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Some aspects of nursery rearing of the Asian seabass (*Lates calcarifer,* Bloch) in indoor cement tanks

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ABSTRACT

Asian seabass (*Lates calcarifer*) is a highly valued food fish of great culture potential. Nursery rearing of Asian seabass in indoor cement tanks was undertaken. Fish were fed on artificial diets at 4% body weight and four times feeding per day with periodical size grading. Mean weight and length at the end of the 45 days experimental period was 8.55 g and 91.03 mm, respectively. While survival rate was 100%, FCR and PER at the end of the 45 days experimental period was 1.15 and 1.07%, respectively. The results of various growth parameters studied showed that the values obtained were in conformity with earlier reports on nursery rearing of Asian seabass under varied rearing systems and growth conditions.

Keywords: Asian seabass, *Lates calcarifer*, Nursery rearing

Introduction

Asian seabass *Lates calcarifer,* also known as barramundi, is a catadramous species widely distributed in the Indo-West Pacific region from the Persian Gulf, throughout south-east Asian countries to Australia. Seabass has been cultivated in brackish as well as freshwater ponds and marine cages in many south-east Asian countries (Cheong, 1989). Asian seabass is an ideal aquaculture candidate species due to its high demand and rapid growth, and has been cultured successfully in Australia since 1980s (Partridge, 2008). Though cage culture technology for seabass has been established, grow-out techniques in ponds are still at infancy.

Asian seabass is a potential candidate species in India for rearing in closed recirculating systems as well as in floating cages because of its fast growth rate, ability to adapt to varying environmental conditions and its demand in domestic as well as export markets.

While many published reports are available on nursery rearing of *L. calcarifer*, reports on work done in India are scarce. The present study was conducted on growth performance and survival of seabass during nursery rearing in cement tanks, fed on artificial diets.

Materials and methods

L. calcarifer fingerlings

Ten thousand hatchery produced fingerlings of *L. calcarifer* were brought from Rajiv Gandhi Centre for Aquaculture, Sirkazhi, Tamil Nadu. The fingerlings (weight: 2.01 ± 0.53 g; total length: 55.58 ± 4.64 mm) were packed in aerated polythene bags (50/bag) containing 5l of seawater (salinity 28 ‰; pH: 7.8:, temperature: 28 ^{O}C) and transported to the nursery rearing tanks at Kumta, Karnataka by road. The transportation time was 19 h.

Rearing system

Immediately on arrival, the fishes were given a freshwater dip and placed in four cement tanks each of size 10’ X 6’ X 5’ containing 7000 l of seawater (2500 fingerlings/ tank) with continuous aeration. The juveniles were reared in nursery rearing tanks upto 45 days before they were shifted to open sea cages for further experiments.

Feeding regime

From second day onwards, the fish were fed commercial fish feed with a pellet size of 0.5 mm diameter at 4% of the body weight, four times a day (6.00 am, 12.00 pm, 6.00 pm and 12.00 am) for the first 15 days. Then the pellet size was increased to 1 mm for next 15 days while the feeding rate and frequency remained unchanged. For the remaining 15 days, the fishes were fed with a pellet size of 2 mm. Proximate analysis of the feed was done in the beginning of the experiment (AOAC, 1975). Eighty per cent of the water was replaced 5 min after feeding with 20 min flow -through thereafter. It was confirmed that the feed was consumed immediately after feeding with no visible feed pellets settled at the bottom.

Water quality parameters

Water quality parameters such as temperature, pH, salinity and oxygen were monitored daily using portable instruments, while critical parameters such as unionised ammonia (NH_3) and nitrite (NO_2) were measured fortnightly using titration methods as specified by APHA (1980).

Grading and fish samplings

The fishes were graded every 15 days with an automatic grader and grouped into three different sizes. After grading, representative samples were collected for studying growth parameters.

The following growth parameters were enumerated as per the methods described by Salama and Al-Harbi (2007).

