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Phytoplankton at base of Antarctic food web at risk from ocean acidification

Two new studies have found that the productivity and diversity of phytoplankton in the ocean surrounding Antarctica are at risk from rising CO_2 levels.

Single-cell phytoplankton are at the base of the Antarctic food web but the studies led by Institute for Marine and Antarctic Studies (IMAS) researchers found they will be increasingly threatened over coming decades as rising carbon levels cause the Southern Ocean to become more acidic.

The two studies published in the scientific journal *Biogeosciences* involved collaboration between IMAS, ACE CRC, the Australian Antarctic Program and the Australian Research Council-funded Antarctic Gateway Partnership

Using tanks located at Prydz Bay in East Antarctica, researchers Alyce Hancock and Stacy Deppeler tested phytoplankton at different levels of CO_2, mimicking rises expected by the end of the century.

They found that ocean acidification would lead to changes in the productivity and composition of phytoplankton communities in the Antarctic, affecting the way nutrients are cycled and reducing the energy available to higher organisms.

Ms Hancock said the Southern Ocean is particularly vulnerable to ocean acidification as it is one of the world's largest sinks of CO_2 emissions.

"Phytoplankton are incredibly abundant and play a critical role at the base of the food web in the Antarctic ecosystem, but they're so small you can't see them with the naked eye," Ms Hancock said.

"We wanted to see how ocean acidification will affect phytoplankton communities as, until now, very little has been known about their sensitivity to rising CO_2.

"My research looked at the composition of the phytoplankton community and found that we can expect to see a shift from a community dominated by large cells to one dominated by small cells."

Ms Deppeler said her study focused on how increasing CO_2 would affect the productivity of phytoplankton, particularly the health of the cells and their ability to photosynthesize and grow.

"With increasing CO_2 we saw a decline in cell health, resulting in reduced productivity," she said.

"We found that there is a 'tipping point' for the changes detected across our two studies that is within the range of increased ocean acidification predicted to occur around the end of this century.

"Once this point is reached we can expect to see cascading impacts throughout the Antarctic food-web, significantly changing the Antarctic ecosystem," Ms Deppeler said.

The two studies were conducted as part of an Australian Antarctic Science program led by Dr Andrew Davidson, and also involved researchers from University of Technology Sydney, the Australian Antarctic Division and Southern Cross University.

Captions for images attached:

(Tanks.antarctic.jpg) 6 x 650L tanks (minicosms), housed in a temperature-controlled shipping container, were used to investigate the effects of ocean acidification on Antarctic marine microbes (photo: Dr Andrew Davidson).

(Phytoplankton.jpg) Antarctic phytoplankton community in the ocean acidification experiment (photo: Alyce Hancock).

(group.jpg) The ocean acidification experiment team at Davis Station, Antarctica, December 2014 (back row, from left): Dr Andrew Davidson (Australian Antarctic Division), Stacy Deppeler (Institute for Marine and Antarctic Studies), Penny Pascoe (Australian Antarctic Division); (front row, from left) Dr Kai Schulz (Southern Cross University), Alyce Hancock (Antarctic Gateway Partnership), Cristin Sheehan (University of Technology Sydney) and Dr Katherina Petrou (University of Technology Sydney).

****More images are available on request****

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