

EFFECTS OF SIZE DISTRIBUTION, FEEDING AND LIGHT REGIME ON GROWTH AND SURVIVAL OF COD JUVENILES IN TANKS

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Introduction

Culture of Atlantic cod, *Gadus morhua* L., juveniles has been hampered by cannibalism and incomplete weaning during the early juvenile stage (Folkvord, in press). In the production ponds of juveniles the plankton supply will eventually become limiting (Blom *et al.*, in press). If this occurs before the juveniles can be readily weaned onto artificial diets, cannibalism will develop (Folkvord, in press). Increased size dispersion is a problem since it is not possible to grade the cod juveniles in the pond. We therefore designed two experiments to evaluate the effects of 1) initial size distribution and 2) light and feeding regime, on growth, survival and cannibalism of juvenile cod.

Materials and methods

The experiments were carried out in black 180 l circular tanks with conical bottoms. The two experiments lasted 16 and 37 days and the temperature averaged 8.5 and 9.6°C, respectively. The fish came from a juvenile production pond (Blom *et al.*, in press) and averaged 0.5 and 0.9g at the start. The stocking density was 50 fish/tank and 1mm granulate commercial dry feed was supplied in excess (every 8min, 24h per day). Five or six replicates were used per treatment. In the first experiment we used four size distribution categories: hand-graded (minimum variation), apparatus-graded, apparatus-graded plus two larger siblings (on average 50% longer) and apparatus-graded plus 10 larger siblings. In the second experiment (all apparatus-graded) we used three different feeding (F) and light periods (L) per day (16F-16L, 16F-24L or 24F-24L). In addition we used four different feeding frequencies: fish were fed every 1, 8 or 32 min or manually fed (three or four times a day).

Results

Initial size distribution had a pronounced effect on survival ($P < 0.001$, one-way ANOVA, range 18-96%). About 75% of the mortality was due to cannibalism. In tanks where 10 larger siblings were added most of the remaining 40 fish were eaten during the 16 day experimental period (Fig. 1). Average growth rates were also closely related to mortality

rates because of selective removal of smaller individuals. The average daily growth rate ranged from 3.5 to 11.5% in the tanks with the lowest and the highest cannibalism rates respectively.

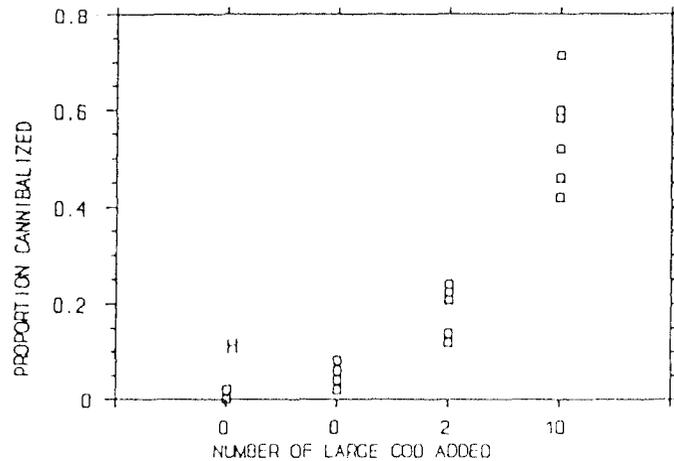


Fig. 1. Proportion cannibalized versus number of large cod added per tank. H indicates tanks with hand-graded fish.

In the second experiment no effects of feeding and light hours were found on survival or average growth ($P < 0.05$, 1-way ANOVA). There were also no significant differences between the feeding frequencies tested ($P < 0.05$, 1-way ANOVA). Overall survival was 80% (range 50-96%) and the average daily growth rate 2.7% (range 2.2 -3.4%/day). About 25% of the mortality was due to cannibalism.

Discussion

The results clearly show the dramatic effect on cannibalism and survival of size differences among equally aged cod juveniles on cannibalism and survival. We therefore strongly recommend grading of small cod juveniles to avoid problems related to size-dispersion. This implies an earlier harvest of smaller juveniles from the production ponds. The survival during weaning will be lower if it takes place at an earlier stage (Otterå and Lie, in press), but overall survival may be higher due to a shortened period of intense cannibalism.

References

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