

## The origin of boreal species invading Arctic waters, Northeast of Greenland

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Due to ocean warming, marine fishes and invertebrates are beginning to extend their distribution into previously uninhabitable waters to follow their preferred food or conditions. This has already become evident within the Arctic i.e. the Barents and Bering seas. One Arctic ecosystem we identified that may be, or may become open to invasion by these southern species is the Northeast Greenland shelf. However, it is not currently known how southern species can access this area from adjacent seas, e.g. the Icelandic and Norwegian seas.

This study aimed to identify how such species can reach the Northeast Greenland shelf, either by (active) migration from Iceland or (passive) dispersal from Norway i.e. by moving against the prevailing ocean circulations or by following them. To do this, we used population genetic tools to identify the population genetic signature of specimens we found recently on the Northeast Greenland shelf between 2007-2017. These were specimens of the fishes; Atlantic cod and beaked redfish, and the crustacean; deep-sea shrimp. We used several statistical analysis tools to match the population genetic signature found for these, possible southern invaders, with known populations from the surrounding seas, around Iceland, and Norway.

Our results show a high level of similarity between the population signature observed in all three species under study that were found in Northeast Greenland and their respective populations within the Barents Sea (Norway). This finding supports the theory that southern invading species can disperse from Norway i.e. the Barents Sea, to the Northeast Greenland Shelf – an Arctic habitat.

We cannot show that our samples are the first individuals of their species to reach the Northeast Greenland Shelf as survey explorations into the diversity of fish and invertebrates in this area are relatively recent. However, our results show that it is possible for these three species to disperse from the Barents Sea to the Northeast Greenland shelf, and with a warming climate in mind, it is conceivable that further individuals of the same species may follow, in addition to other species from the

Barents Sea with similar life cycles i.e. with planktonic larvae e.g. capelin and Atlantic haddock.

Newcomers into the Arctic have the potential to alter relationships between Arctic species due to increased competition and/or predation. It is for this reason that our results are of interest, in particular to those whom model the movement and interactions of marine fishes and invertebrates, to predict how the Arctic may or may not change in the future. Our novel finding showing that individuals can disperse from the Barents Sea to Northeast Greenland is information that can add to these models to enhance their ability to predict change, both for the Arctic, and surrounding seas.