



## **Coral Bleaching**

### **Carl Safina**

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Hard corals first appeared several hundred million years ago. That's a long time ago. But forms that could attach to each other and build reefs didn't evolve until around 25 million years ago. That's still a long time.

A coral reef is built of individual coral units called *polyps*. Corals are related to jellyfish, and a coral polyp is basically a tiny jellyfish that grows itself a hard case made of limestone. Immense numbers of polyps, cemented to each other, form a reef.

Reef-building corals live with single-celled food-making algae-like "dinoflagellates" existing inside them. Those internalized dinoflagellates give the corals their colors—usually beige, or light greenish, or even a bit blueish.

Vocabulary terms: Scientists call those coral-dwelling dinoflagellates "zooxanthellae." Coral aficionados call them zoox—pronounced "zokes"—for short. Many corals start life without zoox. One of the first things those baby corals need to do: get zoox.

Reef-building corals live in warm shallow seas (70° to 85° F; 21° to 29 °C), where water is clear enough to drench their internal zooxanthellae in sunlight. Like plants, the zoox use sunlight to manufacture sugars. Basically, the zoox are renters, paying the corals in sugar.

Zoox provide the coral with energy, but not with the nutrients like amino acids and other things the corals need for growth. For that, the coral polyp needs food. That's why it has those tentacles, stinging cells, and mouth. The corals' excreted waste (such as ammonia) becomes the fertilizer that the zoox need to grow. So zoox provide the corals with energy, and the corals provide them with food and shelter.

Growing many millennia, manufacturing limestone rock during that whole long span of time, some coral reefs have become ocean megalopolises stretching hundreds of miles. Just as a city includes some builders and many users, so, too, coral reefs. Like humans, corals create the structures that define the place.

When unusually hot weather drives seawater temperature abnormally high, the sugar-making zooxanthellae leave their coral polyps. What *about* the heat makes them do that isn't known exactly. Because zoox give corals their color, reefs without them turn porcelain white. This is called "coral bleaching."

If the water temperature gets back closer to normal in a few days, the zoox will go back inside the corals and the corals will survive. But prolonged bleaching

can starve corals. In fact, coral bleaching has already killed large swaths of reef in many regions of the world.

Coral bleaching was new in 1980. Now it's frequent. And it has already affected reefs wherever they grow, worldwide.

Coral bleaching is caused by warming. And the warming is caused by carbon dioxide. And the carbon dioxide is caused by us all, by burning things. Mainly by burning fossil fuels like oil, coal, and gas. Since the Industrial Revolution, the amount of carbon dioxide in the atmosphere has increased by about one-third—a gigantic change. Like insulation in the atmosphere, carbon dioxide traps heat.

About half the human-produced carbon dioxide has dissolved into the ocean. But we're producing it so fast, it's "backing up" near the ocean's surface. The North Atlantic is absorbing only half the CO<sub>2</sub> it did in the mid-1990s. That means more CO<sub>2</sub> is lingering in the air, warming it faster.

Even some of the more optimistic scenarios now project that, by 2080, "bleaching" will hit 80 to 100 percent of the world's tropical coral reefs every year. That would be the end of them. To outrun that, corals would have to continually adapt their temperature tolerance.

Noah Idechong, a robust Palauan fisherman and conservationist named by Time Magazine among its "Heroes of the Planet"—and now Speaker of Palau's House of Delegates, remembers one big coral bleaching incident in the late 1990s this way: "The wind stopped. Everything stopped. The water got so hot, it was actually uncomfortable to swim in. Even the oldest fishermen had never seen such a time. You can't imagine how sad it was, seeing all our reefs dying."

But now Palau's reefs are recovering. That's not the case in many other areas that have suffered coral bleaching. (One big difference: Palau doesn't allow export of its parrotfishes. But *that's* another story.)

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## References and Further Reading:

**The North Atlantic is absorbing:** Sabine, C. L. et al., 2004, "The Oceanic Sink For Anthropogenic CO<sub>2</sub>." *Science* 305: 367–71.

**Human reliance on reefs:** Cinner, J. E., et al., 2009, "Linking Social And Ecological Systems To Sustain Coral Reef Fisheries," *Current Biology* 19, 206–212, DOI 10.1016/j.cub.2008.11.055.

**See also:** Hoegh-Guldberg, O., 2005, "Low Coral Cover In A High-CO<sub>2</sub> World," *Journal of Geophysical Research* 110, C09S06, doi:10.1029/2004JC002528.

**Also:** Pandolfi et al., 2003, "Global Trajectories Of The Long-Term Decline Of Coral Reef Ecosystems," *Science* 301: 955-958.

**And also:** Donner, S. D., et al., 2005, "Global Assessment Of Coral Bleaching And Required Rates Of Adaptation Under Climate Change," *Global Change Biology* 11: 2251–65.

**Lack of resilience of stressed reefs to bleaching, see:** Carilli J. E. et al., 2009, "Local Stressors Reduce Coral Resilience To Bleaching," *PLoS ONE* 4: e6324, available online.

**More grazing fish mean less leafy algae:** Newman, M. J. H. et al., 2006, "Structure Of Caribbean Coral Reef Communities Across A Large Gradient Of Fish Biomass," *Ecology Letters* 9: 1216–1227.

**Calcification has declined 14.2%:** D'earth, G., et al., 2009, "Declining Coral Calcification On The Great Barrier Reef," *Science* 323: 116 – 119.

**Charlie Veron quoted in:** United Press International, 2009, "Scientists Say World's Coral Reefs Doomed," July 7.

**Ocean temperature warmest ever measured:** Borenstein, S., 2009, "World Sets Record For Ocean Temperature," *The Boston Globe*, Aug 20.



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