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Influence of Salinity on the Growth and Feed Utilization in *Liza parsia* Fry

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Abstract

Liza parsia is one of the euryhaline species of finfish cultivated in the low saline coastal waters of India. Since salinity influences growth and food intake in euryhaline species, an experimental study was carried out to determine the effect of salinity levels 5‰ to 35‰ on growth and food conversion in *Liza parsia* fry. Salinity levels ranging from 5 to 25‰ did not significantly influence the survival (88.3% to 93%) but 30 to 35‰ salinity levels provided relatively low survival rates of 79.7 and 78% respectivley. Under the restricted ration (8% of body weight) food intake was not significantly influenced by salinity. Growth and food conversion rates were significantly influenced by salinity, levels 15 to 25‰ providing the best growth. This study shows that though *L. parsia* fry can tolerate salinities from 5‰ to 35‰, levels above 25‰ seem to be unfavourable for normal growth and feed utilization.

Introduction

In an excellent review, Kinne (1971) discussed the diverse effects of salinity on euryhaline species. Salinity is known to influence the distribution and abundance, survival and growth, as well as maturation and spawning of a variety of euryhaline species (Pearse and Gunther, 1957; Gunther, 1961). Responses of euryhaline fish species to environmental salinity changes have been well documented from the wild, with major emphasis on salinity induced variations in distribution. However, there is paucity of experimental evidence concerning the effects of salinity changes on euryhaline finfish. Knowledge of the response of cultivated finfish species to salinity changes would be of immense value in coastal aquaculture, especially in selection of sites as well as in maintaining desirable salinity levels, to achieve maximum survival, growth and efficient utilization of ingested food.

Ever since the pioneering experimental study on *Cyprinodon macularius* (Kinne, 1960) several attempts have been made to evaluate the influence of salinity on growth, food intake, food conversion, nutritional requirements or biochemical changes in the organs and tissues of euryhaline finfish (De Silva and Perera, 1976, 1985; Mukhopadhyay and Karmakar, 1981; Teshima *et al.*, 1984; and Jurss *et al.*, 1984, 1986). The ability to tolerate waters of a particular salinity varies, amongst other things, with the stage of development of the fish (Holliday, 1971). Hence, experimental studies are essential to ascertain the salinity preferences of different growth stages of fish. The objective of the present study was to understand the effect of salinity on survival, growth and feed utilization in the fry of the cultivated mullet, *Liza parsia*.

Material and Methods

The mullet fry for the experiments were collected from the estuarine creeks of Vypeen Island, Cochin, using a velon-screen net and transported under oxygen packing to the experimental facility. They were acclimatised for 48 hours in ambient salinity (13‰).

Sea water (35‰) for the experiment was collected from off-shore regions and the desired saline media was prepared by dilution. Salinity concentrations were measured with an American Optical Refractometer. The fry were segregated size-wise and transferred to circular plastic tubs (50 cm dia) and acclimatised to test salinities for one week. Fifteen fishes (3.3 ± 0.3 cm total length and mean weight 0.434 g) were maintained in each of the three replicates per treatment. Individual fish weights were recorded after acclimatization. Water was aerated and temperature and salinity monitored daily. Water change was made once in two days. The fishes were maintained for 45 days and fed with a semi-moist purified diet, at 8% of the body weight, once a day at 0900 hrs. and the left-over food collected next morning. Group fish weights were recorded every 15 days and the ration supplied was adjusted accordingly. Analysis of variance was carried out on the data to examine the effect of salinity on growth and conversion efficiency. Students 't' test was used to find out the significance in results between the different treatments.

Results and Discussion

Data on food intake obtained from different treatment groups are given in Table 1. Food intake was not significantly affected by salinity levels when the restricted ration was offered. Food consumption depended on weight of fish.

Growth of the Fish (Fig. 1) was significantly influenced by the salinity level. The maximum weight gain (0.543 ± 0.018 g) was at salinity 15‰, followed by almost similar gains at

20‰ (0.512 ± 0.043 g) and 25‰ (0.536 ± 0.028 g). Lower and higher salinity levels produced inferior weight gains. Analysis of variance indicated that salinity content of the medium has highly significant ($P < 0.001$) effect on weight gains. Significant difference was noted at 5, 10, 30 and 35‰ when compared to the weight gains in the range 15-25‰ ($P < 0.01$). The food conversion efficiency also was significantly affected by salinity. Salinities which resulted in good conversion ratios in the descending order are 25, 15, 20, 10 and 5. Gross conversion efficiency (Fig. 2) was comparable among salinity levels of 15, 20 and 25‰, while in other treatments they were significantly lower. Survival rates (Table 1) ranged from 78 to 93%. While there was no significant differences in survival rates between salinities 5 and 25‰, significantly low rates were observed at salinities 30‰ (79.7%) and 35‰ (78%).

