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Growth and Survival of Indian Salmon *Eleutheronema tetradactylum* (Shaw, 1804) in Brackish Water Pond

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ABSTRACT

This study was conducted to assess the growth performance and survival rate of a commercially important finfish *Eleutheronema tetradactylum* in 100 m^{-2} of sandy clay brackish water earthen ponds. Wild 36.14 g of *E. tetradactylum* juveniles were stocked at 0.5 individuals m^{-2} and cultured for 45 days by feeding trash *Muraenesox* sp. (pike eel) at 12 h intervals. Average body weight of *E. tetradactylum* was found 75±5.6 g for treatment ponds and 65±3.57 g for control ponds at the end of experiment. Feed Conversion Ratio (FCR) was 2.3 with the survival rate of 70-80% at the end of the culture in the experimental culture ponds. The results of the present study suggest that the production of four finger thread fin could still be increased up to the marketable size if it is done for 5-6 months culture period by feeding trash fish.

Key words: Aquaculture, *Eleutheronema tetradactylum*, coastal belt, four finger thread finfish, earthen pond

INTRODUCTION

The fish *Eleutheronema tetradactylum* (Shaw, 1804) is commonly known as Indian salmon or four finger thread finfish in English, 'Sahal' in West Bengal (Patnaik, 1969) and 'Rishi Kuchi' or 'Thailla' in Bangladesh. It is one of the most important fish not only in the Bay of Bengal of Bangladesh but also in Kuwait, India, Thailand, Vietnam, Malaysia, Singapore, Myanmar, Cambodia and Northern Australia and Indonesia (Quddus and Shafi, 1983). This carnivorous fish is available in the coastal belt of Chittagong, Cox's Bazar, Barishal, Patuakhali, Chandpur, Noakhali and various coastal Islands of Bangladesh. Besides, this fish is commonly found in the coastal shallow water of the Bay of Bengal, Indian Ocean and play vital role in the national economy (Malhotra, 1953).

The demand of *E. tetradactylum* in the national markets is high and growing fast. This fish is one of the highly esteemed table fish both at home and abroad. Therefore, there is great potentiality of the culture of this species in the coastal area of tropical and sub-tropical countries. Besides, the fish *E. tetradactylum* farming could be established in the coastal area as a ready alternative to shrimp farming, the industry of which is presently beset with problems of diseases and environmental degradation. While some studied on other polynemid fishes elsewhere (Prasad *et al.*, 2005), in mariculture field there is very little scientific information on

E. tetradactylum biology (Moyle and Cech, 1988), ecology (Starr, 2004) and culture. Hence, the objective of this study was to investigate the growth and survival of *E. tetradactylum* in the earthen pond toward introducing of new candidate for the development of aquaculture in the abandoned coastal shrimp culture ponds in the tropics.

MATERIALS AND METHODS

The present experiment was conducted in the earthen coastal ponds of PC Park Hatchery (a commercial private firm) at Cox's Bazar, Bangladesh from November 2007 to January 2008. Six 1.5 m in depth earthen ponds (10×10 m) prepared by bamboo fence were selected for this experiment. Three ponds were used as Treatment (T) while others were used as Control (C). All ponds were prepared by cleaning trashes and exchanges of water for 2 to 3 times. The fingerlings of *E. tetradactylum* were collected from the traditional shrimp culture ponds where it grows as by products. The fingerlings of *E. tetradactylum* with the size of 36.14 g were stocked at 0.5 individuals m^{-2} in each culture pond for 45 days experimental trails.

Feeding methods, rates and frequency: Aside from the live food available in the culture ponds, the chopped trash pike eel *Muraenesox* sp. was applied every day at the rate of 5% of the total body weight of *E. tetradactylum* (Biomass) in the pond. Half of the total feed was applied in the morning and the other half in the afternoon through spreading by hand. The feeding rate was monitor through checking in the feeding tray after two hours post feeding. In control ponds, no feed was given.

Collection of fish and production parameters: Ten live fish were collected from each pond at every fifteen days intervals thus a total of ten samples were used to determine the body weight, specific growth rate and mean daily growth rate and feed conversion ratio following Agouz and Anwer (2011). The weight of fish was determined to the nearest gram.

Collection and analysis of pond water: Water quality parameters were measured *in situ* at fifteen days intervals throughout the culture period. Water salinity, pH and temperature were estimated by refractometer (o~100, OSK, Japan), pH meter (Hanna, Italy) and mercury thermometer respectively. A Secchi disk to nearest cm determined transparency of water following Hossain *et al.* (2007).

Surface (<0.5 m depth) water samples were collected from each culture pond. The collected samples were preserved by HCl for further analysis and brought back to the IMSF laboratory in an icebox. Dissolved Oxygen (DO) and Total Suspended Solid (TSS) was determined by Agboola *et al.* (2008).

Data analysis: Simple t-test was used to compare the means of two sets of observations both at treatment and control ponds using SPSS version 10. Correlation regression analysis was used to find out the best physico-chemical parameters for fish growth during the culture period in ponds.

