

Great Barrier Reef suffering worst-ever coral bleaching

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Researchers from Australia and the United States have reported that a 700-kilometer span of Australia's Great Barrier Reef has lost two-thirds of its shallow-water coral in the past nine months as a result of coral bleaching induced by global warming. This is the most severe episode of coral loss on the Great Barrier Reef on record, surpassing the events of 1998, 2002 and 2006. It will take at least ten years for the region to recover.

The current mass bleaching was caused by water temperatures approximately 1 degree Celsius above average from February to April (late summer and early fall in the Southern hemisphere), the result of climate change and assisted by a particularly strong El Niño. About half of the coral in the northern part of the reef is dead. Given that the reef lost more than half of its coral between 1985 and 2012, this latest episode threatens the continued existence of the Great Barrier Reef as a whole.

To check against this phenomenon happening randomly, the researchers generated thousands of different climate models, looking at the relationship between ocean temperature and human carbon emissions. While it is not impossible that this warming could have occurred without humans, the chance that this could have occurred naturally is just over a half of a percent. This agrees with three decades of study into the relationship between global warming and coral bleaching.

Like all coral reefs, the Great Barrier Reef is a series of complex organisms whose survival is largely based on the symbiotic dependency between coral and an algae known as zooxanthellae. The algae provides the coral food and color while the coral provides an environment for the algae to grow. The relationship, however, is rather fragile and continues largely due to

the conditions surrounding the reef, including weather such as typhoons or hurricanes, the water's chemical composition and the water's temperature.

If, as in the current case, water temperatures rise above a certain threshold for an extended period of time, the coral becomes stressed and expels its algae. This leaves the coral bleached white and reduces its energy supply by ninety percent. At this point, the coral begins to starve and has anywhere from months to weeks to live. Starvation, in turn, also leaves the coral more likely to die from predators such as snails and crown of thorns starfish, bacterial infections and pollution.

Rising temperatures are not the only threat to coral reefs. Increased oceanic acidification (another consequence of global warming), chemical pollutants, runoff and overfishing are among the other factors that can stress coral enough to cause bleaching.

The loss of the Great Barrier Reef would have far-reaching ecological consequences. It has existed for about 18 million years and, in its current form, for about 8,000 years, since the last Ice Age. It is the largest structure on Earth constructed by living organisms. It consists of 2,900 individual reefs over 900 islands, spanning 344,400 square kilometers and can be clearly seen from outer space.

Millions of animals use it as their primary breeding ground each year, including several million aquatic creatures and between 1.4 and 1.7 million birds. It is home to 5,000 species of mollusks, 1,500 species of fish, 500 species of algae and seaweed, 215 species of birds and dozens of species of sea turtles, sharks, sea horses and other aquatic creatures. Hundreds of these species are endangered, with many being unique to the region.

As global ocean temperatures continue to rise, the life

supported by the Great Barrier Reef is increasingly threatened. If the current warming continues apace, the reef is predicted to undergo a mass bleaching once every two years, rather than once every five or ten years. Given that it will take a minimum of ten years to recover from the current bleaching, more frequent occurrences raise the risk of the Great Barrier Reef as a whole dying off and many of the species it protects becoming extinct.

The problems facing the Great Barrier Reef are of a global character. Reefs in Hawaii and the Caribbean have also suffered mass coral bleaching events that coincide generally with global warming and particularly with El Niño events. In 1998, a global bleaching event killed off one-sixth of the world's coral. In 2010, reefs in Southeast Asia and the Indian Ocean suffered their worst recorded bleaching events, with some regions losing 20 percent of their total coral.

While coral bleaching has been observed for about a bit more than a century, occurrences in the first half of the 20th century were local and relatively mild. Parts of reefs would bleach, smaller sections would die, but the reefs as a whole would recover. An early instance of regional bleaching was observed during 1979, in the Caribbean and the Florida keys. The first recorded global coral bleaching event coincided with the El Niño of 1982-83.

Since then, global bleachings have occurred in the wake of every El Niño weather pattern. In 1990 global warming was established as the primary culprit. Research published then by climate scientists at the Smithsonian Institution conclusively showed that the coral bleachings of 1979-80, 1982-83 and 1986-88 were a result of warmer ocean waters caused by the combined effect of El Niño and rising average ocean temperatures as a result of increased carbon emissions.

The situation has grown more serious in the past quarter century. Human-induced global warming has continued apace, with 90 percent of the excess heat caused by carbon emissions entering the world's oceans. As a result, average global ocean temperatures have increased 1 degree Celsius since 1980, stressing coral reefs globally to just under the conditions for bleaching. It is estimated that if carbon emissions continue as they are, coral reefs will suffer bleaching every other year by the mid-2030s. As predicted in 1990, if the trend of increasing global temperatures is

allowed to continue, coral reefs will soon no longer exist.

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