Average Daily Growth Rate (ADGR g/day) = W_2-W_1/d,

where, W_2 is the mean weight of the fish in the following sampling, W_1 is the mean weight of the fish in the first or previous sampling and 'd' is number of days between samplings.

Specific Growth Rate (SGR) = $\ln W_2 - \ln W_1 / d \times 100$

where, $\ln W_2$ is the natural logarithm of the mean weight of the fish in the following sampling and $\ln W_1$ is the natural logarithm of the mean weight of the fish in the first or previous sampling.

Survival Rate (SR %) = $N_2/N_1 \times 100$

where, N_2 is the remaining number of fish and N_1 is the initial number of fish.

Biomass = Mean weight x Number of remaining fish.

Biomass Increase (BI) is calculated as the difference in the biomass in kilogram between sampling.

Feed Conversion Ratio, FCR = TFC/BI where, TFC is the total amount of feed (kg) consumed and BI is the biomass increase.

Protein Efficiency Ratio, PER = BI/TPC where, TPC is the total amount of protein consumed.

Results

Proximate composition of the feed is given in Table 1. Mean weight, mean length, ADGR and SGR of the seabass juveniles reared in indoor cement tanks, at 15 days interval are shown in Table 2. Mean weight and length at the end of the 45 days' experimental period was 8.55 g and 91.03 mm, respectively. ADGR and SGR at the end of the experimental period were 0.24 g and 3.22%, respectively. SR, FCR, BI and PER at 15 days interval are shown in Table 3. While SR was 100%, FCR and PER at the end of the 45 days experimental period was 1.15 and 1.07%, respectively. Ranges in water quality values measured during the rearing period are shown in Table 4. The values recorded were: temperature - 29.2 to 29.8 °C, pH - 7.2 to 7.4, salinity - 31.2 to 32.6 ‰, DO - 5.5 to 6 mg l^{-1}, ammonia -0.02 to 0.03 mg l^{-1}, and nitrite 0.01 to 0.02 mg l^{-1}.

Table 1. Proximate composition (%) of the feed on dry matter basis

Proximate composition	Percentage
Dry matter	91.86
Moisture	8.14
Crude protein	38.43
Ether extract or crude fat	3.18
Crude fibre	3.03
Nitrogen free extract or soluble carbohydrates	48.11
Ash or total minerals	7.25
Acid insoluble ash or sand and silica	0.33

Table 2. Mean growth, Average daily growth rate (ADGR) and Specific growth rate (SGR) of Asian seabass juveniles at 15 days interval

Days	Mean weight (g) ± SE	Mean length (mm) ± SE	ADGR (g)	SGR
15	2.60 ± 0.51	64.19 ± 5.46	0.014	0.59
30	5.86 ± 0.68	74.18 ± 6.16	0.21	5.41
45	11.50 ± 0.88	91.03 ± 7.18	0.37	5.05

SE: Standard Error

Table 3. Survival rate (SR), Feed conversion ratio (FCR) and Protein efficiency ratio (PER) of Asian seabass at 15 days interval

Days	SR (%)	FCR	BI (kg)	PER (%)
15	100	1.50	2.2	0.37
30	100	1.20	32.6	2.10
45	100	1.17	82.4	2.21

Table 4. Water quality parameters recorded during the nursery rearing of *L. calcarifer*

Days	Temperature (°C) ± SE	pH ± SE	Salinity (‰) ± SE	Dissolved oxygen (mg l^{-1}) ± SE	Nitrite (mg l^{-1}) ± SE	Ammonia (mg l^{-1}) ± SE
0 day	29.2± 0.2	7.2±0.1	32.6±0.4	5.5±0.58	0.015±0.002	0.02±0.002
15 day	29.8±0.2	7.4±0.2	31.2±0.5	6.0±1.26	0.020±0.004	0.02±0.004
30 day	29.4±0.3	7.2±0.1	32.4±0.2	5.5±0.86	0.015±0.008	0.03±0.002
45 day	29.2±0.2	7.2±0.1	32.6±0.2	5.5±0.14	0.015±0.002	0.02±0.002

SE: Standard Error

Discussion

The present study has amply demonstrated the feasibility of rearing hatchery grown seabass juveniles in indoor cement tanks, fed on artificial diets at 4% of the body weight. The study also demonstrated that Asian seabass juveniles reared under these conditions showed the values of different growth parameters like ADGR, FCR, SR, SGR and PER comparable to previous reports on seabass juveniles reared under different growth and feeding conditions.

