Researchers have demonstrated that hatching in polar cod can begin as early as January in Arctic seas that receive large freshwater input, compared to April-July in seas with little freshwater input. Since early hatching leads to higher survival rates, the effects of climate change may enhance polar cod’s survival by favouring conditions that allow winter hatching to occur.

The polar cod, *Boreogadus saida*, plays an important part in the food web of the Arctic seas. Young fish are preyed on by birds at the sea surface in late summer and then by adult cod as they migrate to deeper, overwintering grounds. Since the chance of survival is higher for larger individuals, selection pressure pushes hatching to occur as early as possible, in late winter or early spring, to allow individuals to reach a larger size before migration begins.

The study hypotheses that early hatching occurs in under-ice river plumes, where the input of freshwater keeps temperatures relatively high in winter (just below 0°C) compared to -1.8°C under the ice. These warmer temperatures accelerate embryonic development and allow successful feeding when the larvae first hatch out.

To test this ‘thermal refuge’ hypothesis, the researchers studied six oceanographic regions of the Arctic Ocean ranging from inland and coastal seas, which are heavily influenced by rivers, to recurrent polynyas, which are areas of open water surrounded by sea ice and with little freshwater input. Results showed that the hatching period became shorter in duration and shifted from winter to summer with decreasing freshwater input. For example, hatching started as early as December and January in the Laptev Sea, Hudson Bay and Beaufort Sea, where freshwater input is high, and was delayed until spring (April or May) in Baffin Bay and the Northeast Water, where freshwater input is minimal.

The scientists estimated individual fish lengths at the end of summer in the different regions sampled between 2003 and 2006 by measuring the thickness of annual growth layers in the inner ear – just like tree rings. Lengths ranged from less than 10mm to 50mm, corresponding to larvae hatched in July and those hatched in December and January, respectively. Importantly, 97% of the polar cod that reached a length greater than 35mm were from the regions with high freshwater input.

The results from this study suggest that the projected effects of climate change in the Arctic Ocean, including earlier ice break-up, more frequent winter polynas and freshwater-induced temperature changes caused by increased river discharge, could enhance the growth and survival of polar cod by promoting conditions that favour winter hatching. Further research is now needed to confirm the thermal refuge hypothesis by directly observing whether winter hatching occurs within plumes of rivers under sea ice.


Contact: caroline.bouchard@giroq.ulaval.ca

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