

# Importance of prey abundance and size spectra

## for growth and survival of larval cod

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### Introduction

Recent studies have suggested that survival of larval cod is related to fluctuations in the plankton community (Beaugrand et al. 2003). A key factor in the prey availability is the prey size spectra which is thought to vary with the composition of plankton (Pope et al. 1994). The objective of our experiment was to study the effect of prey concentration and prey size spectra on growth and survival of cod larvae.

### Methods

The experimental setup consisted of 8 tanks (2500 liter). Four treatments were employed, with two different prey concentrations (high and low) and two different prey size spectra (wide and narrow). To achieve the difference in spectrum, a plankton filter was used to separate "large" and "small" plankton. Cod larvae in narrow spectrum tanks were only fed small plankton, while larval cod in wide spectrum tanks were fed 90% small and 10% large plankton. Thirty larvae were sampled with a tube from each tank once a week over a two month period. Standard lengths were measured in all larvae, and guts were examined on half of the sampled larvae (fig. 1).

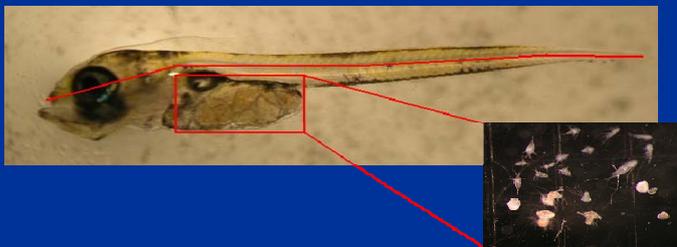


Fig. 1 Standard length was measured from the snout to the end of the notochord. Stomachs were dissected and the ingested prey items were photographed and measured.

### Results

Zooplankton size increased in the large fraction (LF) filtrate throughout the experiment (fig. 2). In the small fraction (SF) filtrate, size increased until day 35, but decreased at the last sampling. Mean zooplankton size ranged from 0.21 to 0.5 mm in the SF, and 0.37 to 0.89 mm in the LF.

Larval cod with access to both small and large prey (wide spectrum) generally ate larger prey than cod larvae with access to only small prey (ANOVA,  $p < 0.05$ ) (fig. 3). In addition, larval cod in the low concentration treatments ingested prey of a wider size range than in the high concentration treatments (ANOVA,  $p < 0.05$ ).

Larval cod grew better in high concentration treatments than in low concentration treatments (ANOVA,  $p < 0.05$ ). Size spectrum of prey did not have any significant effect on growth (ANOVA,  $p > 0.05$ ) (fig. 4).

Generally, larval cod survival was higher in the high concentration treatments than in the low concentration treatments (fig. 5). In addition, a trend of higher survival was found in the wide spectrum treatments than in the narrow spectrum treatments

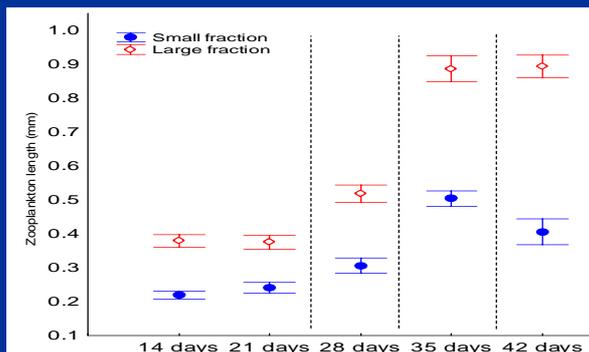


Fig. 2 Zooplankton size from the small (blue symbols) and large (red symbols) filtrate during the experiment. Bars represent 95% conf. interval. The dotted lines indicate change in filter mesh size.

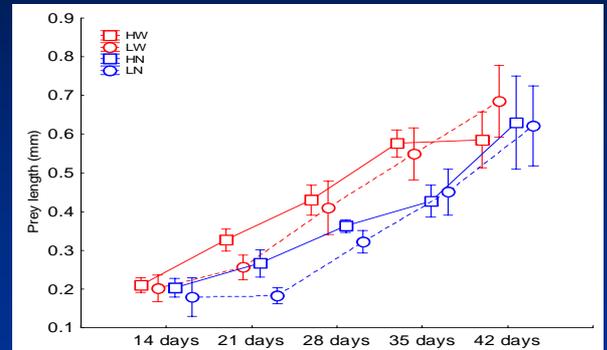


Fig. 3 Size of prey ingested by cod larvae in the different treatments. Bars represent 95% conf. interval. Red symbols are used for wide spectrum treatments, while blue symbols are used for narrow spectrum treatments. Solid lines indicate high concentration and dotted lines indicate low concentration treatments.

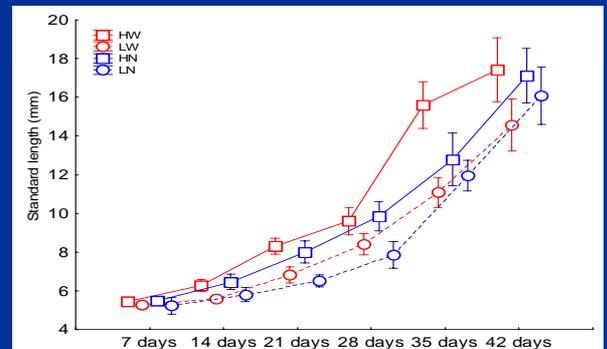


Fig. 4 Growth of cod larvae in the different treatments. Bars and symbols as in fig. 3.

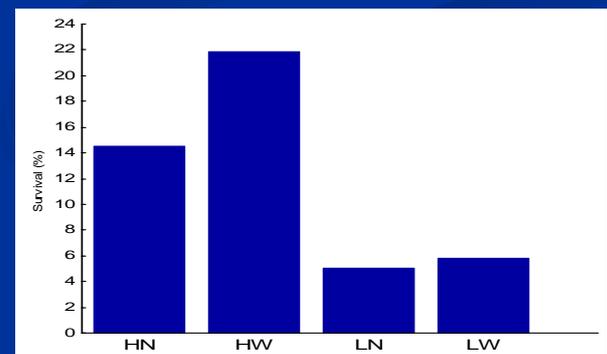


Fig. 5 Final survival of larval cod in the different treatments.

### Conclusions

- Larval cod include larger and larger prey items in their diet as they grow.
- In our experiment only prey concentration had an effect on growth of larval cod, however both prey concentration and prey size spectra probably interact to affect the survival of cod larvae.

### References

- Beaugrand G, Brander KM, Lindley JA, Souissi S, Reid, PC (2003). Plankton effect on cod recruitment in the North Sea. *Nature* **426**: 661-664.
- Pope JG, Shepherd GJ, Webb J (1994). Successful surf-riding on size spectra - the secret of survival in the sea. *Philosophical Transactions of the Royal Society of London Series B-Biological Sciences* **343**: 41-49.