

Coral Reef Ecology: Coral Bleaching—Scientific Background

Coral reef ecosystems are known for their biodiversity, or variety of living things. Scientists consider biodiversity an important measure of ecosystem health and stability. Corals are tiny invertebrates that live in large groups; a single coral organism is called a polyp. Over time, the hard exoskeletons of some types of corals accumulate to form large reefs. The bright colors of a coral reef come from the photosynthetic algae living inside the corals in a type of symbiosis called mutualism, in which both species benefit from living together in a close relationship. Corals provide algae with a place to live, and algae provide energy for corals.



Other coral reef organisms featured in this Investigation include staghorn and boulder star corals, algae, sponges, hawksbill sea turtles, queen angelfish, stoplight parrotfish, yellowtail snapper, and Nassau grouper. Sponges are filter feeders that consume plankton suspended in the water. Hawksbill sea turtles are large turtles that feed primarily on sponges. Groupers are large predatory fish that feed on many reef fish, including snappers, angelfish, and parrotfish. Snappers eat smaller fish, shrimp, crabs, and worms. Queen angelfish mainly eat sponges, while stoplight parrotfish and long-spine sea urchins feed on algae.

Biotic factors are the living things in an ecosystem—like fish, coral, algae, plants, and sponges. Predators and prey are biotic factors. Abiotic factors are the nonliving parts of an ecosystem—like sunlight, water, air, nutrients, sand, temperature, storms, and other environmental conditions. Corals are affected by many environmental factors, including ocean temperature, pH, and storm damage. The pH scale ranges from 0 to 14 and measures how acidic or alkaline (basic) a substance is. Lower numbers indicate a strong acid, while higher numbers indicate a strong base. A pH of 7 indicates a substance that is neutral (neither an acid nor a base). Pure water has a pH of 7. Historically, ocean water has had a slightly basic pH, around 8.2 on the pH scale. It has become more acidic as the ocean absorbs carbon dioxide from the atmosphere. Global warming has increased ocean temperatures and storm severity. Warmer water and other environmental stresses can cause corals to bleach, or expel their symbiotic algae. Bleached corals appear white and cannot survive long without their main food source.

Warmer waters and nutrient pollution from runoff and sewage overflows lead to algae blooms, when algae populations suddenly overgrow. The algae cover corals and block sunlight from reaching their symbiotic algae. Later, bacteria break down dead algae, using up dissolved oxygen in the process. Populations of corals, fish, and other organisms decrease because they cannot breathe.