Increase in acidity may not be harmful to coral reefs after all

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Close up of polyps are arrayed on a coral, waving their tentacles. There can be thousands of polyps on a single coral branch. Credit: Wikipedia

(Phys.org)—A combined team of researchers affiliated with the Scripps Institution of Oceanography and the Bermuda Institute of Ocean Sciences has found, via a five year study, that increased ocean acidification may not pose the threat to coral reefs that scientists have thought. In their paper published in *Proceedings of the National Academy of Sciences*, the team describes their study and why they now believe that an increase in green house gas emissions many not have the devastating impact on coral reefs that most in the field have assumed would occur.

To better understand what might happen with coral reefs if more carbon dioxide makes its way into the oceans due to an increase of the gas in the atmosphere caused by human emissions, the researchers set up monitoring devices along a coral reef offshore from Bermuda—information from the sensors was monitored for five years (2007 to 2012). The team also had access to data from an ocean chemistry monitoring station approximately 80 kilometers from their study site. The combined data offered a unique perspective on coral activity.

In studying the data, the researchers noticed that spikes of phytoplankton blooms occurred during 2010 and again in 2011—those blooms made their way to the coral reef offering more food than normal for the coral. The coral responded by growing which caused them to pull more alkaline carbonate from the surrounding water, making it more acidic. Eating more also resulted in the corals emitting more carbon dioxide into the water. The result was a big increase in acidity—to levels higher than have been predicted for the future due to human emissions—yet, the coral continued to flourish.

These observations contrast sharply with the prevailing view that an increase in acidity is harmful to coral—leading to death if it goes too far. But the levels seen by the researchers with this new effort suggest that is not the case at all, and therefore muddles theories regarding the impact on the oceans of higher levels of carbon dioxide and warmer temperatures. Another team with Western Australia noted that the results found by this new team appeared to agree with those of a small study they conducted where they put boxes around some coral and piped in carbon dioxide, to no detrimental effect.

More information: K. L. Yeakel et al. Shifts in coral reef biogeochemistry and resulting acidification linked to offshore productivity, *Proceedings of the National Academy of Sciences* (2015). DOI: 10.1073/pnas.1507021112

Abstract

Oceanic uptake of anthropogenic carbon dioxide (CO2) has acidified open-ocean surface waters by 0.1 pH units since preindustrial times. Despite unequivocal evidence of ocean acidification (OA) via open-ocean measurements for the past several decades, it has yet to be documented in near-shore and coral reef environments. A lack of long-term measurements from these environments restricts our understanding of the natural variability and controls of seawater CO2-carbonate chemistry and biogeochemistry, which is essential to make accurate predictions on the effects of future OA on coral reefs. Here, in a 5-y study of the Bermuda coral reef, we show evidence that variations in reef biogeochemical processes drive interannual changes in seawater pH and Ωaragonite that are partly controlled by offshore processes. Rapid acidification events driven by shifts toward increasing net calcification and net heterotrophy were observed during the summers of 2010 and 2011, with the frequency and extent of such events corresponding to increased offshore productivity. These events also coincided with a negative winter North Atlantic Oscillation (NAO) index, which historically has been associated with extensive offshore mixing and greater primary productivity at the Bermuda Atlantic Time-series Study (BATS) site. Our results reveal that coral reefs undergo natural interannual events of rapid acidification due to shifts in reef biogeochemical processes that may be linked to offshore productivity and ultimately controlled by larger-scale climatic and oceanographic processes.