Florida Department of Environmental Protection
Coral Reef Conservation Program

SEAFAN BleachWatch Program

Coral Bleaching Fact Sheet

Corals and Coral Bleaching

Corals are composed of animals called coral polyps (*see photo right)*, which secrete hard, limestone skeletons. A single coral colony is made up of numerous individual coral polyps. These polyps receive up to 90% of their energy requirements from microscopic algae known as zooxanthellae that live within their tissues and provides them with carbohydrates and oxygen through photosynthesis. While the density of zooxanthellae varies in individual species of corals, they are usually golden brown in color and responsible for much of the normal "healthy" coloration of coral. Stressed corals may lose or expel zooxanthellae, which leaves behind the transparent coral tissue and reveals the underlying white skeleton, giving the coral a bleached white appearance. This process is called coral bleaching.

Healthy polyp showing zooxanthellae (*Porites astreoides)*. Photo credit: Mote Marine Laboratory

Coral tissue without their symbiotic algae is nearly transparent, however there a few tricks that can help you see tissue. If you are confident in your buoyancy control, you can get close to the coral to look for live polyps. You can also try to look at a colony from an angle – this allows you to better see if the tissue is present or if any tentacles are extending from the polyps. You can also wave your hand (gently!) near the coral as the extra movement of water might prompt a reaction from the coral. As always, you should do your best to avoid any direct contact with the coral.

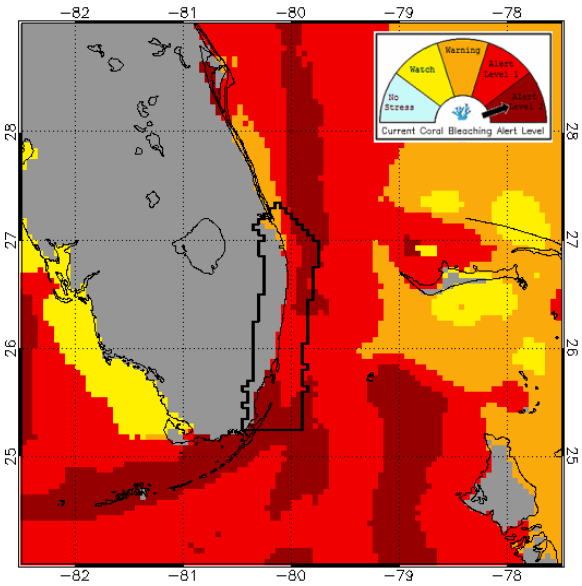
What Causes Coral Bleaching?

Bleaching is a stress response that results when the coral-algae relationship breaks down. Coral bleaching can be caused by a wide range of environmental stressors such as pollution, oil spills, increased sedimentation, extremes in sea temperatures and salinity, low oxygen, disease, and predation. Bleached corals are still living, and if the environmental conditions return to normal soon enough, the corals can regain or regrow their zooxanthellae and survive the bleaching event. If the stressors are severe or prolonged, however, bleaching can lead to the death of corals. Bleached corals are more susceptible to disease, predation, and death because they are without their primary energy source.

Comparison of healthy (left), paling (middle), and bleached (right) brain coral (*Colpophyllia natans).* Photo credit: Mote Marine Laboratory

Mass Bleaching and Recovery

Localized or colony-specific bleaching has been recorded for over 100 years, but only in the last 20 years have mass bleaching events been observed where a wide range of coral species bleach over a large area of reef. While the influence of local stressors can explain small scale bleaching events,



NOAA Coral Reef Watch Bleaching Alert Area for 9/14/2015 (http://coralreefwatch.noaa.gov).

widespread, mass bleaching is most commonly attributed to elevated sea temperatures in conjunction with increased ultraviolet radiation due to calm weather and clear skies. Because most corals live close to their maximum thermal limits, a temperature increase of only 1-2ºC above the long-term average can trigger mass bleaching, particularly when prolonged.

There have been several large-scale mass bleaching events over the last several decades. However, the most recent 2014-2016 El Niño event was by-far the worst and caused severe bleaching and mortality for reefs around the world. It is likely that both the severity and frequency of such events will increase in the future.

In situations where bleaching causes extensive coral death, recovery is dependent on new coral recruits settling and growing on the reef. This is a time-consuming process, even on relatively healthy reefs. Regrowth of reefs that have been severely damaged by bleaching may take decades and the new reef may be significantly different from what existed before bleaching. If a recovering reef is affected by another bleaching event or stress before it has fully recovered, then it may persist in a degraded state for much longer. In locations suffering from pollution or other chronic pressures, recovery can be particularly slow or inhibited altogether.

Are All Corals Affected the Same Way?

Not all corals are affected by bleaching in the same way. Different species and growth forms of corals have different susceptibilities to bleaching. Since all reef communities are composed of a different mix of corals, often some reefs are more badly affected than others. Also, levels of climate and environmental stress can vary among reefs, leading to differences in the amount of bleaching seen at different locations. This leads to many unanswered questions about mass bleaching and the resilience of different reef communities.

Branching species, such as Staghorn coral (*Acropora cervicornis*), are generally more susceptible to bleaching. Photo credit: Mark E. Brandenburg

Further Reading

- **NOAA's Coral Reef Information System (CoRIS)**
  http://www.coris.noaa.gov/about/welcome.html
- **Florida Keys National Marine Sanctuary**
  http://www.floridakeys.noaa.gov
- **NOAA's Coral Reef Conservation Program**
  http://www.coralreef.noaa.gov
- **Great Barrier Reef Marine Park Authority's Coral Bleaching Information**
  http://www.gbrmpa.gov.au
- **International Coral Reef Information Network**
  http://www.coral.org
- **NOAA's Coral Health and Monitoring Program**
  http://www.coral.noaa.gov/