Seasonal salinity variations are pronounced in estuaries, backwaters and lagoons of India, and therefore *Liza parisa* which is cultivated in coastal ponds is exposed to wide changes in salinity. The results indicate the salinity of water has significant influence on survival, growth and food-conversion efficiency of *L. parsia* fry. Salinities ranging from 5 to 35‰ are usually encountered in their nursery grounds. However, the fry had high survival rates at S‰ 5 to 25‰ indicating their preference for lower salinity levels. The results of the acclimatization tests indicate that the fry are not probably capable of regulating the internal osmotic and ionic concentration in fresh water.

Growth rate recorded from various salinity treatments indicate that for maximum growth the fry require relatively narrow ranges (15 to 25‰) of salinity. The gross conversion efficiency data also indicate that the above salinity range is ideal for better utilisation of ingested food. Thus salinity ranges of 15-25‰ is bio- energetically advantageous to the fry. The significantly lower gross conversion efficiency at higher and lower salinity levels indicate that the fish fry expend a greater proportion of the ingested food energy for maintainence and routine metabolism than for growth.

Usually salinity tolerances tend to decrease as test temperatures and concentration of dissolved gases decrease (Kinne, 1971). In the present study all treatments were maintained under almost similar laboratory conditions and hence not discussed further. However, variations in the ionic composition of various saline media as a result of mixing of fresh-water might influence tolerance levels. Besides, differences in salinity may also modify the specific gravity of water which may result in differences in swimming effort and activity levels (Holliday, 1971). These factors may necessitate diverting a certain amount of energy for physiological adjustment by fish which otherwise would have been used for tissue building.

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Table 1. Growth, conversion efficiency, and survival of *Liza parsia* at different salinities.

Salinity (‰)	Initial weight (g)	Final weight (g)	% growth per day (g)	Total dry food consumed	Food Conversion ratio	% Survival
5	0.421 ±0.030	0.793 ±0.032	1.96 ±0.14	1.764 ±0.107	4.74 ±0.26	88.3
10	0.433 ±0.049	0.874 ±0.058	2.26 ±0.22	1.882 ±0.194	4.32 ±0.32	90.7
15	0.436 ±0.020	0.979 ±0.005	2.77 ±0.22	1.975 ±0.072	3.64 ±0.20	93.0
20	0.429 ±0.033	0.941 ±0.055	1.65 ±0.29	1.899 ±0.205	3.70 ±0.25	90.3
25	0.428 ±0.010	0.964 ±0.034	2.78 ±0.13	1.925 ±0.153	3.59 ±0.10	89.7
30	0.432 ±0.024	0.793 ±0.070	1.86 ±0.26	1.923 ±0.136	5.49 ±0.96	79.7
35	0.456 ±0.035	0.820 ±0.051	1.77 ±0.13	1.877 ±0.177	5.15 ±0.42	78.0

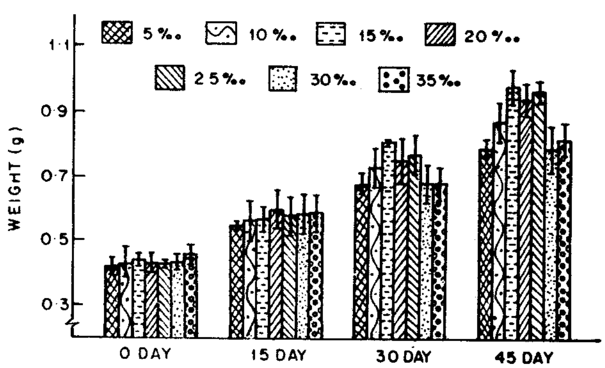

Fig. 1. Growth of *L. parsia* at different salinities

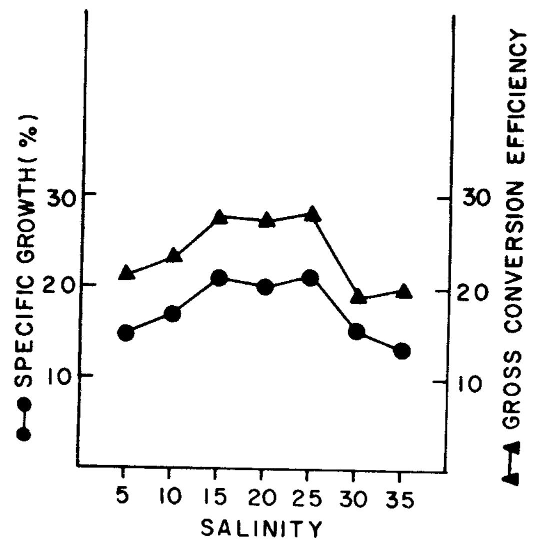

Fig. 2. Specific growth (weekly weight increment) and gross conversion efficiency of *L. parsia* exposed to different salinities.