THE EFFECT OF DIFFERENT SHORT PULSE FEEDING REGIMES ON GROWTH AND SURVIVAL OF ATLANTIC BONITO LARVAE *Sarda sarda*

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Introduction

One of the most easily manipulated variables in fish larval culture is the photoperiod. Long light photoperiod regimes are commonly used to enhance growth in commercial species. However, for species with a piscivorous larval period, as the Atlantic bonito *(Sarda sarda)*, long time exposure to light could lead to a lower survival through aggressive behavior and cannibalism. One alternative could be modifications of the light and dark cycles during the photophase. These modifications can result in short pulse feeding regimes since bonito larvae fill up their stomach completely during light hours but do not feed in darkness. Little is known about how such intermittent feeding regimes affect growth and survival in fish. In this study, we tried different alternating and continuous light regimes during the culture of bonito larvae to identify the best regime that maximizes growth and survival.

Materials and methods

Fertilized eggs of Atlantic bonito were obtained from different spontaneous spawning events by a captive broodstock at the Spanish Institute of Oceanography (IEO) in Mazarrón. Bonito larvae 8 days post hatch (dph) were reared in 150 l tanks equipped with a lid that was used to cover and uncover the tanks to manipulate the hours of light and therefore pulse feeding regimes. Bonito larvae were always fed with yolk sac seabream larvae *ad libitum*. A total of three experiments were conducted. In all, a continuous dark period of 7.5hours was maintained from 24:00 to 7:30. All light regimes had a total of 9 light hours except for one that had 15hours of light (15L:9D).

In the first experiment, light regimes provided alternating light and dark conditions of either 1.5, 3 or 4.5hours from 7:30 to 24:00 (Table I). In the second experiment, the 3hours alternating light regime was compared to two continuous regimes of 15hours of light (15L:9D) and 9hours of light (9L:15D). These two experiments were conducted at the same temperature, 24.7±0.4°C. The third experiment was identical to the second experiment but at colder temperatures, 21.4±0.45°C. All regimes had 3 replicates. 10 larvae were sub-sampled 3 days after the experiments began and were ended after 6 days when all larvae were sampled. Due to slower growth, the third experiment ended after 9 days. The larvae were measured in standard length and individual dry weights were calculated. Larvae were counted in the tanks every 3 days to estimate survivorship.

Results

Final larval sizes in the alternating light regimes were larger in the 3hours than those obtained in the 1.5 and 4.5hours (first experiment, Fig. 1a, Tukey test $p<0.01$). Larvae from the continuous 15L:9D and the alternating light regime of 3hours were larger already 3 days after the onset of the experiment compared to the 9L:15D (second experiment, Fig. 1b, Tukey test $p<0.01$). These differences increased towards the end of the experiment when larvae of the continous15L:9D regime were also larger than those from the alternating 3hours (Fig. 1b, Tukey test $p<0.01$). However at the lowest temperature, larvae reared under 15L:9D and 3hours regimes needed 6 days to be significantly larger compared to the 9L:15D (third experiment, Tukey test, $p<0.01$). Survival rates varied between 30-40% and were not significantly different between any of the regime (Tukey test, $p>0.01$).

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Table I. Light regime schedules, crosses for dark and white spaces for light hours. The different treatments consisted on three alternating light regimes of 1.5, 3 and 4.5hours respectively and two continuous light regimes of 9L:15D and 15L:9D.

Treatments	Regimes	7:30	9:00	10:30	12:00	13:30	15:00	16:30	18:00	19:30	21:00	22:30	24:00
ALTERNATING LIGHT	1.5		xxxxx		xxxxx		xxxxx		xxxxx		xxxxx		xxxxx
	3			xxxxx	xxxxx			xxxxx	xxxxx			xxxxx	xxxxx
	4.5				xxxxx	xxxxx	xxxxx				xxxxx	xxxxx	xxxxx
CONTINUOUS LIGHT	9L:15D							xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
	15L:9D											xxxxx	xxxxx

room lights switch on (7:30) — room lights switch off to 7:30 (24:00)

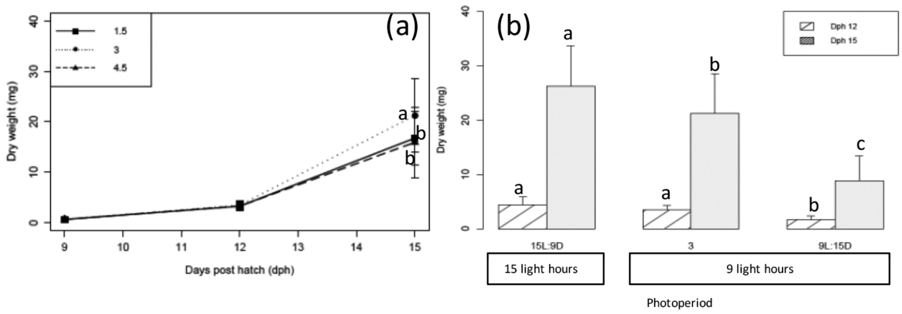

Figure 1. Mean dry weight (mg) of *Sarda sarda* larvae a) on dph 9, 12 and 15 reared at alternating light regimes of 1.5, 3 and 4.5hours, and b) on dph 12 and 15 at two continuous light regimes (15L:9D and 9L:15D) and an alternating regime of 3hours. All experiments were conducted at 24.7±0.4°C. The different letters indicate significant differences between treatments ($p < 0.01$) at a given age.

Discussion and conclusions

The 3hours alternating light regime yielded the largest larval sizes at the end of the experiment compared to the other alternating regimes. Final sizes at the 3hours regime were larger than those obtained under the 9L:15D continuous light regime at both temperatures. The time to satiation and the elapsed time to evacuate food totally from the gut in a similar species is about 3-4hours (Young and Davis, 1990). Our results suggest that a better strategy for bonito larvae growth is to fill their stomach more than once per day followed by a resting period when food is being digested. However, no effect was observed in terms of survival, possibly due to high abundance of larval prey. Changes in the light regime that result in pulse feeding can be a good strategy to increase growth in larval cultures when fitting well the evacuation and satiation rates.

References

Young JW. and TLO. Davis. 1990. Feeding ecology of larvae of southern bluefin, albacore and skipjack tunas (Pisces: Scombridae) in the eastern Indian Ocean. Marine Ecology Progress Series 61:17-29

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