Climate change threatens nutrients essential to human health

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Essential fatty acids, such as EPA and DHA, are vital to the health of all vertebrates, with a direct relationship to cardiovascular and immune system health, as well as neurological function, vision, and reproduction. New research from Ryerson University shows that climate warming may have a significant negative effect on production of these omega-3 fatty acids in algae, which may lead to cascading effects throughout the world's ecosystems, culminating in an overall decline in the global availability of these nutrients for human wellbeing.

Led by Stefanie Hixson, a research associate in the Department of *Chemistry and Biology* at Ryerson University, the research represents the first-ever large-scale study to demonstrate that increasing water temperature is expected to have a negative effect on eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) and production, and concludes with the prediction that a 2.5°C increase in water temperature will reduce EPA by 8.2 per cent and DHA by 27.8 per cent globally.

"We knew that algae use certain fatty acids to adapt to changes in water temperature, so we looked at this effect on a global scale," said Hixson. "Our results demonstrate that by the year 2100 EPA and DHA production—and therefore its availability for human consumption—will be very significantly impacted if current trends in global warming continue unabated. This is a serious problem, as the current supply of these nutrients has been shown by other researchers to be barely sufficient to meet the nutritional demand of the human population."

The two nutrients must be obtained through our diet as the body cannot synthesize them efficiently. These essential fatty acids are consumed by humans through eating fish, squids, and shellfish or by taking fish oil supplements, and are created by marine and freshwater algae that are then passed along the food chain to fish.

The research was conducted by first compiling data from the literature for EPA and DHA levels in different species of algae from around the world, at specific temperatures. This large data set was then used to predict the levels of DHA and EPA in algae with certain increases in temperature based on climate change models.

"It is our hope that governments will view this evidence-based research as an accelerated call to action to address the critically urgent issue of climate change," said co-author Professor Michael Arts, Department of *Chemistry and Biology*. "Controlling emissions of greenhouse gases like carbon dioxide, and especially methane, takes on a new urgency when seen in the light of climate warming-induced reductions in the global stockpile of the brain-building nutrient DHA."

The researchers' next steps involve using this data to model how the decrease in DHA production might impact animals in the future, especially with regard to cognitive performance, including intelligence. They also plan to conduct field experiments to directly test how global warming may be impacting both the production and movement of EPA and DHA through freshwater wetlands and from there onto the land.

More information: Stefanie M. Hixson et al. Climate warming is predicted to reduce omega-3, long-chain, polyunsaturated fatty acid production in phytoplankton, *Global Change Biology* (2016). DOI: 10.1111/gcb.13295

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