Early life of key fish species, capelin Mallotus villosus and Atlantic cod Gadus morhua, in West Greenland

Research involving the processes governing early life of fishes is important for understanding recruitment to the adult population. The forcing factors, like oceanographic processes and the associated plankton communities, impact the distribution and transport of fish larvae and determine their growth conditions, survival and recruitment to the adult stock. The temporal and spatial overlap of fish larvae and their prey is essential for their feeding, growth and survival. Investigations of the prey size spectra in fish larvae made possible to observe inter-specific prey competition and gain knowledge on the role in the food web. The changes in environmental factors between subarctic and Arctic areas along the west coast of Greenland provide a unique study frame. Here, the period of high primary productivity is short and limited by seasonal changes in light, consequently prey availability for the fish larvae during the summer. The duration of the productive season is of great importance for the early life of fish. The present thesis investigates the diets of capelin and cod in the subarctic Kapisigdlit, as well as the feeding of non-commercial larval fish in the entire Godthåbssfjord system. Furthermore, growth and feeding of capelin were compared between the two distant localities, Kapisigdlit Fjord and Disko Bay.

In Kapisigdlit Fjord, the zooplankton community structure was dominated by rotifers and harpacticoid copepods. These organisms appeared too small as prey for cod larvae, where they were feeding on prey sizes of about 5% of their own size (Paper I) and consequently the prey preference spectra covered calanoid nauplii, cladocerans and calanoid copepods with increasing larval size.

In the Godthåbssfjord system and Fyllas Bank area, 4 hydrographic zones were defined; in each zone distinct zooplankton and ichthyoplankton assemblages were observed (Paper II). Calanus spp are mainly found off Godthåbssfjord, while the smaller copepods are found in the inner fjord. Cladocerans and rotifers were mainly found in Kapisigdlit Fjord, where the key fish species capelin and cod spawn. Sixteen larval fish species were found in the area, and 3 main assemblages were identified according to their similarities, which are related to the hydrographic zones. Fish larvae may benefit from the estuarine circulation to distribute themselves from the spawning areas through the Godthåbssfjord. The diet of the larval fish species varied markedly along the fjord. Prey sizes preferred to impact the distribution and transport of fish larvae and were positively correlated to their mouth sizes. American plaice and sandeel were probably not compete for food with other fish species since these, contrary to other species, had high preference for microplankton. Capelin larvae from Kapisigdlit Fjord and Disko Bay emerged from the spawning sites when the sea surface temperature reached 6°C, this temperature was reached 1 month later in the northern locality though (Paper III). Their highest pelagic abundances were found when the sea surface temperature reached 8°C. Larval growth rate differed between the two localities, larvae growing faster in the northern Disko Bay than in Kapisigdlit Fjord.

Apparently, the later emergence of larvae in the northern locality was compensated by a higher growth rate, so the capelin larvae could reach the appropriate larval stage and size for overwintering. With respect to diet of capelin larvae, the feeding incidence was found to be greater than 50% and we found a broader spectra of prey taxa than seen in other investigations (Paper IV). The dominating prey items in both localities are: numerically, the rotifers and cyclopoid copepodites, and harpacticoid nauplii in Kapisigdlit only; while in terms of biomass, calanoid nauplii and cyclopoid copepodites dominated in both localities. The prey size spectra calculations show some feeding on microplankton, invertebrate eggs and rotifers for the smaller larvae, but the main organisms of preference – and of importance as biomass consumed – were calanoid nauplii and cyclopoid copepodites.

The findings indicate that capelin and cod larvae were not competing for food as their prey size spectra do not overlap. While cod is preying on larger organisms as they develop, the increase in maximally preferred prey size showed a slower increase during growth of the capelin larvae. Cyclopoid copepodites are food source for both capelin and cod, and there might be some competition for this item, however this plankton group is very abundant in the west coast of Greenland. However, the competition for food seems to be greater between cod and other fish larvae. With capelin, competition with other fish larvae seems to be minor. The increase in water temperatures in west of Greenland may impact the capelin stocks. When larval emergence is linked to temperature, and the initiation of productive cycles is linked to the break-up of ice cover and the subsequent irradiance increase in the water column, climatic changes in Arctic regions could lead to a mismatch between larval emergence and optimal conditions for their feeding and growth. Thus it would be feasible to investigate the capelin stock genetic characteristics in these areas, to evaluate the potential impact generated by the global warming because of the importance of the capelin for the food web in the west coast of Greenland.

General information
Publication status: Published
Organisations: National Institute of Aquatic Resources, Section for Marine Ecology and Oceanography
Contributors: Malanski, E.
Number of pages: 168
Publication date: 2016

Publication information
Publisher: DTU Aqua. Institut for Akvatiske Ressourcer
Original language: English