

Antarctic fjords are climate-sensitive hotspots of diversity in a rapidly warming region

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Deep inside the dramatic subpolar fjords of Antarctica, researchers from the University of Hawai'i at Mānoa have discovered an unexpected abundance and diversity at the seafloor. During a recent expedition, UH scientists for the first time studied the seafloor communities of glacier dominated fjords along the west Antarctic Peninsula, a region undergoing very rapid climate warming.

The scientists expected to find impoverished [seafloor](#) communities highly disturbed by glacial sedimentation, similar to those that have been documented in well-studied Arctic regions. To their surprise, bristle worms, anemones, sea spiders, and amphipod crustaceans abounded in their seafloor photographs, along with a number of sea cucumbers, deep ocean jellyfish and other species. Above the seafloor, the fjord waters were dense with krill.

Scientists suggest that the differences in diversity and abundance between Arctic and Antarctic fjords can be explained by the fact that the subpolar Antarctic is in an earlier stage of [climate warming](#) than the Arctic, allowing the Antarctic fjords to sustain high levels of productivity. The Antarctic fjords show little disturbance from glacial melting.

"Our study area along the Antarctic Peninsula is warming as fast as anywhere in the world, and the amazing ecosystems there are changing

very quickly," said Craig Smith, a professor of oceanography at UH Mānoa who has been studying how marine ecosystems in the Antarctic are responding to climate warming.

"There appears to be something special about these fjords that stimulates seafloor productivity," said Laura Grange, a researcher at the National Oceanography Centre, University of Southampton, United Kingdom, who was a postdoctoral collaborator at UH Mānoa with Smith during this study.

"Seafloor ecosystems at the bottom of fjords rely on detritus for food, so these Antarctic fjords must be getting some sort of enhanced food input, most likely from phytoplankton blooms, macroalgal debris, or even from krill—their molted carapaces or the dead bodies that sink to the bottom," Grange said. Researchers have even suggested that large aggregations of humpback whales may stimulate fjord primary productivity by releasing nutrients as they feed and defecate in the fjords during seasonal immigration.

Even with a variety of pathways to fuel the remarkable diversity of animals on the seafloor, Antarctic fjord ecosystems are at risk from climate warming.

In today's Antarctica, fjord glaciers currently sustain very little melting and the icebergs they shed drift out to sea without dropping much sediment – scientists say these fjords have "weak meltwater influence." As a result, fjord headwaters are clear of suspended sediments, allowing phytoplankton and benthic algae to bloom, and producing little burial disturbance of rich seafloor fauna.

These favorable conditions are very likely to change as the climate warms rapidly, accelerating glacial melting and dumping large amounts of fine glacial sediments into fjord headwaters.

The resulting higher turbidity and seafloor sedimentation will likely shade the phytoplankton and bury diverse seafloor communities, or smother primary production and biodiversity in these narrow canyon-like ecosystems.

"The extraordinary ecosystems, which provide habitat and foraging areas for krill and baleen whales and are hotspots of seafloor diversity, are very likely to be negatively impacted by the very rapid climate warming occurring along the Antarctic Peninsula," Smith said. "The fjords also happen to be the focus of Antarctic ecotourism, with thousands of visitors on cruise ships each year entering the fjords to view penguins and whales and to experience the sheer abundance and diversity of Antarctic life. Climate warming may thus dramatically change some of the most iconic of Antarctic ecosystems."

"These Antarctic fjord ecosystems may play a disproportionately large role in feeding and recruiting of mobile species, including juvenile fish and whales," Smith said. "We urgently need to develop a better understanding of the structure, function, and climate sensitivity of these fascinating and imperiled seafloor communities."

More information: Megafaunal communities in rapidly warming fjords along the West Antarctic Peninsula: Hotspots of abundance and beta diversity. Laura J. Grange and Craig R. Smith. *PLOS ONE*. [dx.plos.org/10.1371/journal.pone.0077917](https://doi.org/10.1371/journal.pone.0077917)

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