



Antarctic ecosystems will be affected by warming waters.

OCEAN WARMING

Climate trial heats up Antarctic sea bed

Some species double their growth rate on artificially warmed ocean floor.

BY QUIRIN SCHIERMEIER

The future has come to a small patch of the Antarctic sea bed, courtesy of an experiment that placed electric heating pads on the ocean floor. The pioneering trial is one of the most realistic and technically challenging ocean-warming experiments yet performed, researchers say — and it opens up a new avenue by which to explore how warming oceans affect marine ecosystems.

In the past 40 years, the surface waters of Earth's oceans have warmed by some 0.4 °C on average as a result of climate change. And if greenhouse-gas emissions continue at their current pace, models forecast, the warming could reach up to 2 °C by 2100. But researchers

know little about how ocean ecosystems will respond — and uncertainties are largest in polar regions where there are few field data, says Gail Ashton, a marine ecologist with the Smithsonian Environmental Research Center in Tiburon, California.

That data gap spurred Ashton and her colleagues to carry out their artificial-warming experiments. They began in 2014, when scuba divers installed 12 panels 15 metres under water on flat sea bed near the Rothera Research Station of the British Antarctic Survey (BAS), on a small island off the west coast of the Antarctic Peninsula. Four panels were heated so that they were always 1 °C above the ambient temperature — which in the region varies from around –2 °C to +2 °C during the year

— and four were heated to 2 °C above ambient temperature. The remaining four were left unheated, as controls.

Using cameras, the divers monitored how typical sea-bed fauna, such as microscopic invertebrates and sponges, colonized the panels. The experiment was supposed to run for two years but ended after nine months when icebergs damaged power-supply cables. Still, researchers saw significant and surprising differences between the panels, says Ashton. “I had hoped we might be able to see some subtle differences after careful image analysis,” she says. “But I would never have expected that the warming effects would be so easily discernible with the human eye.”

Metabolic theory predicts that biological growth rates increase by around 10% for every 1 °C of warming. But some species grew twice as fast on the heated panels as they did on the controls, Ashton and her colleagues report in *Current Biology* (G. V. Ashton *et al.* *Curr. Biol.* <http://doi.org/cnm>; 2017). Distinctly different animal communities settled on the heated surfaces. On the 1 °C set, a species called *Fenestrulina rugula* — a kind of filter-feeding invertebrate called a bryozoan — so dominated the fauna that the diversity of all species on the panel was reduced. The results suggest that species at the bottom of the marine food web are able to cope with one or two degrees of warming, Ashton says, particularly given that it happens over decades. However, species-richness or diversity might be affected, and some species might grow to dominate others.

“The results are very exciting and provocative,” says Craig Smith, a marine ecologist at the University of Hawaii at Manoa. “They suggest that climate warming in the next 50 years in Antarctica could substantially alter the unique diversity of Antarctic ecosystems.”

Simon Morley, a marine biologist with the BAS in Cambridge, UK, and a co-author of the study, says the team plans to extend its findings. In September, he will look for a test site near the Canadian High Arctic Research Station in Cambridge Bay.

“More of these experiments need to be done to be able to generalize, and draw wider conclusions,” says Boris Worm, an oceanographer at Dalhousie University in Halifax, Canada. “Each is necessary to challenge our simplistic assumptions about how climate change may alter the world we live in.” ■

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