

Heat Raises Fears of 'Demise' for Great Barrier Reef Within a Generation

A new study found that temperatures in the Coral Sea have reached their highest levels in at least four centuries.

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By Catrin Einhorn

Aug. 7, 2024

This generation will probably see the demise of the Great Barrier Reef unless humanity acts with far more urgency to rein in climate change, according to scientists in Australia who released new research on heat in the surrounding ocean.

The Great Barrier Reef is the largest coral reef system in the world and is often called the largest living structure on Earth. The study, published on Wednesday in the journal *Nature*, found that recent extreme temperatures in the Coral Sea are at their highest in at least 400 years, as far back as their analysis could reach.

It included modeling that showed what has been driving those extremes: Greenhouse gas emissions caused by humans burning fossil fuels and destroying natural places that store carbon, like forests.

“The heat extremes are occurring too often for those corals to effectively adapt and evolve,” said Ben Henley, a paleoclimatologist at the University of Melbourne and an author of the new study. “If we don’t divert from our current course, our generation will likely witness the demise of one of Earth’s great natural wonders, the Great Barrier Reef.”

The study’s scientific prose put it this way: “The existential threat to the Great Barrier Reef ecosystem from anthropogenic climate change is now realized.”

Tanya Plibersek, Australia's environment minister, said in a statement that the government understood its responsibility to act on climate change and safeguard the reef. She pointed to a recent law that calls for a 43 percent reduction of emissions by 2030 and to \$1.2 billion in measures to protect the reef.

All coral reefs are in danger from global warming, scientists say. Too much heat causes coral to bleach, meaning they lose the symbiotic algae they need to survive. If conditions don't improve quickly enough, the coral die.

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The new research comes as the world's reefs are in the grips of the most widespread bleaching event on record. From January 2023 to this August, 74 percent of the ocean's reef area has experienced bleaching-level heat

stress, according to the National Oceanic and Atmospheric Administration's Coral Reef Watch. The previous record, which occurred between 2014 and 2017, was 65.7 percent.

Coral reefs support an estimated quarter of marine species, protect coasts from storms and underpin activities like fishing and tourism. Their economic value has been estimated at \$2.7 trillion a year.

Dr. Henley recalled snorkeling on the Great Barrier Reef as a boy with his father. "You can't even take in the diversity," he said. "It's a kaleidoscope of color, it's absolutely spectacular."



Bleached corals near Heron Island at the southern end of the Great Barrier Reef. Experts are split over how helpful selective breeding efforts might be. Ove Hoegh-Guldberg

When the Great Barrier Reef experienced back-to-back bleaching in 2016 and 2017, Dr. Henley and colleagues wondered what kind of temperatures it had weathered before records were kept.

To look back as far as possible, they used data from samples of the oldest living corals measured, about 400 years old.

“It’s like finding centenarians in humans, there’s not that many of them,” said Helen McGregor, a professor of paleoclimatology at the University of Wollongong and one of the study’s authors.

Using the chemical signatures in those limestone cores, combined with historical records from ships, contemporary data sets and modeling, the team recreated four centuries of sea surface temperatures in the Coral Sea.

As they worked, mass bleaching kept hitting the Great Barrier Reef: In 2020, 2022, and then this year, when global ocean heat shattered records. The researchers kept

adding in the data.

“It’s a stunningly important summary of the history of the world’s largest reef system,” said Stephen Palumbi, a professor of marine biology at Stanford University who led a committee on coral resilience for the National Academy of Sciences and was not involved with the study. “The paper lays out the danger that corals all around the world face from this heat.”

But Dr. Palumbi also wondered if some hope was to be found in a temperature spike the authors identified during the 1700s, when the water appears to have been almost as warm as it is now. Could that mean certain corals in the Great Barrier Reef have survived similar circumstances in the past?

“Maybe these elders of the reef are better adapted to warmer water than the younglings born in 1920 or so,” Dr. Palumbi said. If so, they would be the ones to target in helping to breed more heat-resistant corals.

There is a split among coral experts over how useful selective breeding and other assistance from humans can be in the face of climate change.

Ove Hoegh-Guldberg, an author of the study and a coral scientist who has been sounding alarms about the effects of climate change on reefs for decades, said he didn't think such attempts could work at scale, in part because of the astronomical expense.

Instead, he said, efforts should be focused on cutting greenhouse gas emissions to zero as quickly as possible, and to protecting the reefs that are faring better as the oceans heat.

"They become the spawning reefs, the ones that will recover things in the future," Dr. Hoegh-Guldberg said.

"And that seems to be helpful in terms of the psychology of the situation. We can do something, but it's also practical."

Reefs will crash to very low levels but will come back in hundreds or thousands of years, Dr. Hoegh-Guldberg predicted.

As Dr. Henley, who snorkeled on the Great Barrier Reef with his father, reflected on the future, he thought of his two-year-old daughter.

“In her childhood years the reef is likely to see immense destruction,” he said. But if global action can hold warming to the low end of global targets, “there’s a reasonable chance that my daughter and her generation can still marvel at the reef in their lifetimes.”

Catrin Einhorn covers biodiversity, climate and the environment for The Times. [More about Catrin Einhorn](#)

A version of this article appears in print on , Section A, Page 7 of the New York edition with the headline: Heat Raises Fears of 'Demise' for Great Barrier Reef Within a Generation