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Declining ice in Arctic threatens polar food web and impacts sea-ice algae

The impact of climate change on the algae that live in Arctic sea ice is likely to be large and complex, according to models co-developed by the University of Cape Town (UCT). Declining sea ice in the Arctic could have a large and complex impact on sea-ice algae – the powerhouses of the polar food web.

Recent research by an international team, co-lead by UCT researchers, investigated how a future, warmer Arctic could impact the algae that live in sea ice – and form the base of the marine food web there. To do this, the team used modelling to predict how growth of sea-ice algae could change as our climate does.

Their findings show that the impact of declines in sea ice on sea-ice algae – and the rest of the food web – in the Arctic is likely to be drastic and complex across the region.

Phytoplankton are tiny algae that float in the oceans. Like plants, they are primary producers that form the base of the food web and can transform carbon dioxide into oxygen. Though microscopic, they are vital to life in the oceans.

In the Arctic, sea-ice algae play an important part in supporting the food web at times of the year when light is low and there is still ice cover.

“The short and tightly connected Arctic food web is heavily dependent on sea-ice algae as a source of organic matter. How much is not completely known,” explains Associate Professor Marcello Vichi from the UCT Department of Oceanography who co-authored the study.

“Ecologists have different hypotheses on what would happen to the food web in a warming Arctic.”

Associate Professor Vichi and his colleagues – Dr Letizia Tedesco, a senior researcher from the Marine Research Centre of the Finnish Environment Institute, and Enrico Scoccimarro, a senior researcher at the Euro-Mediterranean Centre on Climate Change in Bologna, Italy – aimed to contribute to this gap in knowledge using models to investigate how declines in sea ice in the Arctic could impact sea-ice algae.

The climate models projected thinning of snow and sea ice and shortening of the ice season at all latitudes in the future Arctic. The response of the sea-ice algae was more complex and varied from north to south across the region.

Overall, their model suggested a 52% increase in primary production by sea-ice algae in the Arctic during this century.

The diverse responses of sea-ice algae show that the impact of climate change on primary production in the region will likely be complex – as will be the cascading impact on the rest of the food web, from fishes to whales, seals to polar bears.

“Even if the models are imperfect – which they are by definition! – and a faint approximation of the complexity of biological processes, they still provide us with the possibility to benchmark scenarios and expand the conceptual predictions of field ecologists,” says Associate Professor Vichi.

Recognising the crucial role of the ocean and sea ice in the world’s climate, UCT researchers from across departments are working together to take advantage of our position at the edge of the Southern Ocean and near Antarctica to study the ice there. Antarctic sea ice undergoes the largest seasonal cycle of ice on Earth and could provide “a boosted version of what the Arctic may look like at the end of the century,” explains Associate Professor Vichi.

Researchers in the departments of oceanography and chemical, civil and electrical engineering have teamed up under the Marine Research (Ma-Re) Institute, which Associate Professor Vichi is director of.

“We hope that in the future – for the first time – there will be a transfer of knowledge from south to north in a field that is traditionally dominated by the global north.”

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