The future of reefs

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In a world first, a new 'state of the art' climate change experimental facility has been completed at the University of Queensland's (UQ) Heron Island Research Station.

The Climate Change Mesocosm (CCM) project led by Associate Professor Sophie Dove and Dr. David Kline from the Global Change Institute's (GCI) Coral Reef Ecosystems Laboratory is one of the largest and most accurately controlled ocean acidification and warming experimental systems in the world and simulates ocean temperatures and acidification levels predicted to occur on coral reefs in the next 50 to 100 years.

Able to regulate both temperature and CO_2 levels prescribed by the 2100 Intergovernmental Panel on Climate Change (IPCC) scenarios in a highly controlled environment, the CCM system allows studies of climate change from the molecular to the ecosystem level.

“While similar to the “Free Ocean Carbon Enrichment” (FOCE) project, recently featured in Sir David Attenborough's documentary “Death of the Oceans”, the CCM differs in that it regulates the temperature, in addition to, the acidification levels above and below the current ambient conditions of water on the reef,” Dr. Dove said.

"It is unique in so far as the experimental controls allow variation with respect to real-time conditions of CO_2 and temperature measured in the adjacent deepwater of Wistari channel.”

"Conditions in the 72 experimental aquaria and 12 mini-reefs can then fluctuate a fixed amount above or below the ambient control conditions, but importantly incorporate a day/night and seasonal variability."

The main components of the system are 4 x 7,500L custom built air-tight and insulated fibre-glass tanks or sumps, which provide the necessary residence time of the water for the fine control of CO_2 and temperature.

The research is simulating preindustrial ocean conditions of -100 ppm CO_2 and minus 1°C; a control treatment of current reef CO_2 and temperature; the 'B1' IPCC scenario of + 220ppm CO2 and +2°C, and an extreme 'A1FI' scenario of +640 ppm CO2, +4.5 °C.

"In the eight months the FOCE system has been on the reef flat we have noticed the corals exposed to the higher CO_2 levels look quite different. The types of algae are different and the growth rate of the coral appears to have slowed," Dr. Kline said.

"We expect to see similar results from the CCM experiments where reefal organisms respond to the dual influences of acidification and temperature."

Provided by University of Queensland

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