Encyclopedia of Earth

Coral reef zonation

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Table of Contents

Different coral species and morphological types prefer different habitats within a reef ecosystem based on varying degrees of wave energy, temperature and light. Such distributional patterns of corals on reefs creates the zonation found on many coral reefs. These patterns of zonation are different depending on whether the reef is a fringing, atoll or barrier reef. However, there are some general patterns found on most reefs. A typical zonation pattern includes back reef or reef flat, reef crest or algal ridge, and seaward slope or fore-reef.

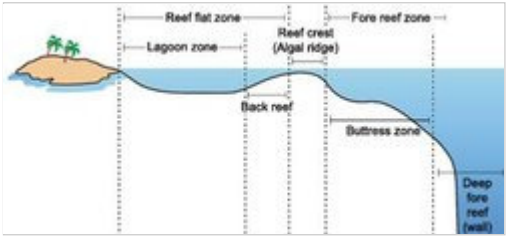

Photo credit: NOAA, CoRIS.

Reef Flat


Photo credit: Reef Relief image archive.

The back reef, also called the reef flat, is the zone found the closest to the shore. Reef flats are shallow water areas that extend from shore to the reef crest, which separates the reef flat from the seaward slope. The shallow water in this part of the reef creates an area with high light intensity and temperature, an environment at the edge of coral tolerance. The geomorphology of reef flats vary depending on location and reef type; they can range from meters to kilometers in width. They also vary in depth from a few centimeters to several meters deep. Due to the shallow depth of this zone, reef flats are often exposed during low tides. The reef exposure along with higher temperature and light intensity inhibits coral growth. Despite these stressors, the corals in this region are protected from the majority of the wave stress that is present on the reef crest.

Reef Crest

The reef crest is found farther away from the shore and is between the reef flat and the fore-reef. The reef crest, also called the algal ridge, is exposed at low tide, as it is the highest part of the reef. Subsequently, this is the area of the reef with the highest wave action and there is usually little coral found on in this zone. There are some corals that can survive on reef crests with less severe wave action, typically short branching corals that are able to withstand moderate to high wave action. Algae, a competitor for space with coral on reefs, are often dominant in this usually coral-free area, leading to the name algal ridge. Some of the algae found on the reef crest are encrusting red coralline algae and brown algae.

Photo credit: Reef Relief image archive.

Fore-Reef

The fore-reef, or the seaward slope, is the area of reef that is the farthest away from the shore. This is on the oceanic side of the reef crest and it slopes downward. The fore-reef is home to the largest corals on the reef, because it is the most hospitable environment with limited wave action. The corals are the most diverse on the reef slope between fifteen and twenty meters of depth, and as depth increases diversity of coral species richness generally decreases. The diversity of corals in this zone is correlated with light availability. As the light decreases with depth the number of corals also decreases.

Changes in Zonation

Coral reefs are threatened by many different factors including increased nutrients, sedimentation, land use, disease, sea-level rise and thermal stress. Climate change is one of the biggest threats to coral reefs, and can lead to changes in zonation. With climate change and increasing thermals stress events, the corals in shallow areas are especially at risk because they are already living at the edge of their tolerance range. In the Seychelles, coral mortality in reef flats and areas with shallow water was near 100% during the 1998 bleaching event. Reef flats in the Seychelles were dominated by staghorn corals and Porites. When these corals died there was an increase in water depth and wave energy reaching the shore. Loss of protection against wave energy is due to a decrease in complexity. As corals die and erode away, the surface of the reef becomes rubble which is less three dimensional than the live reef, making it less effective at dispersing wave action. This can cause increases in shoreline erosion, and greater impacts from storms.

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