

Earth Institute News

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Ecosystems Push South

Warming Climate Drives Plankton and Penguins Poleward



Adelie Penguins on Dream Island, Western Antarctic Peninsula
Credit: William Fraser, Polar Oceans Research Group

Adélie penguins are flocking closer to the South Pole. A [new study in the leading journal Science](#) explains why: they're following the food supply, which is moving southward with changing climate.

Krill, the shrimp-like critters that Adélies like to eat, feed on phytoplankton. But as global temperatures rise, phytoplankton are declining in the north while increasing further south. The [poleward shift](#) is taking place on the Western Antarctic Peninsula, a

finger of land stretching toward South America, one of the fastest warming places on Earth. For decades, penguins and other Antarctic predators have been observed further south on the peninsula, where temperatures are colder and sea ice more plentiful. Previous research shows that Adélie penguins have decreased 70 to 80 percent over their northern range.

" Adélie penguins need lots of krill," said lead author [Martin Montes-Hugo](#), an oceanographer at Rutgers University. "Adélies are going to be happy further south."

The study also indicates that declining sea ice off the peninsula is causing greater mixing in the Southern Ocean, said co-author [Doug Martinson](#), an oceanographer at Columbia University's Lamont-Doherty Earth Observatory. This knowledge is important for predicting future changes to the Antarctic ecosystem, he said. "The sequencing of events pointed out in the paper suggests that the ocean is responding to changes in the sea ice, not the other way around."

Satellite images from the 1980s show a huge green-colored bloom off the peninsula's west coast. But two decades later, the bloom no longer appears in the satellite data. By studying images from the last 30 years, the team found an 89 percent decline in phytoplankton in the northern part of the peninsula, but a 66 percent increase in the south. Overall, there was a 12 percent decline in phytoplankton--a trend that may not bode well for Adélies at any latitude.

" This warming is changing the whole ecosystem," said Montes-Hugo.

To explain what might be causing the shift in phytoplankton, the team studied observed changes in wind, sea ice and cloudiness. In the north, an increasing number of clouds has meant less sunlight to nourish the photosynthetic phytoplankton. At the same time, a decline in sea ice caused increased windiness; this created more mixing in the ocean, further slowing plankton growth.

In the south, the opposite held true. Fewer clouds mean more sunlight, spurring greater plankton growth. More sea ice means less ocean mixing, which also encourages plankton growth. Thus the Adélies have moved south with the phytoplankton, and the krill who feed on them. In the process, sub-Antarctic species--Chinstrap and Gentoos--are replacing the Adélies in their former range. Though the Chinstraps and Gentoos are faring better than the Adélies, they, too, are pushing south in pursuit of food.

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“ Much of what we know about climate change on the Western Antarctic Peninsula at the marine ecosystem level covers the top predators and prey—seals, whales, penguins and krill,” said co-author William Fraser, a penguin expert at Polar Oceans Research Group, a non-profit research group in Sheridan, Montana. The paper “is unequivocal evidence that the rest of the food web is changing also,” he said.

The study was funded by the National Science Foundation and the Virginia Institute of Marine Science.



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