Coral can't escape climate change despite its natural adaptive capacity, says new paper

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A new study shows that despite coral's natural adaptive capacity, even moderate global warming could see the destruction of our coral reefs.

Dr. Christopher Cornwall from Te Herenga Waka—Victoria University of Wellington's Te Kura Mātauranga Koiora—School of Biological Sciences led the study, and says the results are concerning.

"We found that corals' natural adaptive capacity would not be enough to save the reefs from eroding due to climate change. Not unless we stop emitting greenhouse gases immediately and start developing techniques to remove the gases from our atmosphere."

Coral colonies are supported by a rigid skeleton of calcium carbonate, similar in structure to our bones, surrounded by soft "polyps" that look like an anemone. Inside these polyps live tiny, microscopic algae that provide nutrition to the coral.

While coral has a very long generation time—years to decades—that limits their ability to evolve in response to stress, the algae have much shorter generation times that could allow rapid evolution. Some algae have higher thermal tolerance and corals could "shuffle" these, taking up more heat tolerant ones.

The article, "Coral adaptive capacity insufficient to halt global transition of coral reefs into net erosion under climate change," published in the journal *Global Change Biology* on March 21, models how calcium carbonate production could change under climate change with and without the coral evolving tolerance to warming seawater.

The study looked at how production of calcium carbonate would be affected under three warming and acidification scenarios. The scenarios looked at warming between 2050 and 2100, Representative Concentration Pathways (RCP) 2.6, where warming is between 0.7°C and 0.98°C; RCP 4.5, between 0.87°C and 1.59°C; and RCP 8.5, between 1°C and 2.43°C.

Dr. Cornwall says the results show that average coral reef growth globally across the sites he examined only stayed positive under RCP 2.6.

"Only 9 to 35% of our reefs would still be growing by 2050 in scenarios with coral evolution, depending on both greenhouse gas emissions, but in the Atlantic and Indian Oceans they would all be eroding.

"However, only 9% to 13% would still be growing by 2050 without evolution."

He says the natural adaptive capacity of coral will only be able to ensure slightly increased growth rates under lower emissions scenarios.

"Under our worst-case scenarios, only 6 out of the 201 reefs we examined would survive.

"The results show that there's an immediate need to reduce greenhouse gas emissions if we want our reefs around in the long term."

Dr. Cornwall says coral reefs are crucial parts of their ecosystems in tropical and sub-tropical regions, providing homes for nearly a quarter of marine life, and helping to protect our coastlines from erosion, creating a barrier between the ocean and the shore.

"We've seen a lot of damage already with mass coral bleaching events caused by marine heatwaves, but their ability to persist and continue growing is going to be strongly influenced by ongoing warming.

"Many corals just won't be able to adapt quick enough, and we could lose almost or all of their ecological function across the globe."

One solution that has been discussed widely, Dr. Cornwall says, is to propagate more heat-tolerant species with high rates of calcium carbonate production in habitats most at risk.

"The challenge is that the species that are more heat-tolerant tend to be

the ones that grow slower, and the ones that grow faster are the most heat sensitive.

"Really, the best solution is to keep warming below 1.5 degrees and invest in carbon dioxide removal."

More information: Christopher Edward Cornwall et al, Coral adaptive capacity insufficient to halt global transition of coral reefs into net erosion under climate change, *Global Change Biology* (2023). DOI: 10.1111/gcb.16647

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