

A comparative study of early life stages of Northeast Arctic cod and Norwegian coastal cod: Growth and survival in replicated common garden mesocosms



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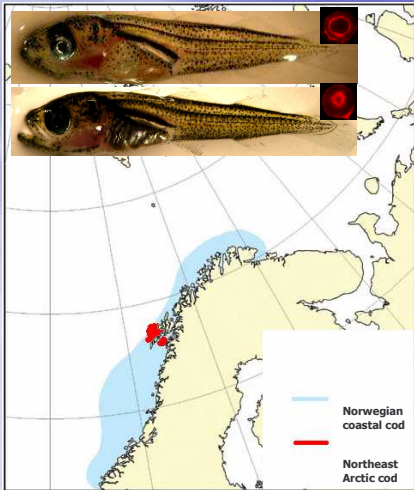
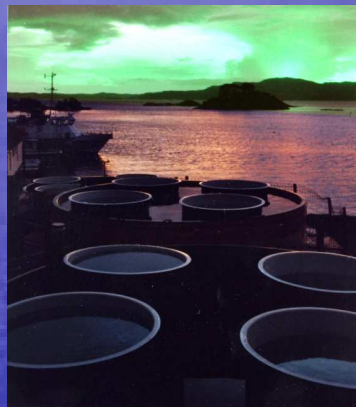


Figure 1 Sampling area for the families of the two populations of cod in the experiment. Insert shows examples of an NC (upper) and NA (lower) cod at approximately 17 mm. In the right corner a picture of the otolith alizarin mark are presented.

Introduction

Earlier work have demonstrated differences in specific growth rates in early life stages (ELS) of cod (*Gadus morhua*) and other species (Conover 1990, Otterlei et al. 1999, van der Meeren and Jørstad 2001). To what extent does this indicate differential selection forces during ELS?

Here, we evaluate growth and survival of Northeast Arctic cod (NA) and Norwegian coastal cod (NC) in replicated mesocosms under different feeding conditions, and furthermore evaluate if size and development would be an advantage in the different conditions.



Materials and methods

Families from the NA population were based on wild fish from Vesterålen, while families from the NC population were based on wild fish from different fjords from Møre and northwards (fig. 1).

The two populations were reared together with a 6 day older NA cohort (mixed) in high (HC) and low feeding regimes (LC) (initially 2000 and 200 prey/l), in addition to being reared separately in HC treatments (non-mixed). The larvae were fed natural zooplankton, and the two stocks were identified in the mixed groups by otolith marking and sampled weekly until 47 dph.

Results

- NA larvae had larger initial size and survived better than NC larvae (figs. 2 and 3).
- In the common rearing mesocosm both populations suffered high mortality. The highest mortality was in the LC treatments (fig. 2).
- NA larvae had a higher growth rate initially (fig. 3), but the two groups was not significantly different in size at the end of the experiment.
- Comparison with the model suggested by Folkvord (2005) indicated that NC larvae grew suboptimal throughout the experiment (fig. 4). NA larvae grew close to their physiological limits during large parts of the experiment, except at the end.
- NC larvae was heavier at length than NA larvae (fig. 5).

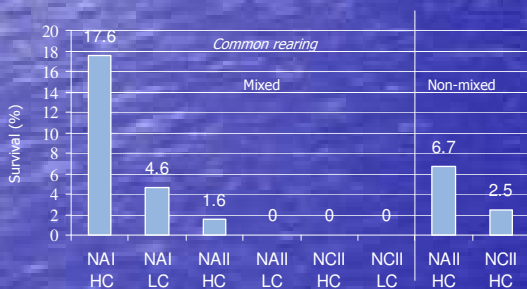


Figure 2 Survival at termination in the different groups. NA and NC denotes the two populations, HC and LC denotes the two different feeding regimes while I and II denotes cohort one and two respectively.

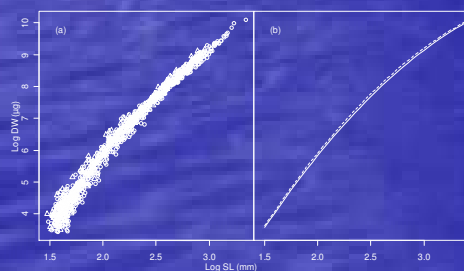


Figure 5 Weight-at-length (a) for all observations from the experiment with NA larvae denoted with circle and NC larvae denoted with triangle, (b) and models for NA larvae (solid line) and NC larvae (dashed line).

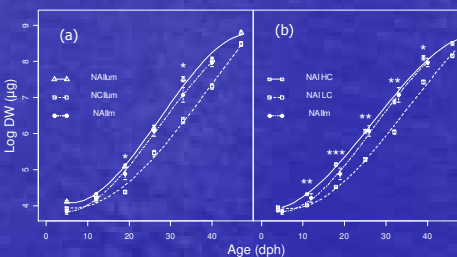


Figure 3 Size at age for the different groups.

- Groups from the second cohort in the mixed (denoted by m) and non-mixed (denoted by um) mesocosms.
- Groups from the mixed mesocosms. The second cohort (NAIIm) are observations from HC treatment.

Coastal cod from the mixed mesocosms are not presented due to few observations (n=3)

* denotes significant differences in weight in nested ANOVAs (not including NAIIIm)

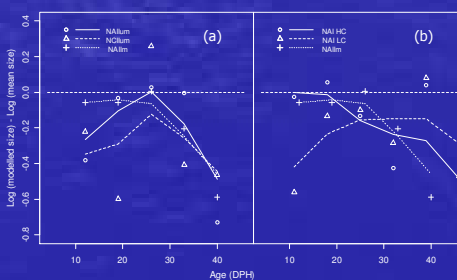


Figure 4 Difference between modeled size (Folkvord 2005) and mean size for

- Groups from the second cohort.
- Groups from the mixed mesocosms.

Discussion and conclusion

- In contrast to earlier findings we found that NA larvae had a higher growth and lower survival than NC larvae, thus stock-specific growth differences does not seem to be very large at early larval stages.
- The more elongated body of NA observed here already at larval stages may be an adaptation for migratory life cycle, indicating that selection occurring at subsequent stages may affect the growth, energy allocation and form of the larva.
- The differences in survival between the mixed and non-mixed tanks may suggest size-selective mortality before possible inter cohort cannibalism could have occurred. Thus, small size differences may have large impacts on survival at ELS in common garden rearing.

References

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