Corals on ocean-side of reef are most susceptible to recent warming: study

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UNC marine scientist Karl Castillo uses a pneumatic drill to take a core sample from a massive starlet coral (Siderastrea siderea) on the Mesoamerican Barrier Reef off the coast of Belize in the western Caribbean. Credit: Justin Ries, UNC-Chapel Hill.

Marine scientists at the University of North Carolina at Chapel Hill have linked the decline in growth of Caribbean forereef corals — due to recent warming — to long-term trends in seawater temperature experienced by these corals located on the ocean-side of the reef. The research was conducted on the Mesoamerican Barrier Reef System in southern Belize.

The results were revealed online in the July 8 issue of *Nature* Climate Change, a journal that publishes research on the impacts of global

climate change and its implications for the economy, policy and the world at large.

The Mesoamerican Barrier Reef System is the second largest reef ecosystem in the world and the largest in the Western Hemisphere, stretching along the coasts of Mexico, Belize, Guatemala and Honduras. In February 2009, UNC researchers Karl Castillo and Justin Ries used a large pneumatic drill to extract 13 core samples from massive starlet corals on the reef and measured the thickness of their annual growth bands in order to estimate trends in their growth rates over the last 100 years. They found a decline in skeletal growth in corals closest to the open ocean, while growth in corals from the other two reef zones — the nearshore (located closest to the shore) and the backreef (located directly behind the reef crest) — remained relatively unchanged.

Castillo, a postdoctoral researcher in the marine sciences department in the College of Arts and Sciences who is a native of Belize, said they surmised that this decline in skeletal growth in the forereef zone was due to a recent rise in seawater temperature, but they wanted to test their hypothesis in this latest study.

They gathered sea surface temperatures for the study site from 1982 to 2008 from the National Oceanic and Atmospheric Association's (NOAA) high-resolution seawater temperature database, which were derived from satellite measurements. They compared that dataset with seawater temperatures extracted from temperature loggers Castillo had installed at the study site in 2002.

Historically, corals in the area closest to the open ocean have seen cooler and more stable seawater temperatures, while those located closest to the shore and behind the reef crest have experienced warmer and more variable seawater temperatures.

Since 1982, the average summer sea surface temperature has been increasing in all three reef zones. Castillo said they found that with an increase in sea surface temperatures, skeletal growth declined over the 1982-2008 interval in the zone closest to the open ocean, while coral growth rates remained relatively stable over that same period in the other two reef zones.

"It looks like forereef corals are the first of this species to be affected on this reef system, suggesting that they may be most vulnerable to recent and future global warming," Castillo said. "However, because backreef and nearshore coral colonies have historically been exposed to warmer and more variable seawater temperatures, they seem to be less affected."

The findings of this new research study offer insights into how corals are likely to respond to future warming. They also highlight the importance of understanding cross-reef differences in the corals' tolerance for rising sea temperatures in an era of rapid global climate change. By identifying which corals are most vulnerable to warming, this work may help coral reef managers triage the reef ecosystem that they are trying to protect, the scientists said.

The researchers, accompanied by graduate and undergraduate students, headed back to Belize this summer to collect additional coral core samples that span the entire reef system, a length of approximately 200 miles, Ries said. Their previous study covered less than one-fifth of that region.

More information: Online paper: www.nature.com/nclimate/journa … ll/nclimate1577.html

Provided by University of North Carolina at Chapel Hill