

### **For cod, the allure of greener pastures may not outweigh the risks of the search**

*When Greenland cod has to choose, the species favours staying in familiar habitats over exploring the environment*

Greenland cod (*Gadus morhua*) is often not found in the habitats associated with the best food; rather, they may feel content to stay in sub-optimal locations that they encounter during their transition from larva to adult. This is what scientists from the Thünen Institute of Sea Fisheries have concluded in a new published study. The researchers analysed more than 4.000 stomachs of Atlantic cod from the coast of Greenland, covering a time period of eleven years.

The shelf ecosystems in Greenland waters are one of several important areas of cod, a species distributed throughout the North-Atlantic, the North Sea and the Baltic Sea. In Greenland waters, cod has a complex life cycle: Adult fish spawn in eastern Greenland, whereby the eggs and larvae are transported with ocean currents to southern and western waters off Greenland (see figure). Here, the juveniles grow up and slowly migrate back eastwards, where they mature. In eastern Greenland, adult cod aggregate on underwater banks where they feed and reproduce. That's why you mainly find small cod in western Greenland, medium size cod in southern Greenland and almost only large individuals in eastern Greenland. The new investigations have shown that the diet composition has a large impact on the energy reserves. However, cod were frequently observed to remain in less favourable habitats even though better ones were relatively close by. The scientists explain that a limited ability to perceive spatial differences in diet quality, which would otherwise provide cod with an incentive to move to better areas, may explain this phenomenon. Although poorer feeding conditions have obvious consequences for growth and reproduction, the costs associated with searching for better habitats may outweigh the potential benefits.

The scientists believe that this strategy is linked to potentially lethal threats, which could occur during the search for a better habitat. Because adult cod mainly lives on underwater banks around Greenland, it could starve in a "food valley" between two banks or even get eaten itself.

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“During our research surveys, we repeatedly discovered areas, where cod was in poor condition. We were able to prove this after we dissected the stomach samples in laboratory”, says Karl-Michael Werner, a biologist from the Thünen Institute and first author of the study. One of the most exciting aspects of this study was that these patterns persistently occurred every year. These results allowed the conclusions that cod is rather sedentary and has difficulties to adapt to spatial differences in habitat quality. This is especially important for ecosystem changes under climate change: It might take longer than expected for cod populations to adapt to changes in the environment. In addition, the results show that particular areas might be of especial important for the stability of the cod populations in Greenland waters. This is important for a long-term sustainable fishery management, because these areas could receive increased attention and protection.

The study “Evidence for limited adaptive responsiveness to large-scale spatial variation of habitat quality” was carried out by the Thünen Institute in cooperation with the Universities of Hamburg, Tromsø and Girona and is published in the journal “Marine Ecology Progress Series” (<https://www.int-res.com/abstracts/meps/v629/p179-191/>).

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