

Tulane researcher studying sea temperatures' impact on Great Barrier Reef

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While bleached corals are still alive, they begin to starve without their symbionts and may die if conditions don't improve quickly. Photo by Thomas DeCarlo.

Rising sea temperatures are causing increasing signs of stress and threatening the existence of one of the world's most diverse and valuable marine ecosystems, Australia's Great Barrier Reef, according to a new international study from a team of researchers that includes Tulane University coral reef expert [Thomas DeCarlo](#).

The assistant professor of oceanography at Tulane [School of Science and Engineering](#) analyzed historical temperature and bleaching patterns at the reef site using underwater drilling to collect coral core samples and CT scans to identify density variations and annual growth bands visible from when coral previously bleached and recovered.

DeCarlo's work, [published this month in Nature](#), documents unprecedented levels of ocean heat leading to bleaching of the Great Barrier Reef, endangering a vital marine ecosystem.

How is climate change threatening coral reefs across the globe?

Corals are animals that live in symbiosis with photosynthetic algae inside their cells. These algae provide most of the energy corals need to survive. When water temperatures are abnormally warm, this symbiosis breaks down. The coral expels the algae, which is called bleaching. The coral turns white as you see the skeleton through the translucent tissues. While bleached corals are still alive, they begin to starve without their symbionts and may die if conditions don't improve quickly.

What makes the Great Barrier Reef so unique — and how does it illustrate the urgency of rising sea temperatures?

The Great Barrier Reef is the longest continuous reef in the world, near the center of reef biodiversity, with hundreds of coral species. It's a World Heritage Site and an icon for Australia. Key findings observed there include:

- The high-temperature events of the past two to three decades are exceptional and unprecedented in the past four centuries.
- There's strong statistical confidence that the highest temperature events causing devastating mass coral bleaching in the past decade have no parallel in at least the last 400 years.
- We found some evidence of coral bleaching in the late 1800s, which wasn't previously known.

- The frequency of mass bleaching has dramatically increased. From 1877 to 1982, there was almost a century between bleaching events. Since 1982, there have been seven mass coral bleaching events, occurring almost every other year recently.
- The severity of bleaching has likely increased, and the short time between events doesn't allow for reef recovery.

Why are coral reefs so important?

Hundreds of millions of people depend on coral reefs for food, economic reasons and livelihood. Reefs also provide tourism revenue, as well as spiritual and aesthetic value. Ecologically, reefs protect shorelines by breaking waves and reducing erosion. As we lose live corals, reefs become flatter and less effective at breaking waves. Reef degradation also leads to loss of biodiversity, as many species depend on specific coral habitats. This impacts fisheries potential and has widespread effects on society and people around the world.

How can we protect coral reefs from further damage?

The primary action needed is reducing greenhouse gas emissions. Climate models show that the warming trend since the late 1800s is due to human activities. These models can simulate natural climate variability and demonstrate that the temperature events of the past two decades on the Great Barrier Reef would have been impossible without human CO₂ emissions. The first step is to acknowledge that a problem exists. Unfortunately, there's still controversy around labeling the Great Barrier Reef as "in danger," despite clear scientific evidence of its deterioration and continued exposure to heat extremes. We need to agree on the danger the reef is in before we can make the hard choices necessary to reduce the speed of climate change.

For more on DeCarlo's work, visit <https://www.sclerochronologylab.com/>



Thomas DeCarlo, assistant professor of oceanography at Tulane School of Science and Engineering.

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