Who gets tired first, the hungry or the satiated?

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Introduction

The anti-predatory behaviour of satiated and hungry larval herring was studied during repeated attacks with a glass probe. Predation and starvation are believed to be the main mortality agents in the early life history of fishes (Bailey and Houde, 89), and it seems likely that these two factors interact in causing the high and variable mortality. The object of this study was to see if the nutritional status of the larvae could influence the behaviour and modify the probability of larval escape.

Materials and methods

Individual herring larvae, starved for 0 and 5 days, were put in an flow-through aquarium (fig. 1) in a random order. The aquarium had a laminar waterflow with the highest watercurrent close to the inlet. One minute after transfer the larvae were exposed to repeated attacks with a handheld black glass probe for maximum 4 minutes. The attacks were directed behind the head of the larvae, approximately 90° to the larva's body axis. The larvae were attacked when they were in free watermasses The position of the larvae, whether the larvae reacted or not, and the distance of the flight response were recorded for each attack. Two experiments were run where starved and fed groups were of different size and/or age (table 1), to separate the hunger effect from the size effect on the results.

Table 1. Summary of experimental design.

Exp.	*Purpose*	*Date*	*Age (dph)*		*n*	*Mean SL (mm)*	
			fed	*starved*		*fed*	*starved*
1	larvae of	7-8/6	61-62	61-62	67	24,6	23,2
	similar age	10-11/6	64-65	64-65	76	25,4	24,0
2	larvae of	21-22/6	54-55	59-60	75	26,9	26,5
	similar size	24-25/6	57-58	62-63	79	28,0	28,0
	but different age	28-29/6	61-62	66-67	75	29,4	29,4

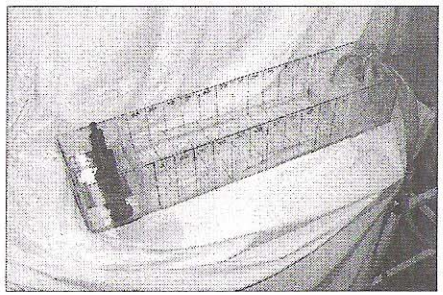

Fig. 1. Test aquarium. Inlet is to the right.

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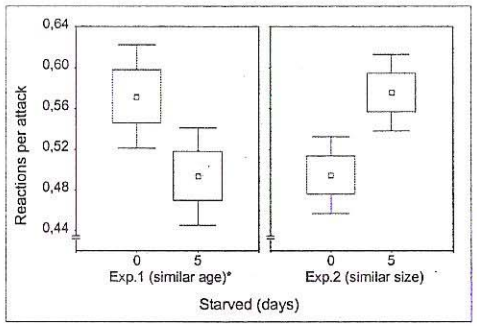

Fig. 2. Mean (+/- SE and 1,96 SE) reactions per attack.

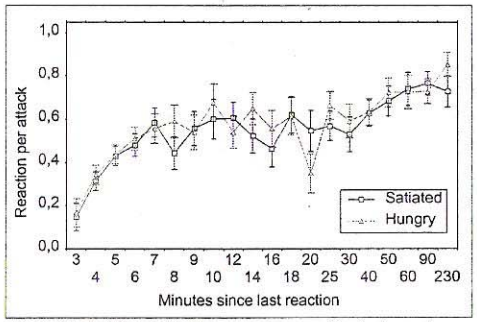

Fig. 3. Mean (+/- 1,96 SE) reactions per attack relative to time since last reaction.

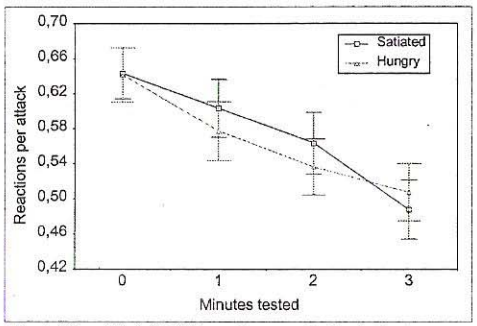

Fig. 4. Mean (+/- 1,96 SE) reactions per attack relative to minutes tested.

Results

There was a significant difference in response between hungry and satiated herring larvae. The hungry larvae reacted more often per attack than younger satiated larvae of similar size (fig. 2). When the hungry larvae were smaller than the satiated but of the same age they reacted less (true for one of the test dates only). There was no significant difference between the groups in neither flight distance nor position in the test aquarium. Both starved and hungry larvae got tired. The probability of reaction was low for both groups when the time since last reaction was less then 7 minutes (fig. 3) and the number of reactions per attack declined over time (fig. 4). There were no difference between hungry and satiated larvae in these variables.

Discussion

The results indicate that larvae starved for 5 days are well able to escape a predator, and that the energy expended is not very different from that used by satiated larvae (fig. 3 and 4). It seems likely that the difference in reaction probability between hungry and satiated larvae is due to the difference in age. The otic bulla and the swimbladder, which are important for the sensory capacity of the growing larvae, develop within the size range used in this experiment. Growth and development of larval fish have been argued to be more closely associated with length than with age (Fuiman, 1989). However, when growth is inhibited due to starvation, development of sensory organs and nerve cells may still continue for some time (Folkvord et al., 1998), and explain why starved, but older larvae, reacted more often than satiated.

Summary

- *Larvae starved for 5 days are well able to escape a predator*
- *Hungry larvae of similar size, but older that the satiated, reacted more often to attacks*
- *So who got tired first?*

The answer is: Both got tired, but none of them before the other...

References

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