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World-first undersea mini lab

A mini-lab submerged on Australia's Great Barrier Reef has been used to conduct the first controlled ocean acidification experiment in shallow coastal waters. The lab will help predict the effects of changed future ocean conditions, driven by climate-change, on ecosystems such as coral.

Credit: David I. Kline

An international team of scientists lead by Dr David Kline and Professor Ove Hoegh-Guldberg of the University of Queensland has devised a small lab-in-a-box set in shallow water two to six feet deep. Inside the box, elevated levels of water acidity mimic the composition of the future ocean as climate change continues, and the reaction of local corals is monitored (other corals in the vicinity were not adversely affected).

The study, published in Scientific Reports, describes how predicted future ocean conditions are simulated by the lab, sited off Heron Island in Australia's Great Barrier Reef.

‘Installing systems like this at reefs and other aquatic environments could be instrumental in helping us identify how ecosystems will change and which locations and ecosystem types are more likely to remain robust and resilient,’ says Lida Teneva, a Stanford doctoral student who worked on the project.

‘From this, we can determine which habitats to focus our conservation efforts on as strongholds for the future.’

Oceans absorb more than a quarter of all atmospheric CO_2, concentrations of which are increasing at a rate twice as fast as at any time in the past 800,000 years or more. This leads to increasingly intense water acidification and widespread coral reef destruction. The potential loss is tremendous: reefs provide aquaculture, protein and storm protection for about 1 billion people worldwide.

Standard in situ studies of ocean acidification have multiple drawbacks, including a lack of control over treatment conditions and a tendency to expose organisms to more extreme and variable pH levels than those predicted in the next century. So, in 2007, the Monterey Bay Aquarium Research Institute in California developed a system that allows for highly controlled semi-enclosed experiments in the deep sea. For this recent study, the researchers modified the system for use in coral reefs.

The system uses a network of sensors to monitor water conditions and maintain experimental pH levels as offsets from environmental pH. It avoids many of the problems associated with standard in situ ocean acidification studies and, unlike lab and aquarium experiments, makes it possible to study amid natural conditions such as seasonal environmental changes and ambient seawater chemistry.

Source: Stanford University and the University of Queensland