Salama and Al-Harbi (2007) observed that the FCR of fingerlings of *L. calcarifer* reared in hyper saline conditions increased with increase in feeding rate while better FCR and PER were achieved with increase in feeding frequencies. Highest FCR (1.34) was achieved with 4% feeding rate while highest FCR (1.74) and PER (1.65) were achieved with 4 times feeding. The authors also reported 100 % survival at the above feeding rate and feeding frequency. Harpaz *et al.* (2005) reported that *L. calcarifer* reared in freshwater in plastic tanks showed reduced growth rate at 2% feeding level and no improvement in growth when fed at 6% feeding level while optimum growth was obtained at 4% feeding level. However, Pillay (1990) observed that rapidly growing Asian seabass frys (0.25 g) required a feeding rate of as much as 10% of their weight, but as they grow and reach about 4 g, a feeding rate of 4% was sufficient. It is reported that feeding fish with insufficient amount of food results in poor growth rate since most of the food is used only for body maintenance (NRC, 1977).

Results obtained by feeding Asian seabass juveniles at 4 times feeding per day in the present study are in conformity with earlier reports in seabass and other teleost fishes. Chan (1979) obtained similar results in common carp where better growth was reported at feeding frequency of 3 or 5 times a day. In the case of cat fish, the final average weight of groups fed 4 times daily was significantly higher than 2 times daily feeding (Hashim, 1994). However, Boonyaratpalin (1997) and Alava (2002) recommended a feeding frequency of 3 times a day for Asian seabass to obtain optimum growth. Harpaz *et al.* (2005) also reported better values of growth parameters in Asian seabass fed 4 times a day. These authors also observed that feeding times had no effect on growth rate of Asian seabass juveniles reared in plastic tanks with conical bottom. Barlow (1993; 1995) reported that Asian seabass reared in outdoor ponds exhibited a distinct feeding pattern by consuming feed throughout the day when fed on live feed, with a noticeable peak during dusk and cessation of feeding in total darkness. However, the results Harpaz *et al.* (2005) showed that the feeding time (day vs. night) did not substantially affect the growth rate of the fish when fed on pelleted feed. They also clearly showed that Asian seabass juveniles, kept in closed systems, are capable of shifting to feeding during the night. It is possible that the overall growth rate of the Asian seabass in the present study could be negatively affected at least to some extent by size grading and counting.

Catacutan and Colaso (1995) observed that *L. calcarifer* fingerlings fed on a diet containing 50% protein and 15% lipid showed best FCR (1.01) and SGR (5.99) while, those fed with a diet containing 42.5% protein and 10% lipid showed comparable growth rate and significantly better PER (2.03). Survival rate was 100 % in both the cases. However, in the present study, similar values were obtained with 38.43% protein and 3.18% lipid.

It can be noted that the water quality parameters were within the limit prescribed by Rimmer and Russel (1998) for nursery rearing of Asian seabass. In addition to other factors, optimum water quality parameters also would have contributed for 100% survival rate observed in the present study.

Major problems that are commonly encountered during culture period are cannibalism during juvenile stage (Katavic *et al*., 1989). Present study clearly demonstrated that proper feeding rate, feeding frequency, water quality and periodical size grading can help to get rid of cannibalism and obtain maximum survival rate and growth.

Since nursery rearing is the most critical phase in seabass culture, the present study has established that Asian seabass juveniles can be reared in indoor cement tanks fed on artificial fish feed. Better values of various growth parameters including a survival rate of 100% were obtained in a 45 days rearing period.

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