

A sea change, deep under Antarctic waters

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The frigid seabottom off Antarctica holds a surprising riot of life: colorful carpets of sponges, starfish, sea cucumbers and many other soft, bottom-dwelling animals, shown on images from robotic submarines. Now, it appears that many such communities could fast disappear, due to warming climate. Scientists sailing on an icebreaker last year have [just published a study](#) showing that gigantic king crabs have spread into warming Antarctic bottom waters, where they are devouring everything in sight and altering the structure of the seafloor itself. The study, in the current issue of *Proceedings of the Royal Society B*, was led by biologist Craig Smith of the University of Hawaii and coauthored by oceanographer Bruce Huber of Columbia University's Lamont-Doherty Earth Observatory, who served as co-chief scientist on the cruise.

Like related northern king crabs popular in seafood restaurants, the southern species *Neolithodes yaldwyni* can measure three feet across and has powerful claws for crushing prey. It was previously known to live in Antarctica's Ross Sea, south of New Zealand. But during the recent cruise, the crabs were found in the Palmer Deep, a distant basin in Antarctica's shallow continental shelf, south of South America. The researchers think the crabs arrived there only in the last 30 or 40 years, after being held back for millions of years by the cold, shallow water of the [Antarctic](#) continental shelf. (Due to the way ocean waters circulate, warmer masses come in from the north and sink, while shallower waters around most of Antarctica remain mostly colder.) To live, the crabs need water warmer than about 34.5 degrees F; and oceanographic measurements show that the Palmer Deep has been heating by about 0.018 degrees a year for at least the last 30 years—enough, apparently, to give larva floating in over the shelf a foothold.

The team estimates that some 1.5 million crabs are now living in just one small area of the Palmer Deep below 3,100 feet. Here, they have virtually wiped out invertebrates including sea lilies, urchins, brittle stars, sea cucumbers and other creatures. Their spindly claws also overturn previously undisturbed sediments, which may fundamentally alter the ecosystem by changing microbial communities and the availability of organic matter. Shallower waters along the nearby Antarctic Peninsula still hold abundant invertebrates—but the peninsula and its coastal waters comprise one of the fastest-warming places in the world. If heating continues at its current rate, the scientists expect the crabs to reach these areas within just 10 or 20 years. “It looks like a pretty negative consequence of climate warming in the Antarctic,” Smith told.

This is only one of many reports to suggest that climate is already driving shifts in ecosystems. Other studies in recent years have indicated that migratory birds in Europe are traveling north earlier; plant and tree species in North America are slowly marching poleward; and alpine

flowers and high-elevation animals such as pikas are being driven to ever-higher altitudes The Antarctic crab invasion “is likely to serve as an important model for the potential invasive impacts of crushing predators,” writes Smith.

Provided by Columbia University

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