlight and smothering coral polyps. Pollution from sewage and fertilizers increases nutrient levels in the water, harming corals. When there are too many nutrients in the water, the ecological balance of the coral community is altered.
- * *Saltwater:* Corals need saltwater to survive and require a certain balance in the ratio of salt to water. This is why corals don't live in areas where rivers drain fresh water into the ocean.

What are the different types of reefs?

Scientists generally divide coral reefs into four classes: fringing reefs, barrier reefs, atolls and patch reefs:

- * *Fringing reefs* grow near the coastline around islands and continents. They are separated from the shore by narrow, shallow lagoons. Fringing reefs are the most common type of reef that we see.
- * *Barrier reefs* also parallel the coastline but are separated by deeper, wider lagoons. At their shallowest point they can reach the water's surface forming a "barrier" to navigation. The Great Barrier Reef in Australia is the most famous example and is the largest barrier reef in the world.
- * *Atolls* are rings of coral that create protected lagoons and are usually located in the middle of the sea. Atolls usually form when islands surrounded by fringing reefs sink into the sea or the sea level rises around them (these islands are often the tops of underwater volcanoes). The fringing reefs continue to grow and eventually form circles with lagoons inside.
- * *Patch reefs* are small, isolated reefs that grow up from the open bottom of the island platform or continental shelf. They usually occur between fringing reefs and barrier reefs. They vary greatly in size, and they rarely reach the surface of the water.