RESULTS

Physico-chemical parameters of experimental ponds: The physico-chemical parameters of the culture ponds were considered to be the same for all treatment and control ponds since all the experimental ponds are situated in the same water environment. The dissolved oxygen

Table 1: Physico-chemical conditions of water in the earthen culture ponds of *E. tetradactylum*

Parameters	Initial	After 15 days	After 30 days	After 45 days
Water temperature (°C)	24	20	22	19.5
Water pH	6.8	6.9	6.7	6.8
Salinity (‰)	20	23	24.5	26
Dissolved oxygen (mg L^{-1})	7.1	6.9	6.5	6.8
Transparency (cm)	19	24	30	28
Total suspended solid (mg L^{-1})	512	438	562	533

Table 2: Growth performance of *E. tetradactylum* during culture period

	Control pond		Treatment pond	
Parameter	Mean	Range	Mean	Range
Specific growth rate (% day^{-1})	1.19^a	1.03-1.42	2.9^b	1.54-4.35
Average daily growth rate (g day^{-1})	1.14^a	0.56-1.77	1.92^b	1.14-2.80
Survival rate (%)	70^a	60-80	80^b	70-90
Feed Conversion Rate (FCR)	-	-	2.3	1.46-3.05
Final weight of fish (g)	65.0^a	55.0-75.0	75.0^b	58-140

Means in the different columns with different letter of superscripts are significantly different (t-test, $p<0.05$)

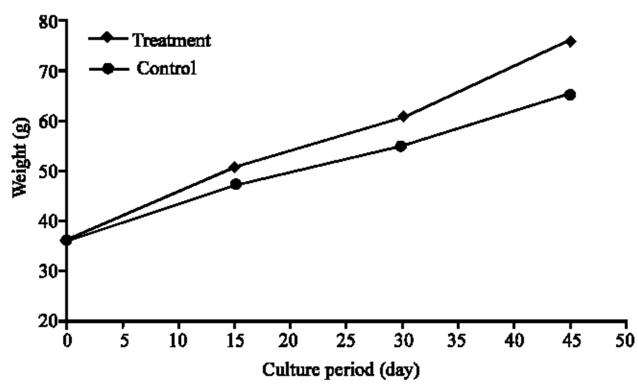

Fig. 1: Weight gain (g) of *E. tetradactylum* during the experimental period

concentration ranged from 6.5 to 7.1 mg L^{-1} during the experimental period. Water temperature ranged from 19.5 to 24°C, pH was from 6.7 to 6.9, while salinity ranged from 20 to 26‰. The salinity of pond water influenced ($r = 0.97$, $p<0.05$) the growth of fish during the culture period. Owing to the buffering capacity of brackish water, there was no major fluctuation of pH during the culture period in the culture ponds. Total Suspended Solid (TSS) and transparency ranged from 438 to 562 mg L^{-1} and 19 to 30 cm, respectively. The water transparency and total suspended solids were fluctuated toward the progress of culture while no remarkable differences were observed during the experimental period (Table 1).

Growth performance and production parameters: The highest average daily growth rate (1.92 g day^{-1}) and specific growth rate (2.9% day^{-1}) were achieved in the treatment ponds than the control (Table 2). Usually, weight gain of fish was higher after the one-month of the culture starts (Fig. 1). The average survival of *E. tetradactylum* was 80% with the range of 70-90%. Significantly

($p<0.05$) highest survival rate (80%) was achieved in the treatment ponds (T) followed by control (70%) while the feed conversion ratio was found to be 2.3 at the end of culture period (Table 2).

DISCUSSION

Physico-chemical parameters of pond water: The physico-chemical factors of water are very important in any aquaculture operation, especially in any controlled culture condition. The concentrations of DO fluctuated during the culture period and never dropped below critical levels (<2.0 mg L^{-1}) in the present experimental culture ponds. The DO level was within the suitable range for the growth of culture species i.e., fish. The water pH value 7.0 is desirable in many aquaculture systems. Tovar *et al.* (2000) noted that acidic pH condition of water affects the survival and growth of culture species. Lower pH also affects the reproductive maturity of fish while the acceptable pH range for fish culture is normally 6.5 to 9.0 as observed by Mohapatra *et al.* (2007) which supports the present findings. Meade (1989) stated that pH standard for aquaculture is 6.5 to 8.0. The water pH recorded in the present investigation ranged from 6.5 to 6.9 which is within the ranges considered by Tovar *et al.* (2000) and Mohapatra *et al.* (2007). The water salinity was between 20 and 26‰ of the ponds cultured. Studies observed a direct influence of salinity on the growth of fishes elsewhere (Boeuf and Payan, 2001) and this is also the case for the present study. Correlation regression shows that salinity in pond water probably an influential factor ($r = 0.97$, $p<0.05$) on the growth of fish. In contrast, this however, may not be due to salinity alone because, the ecosystem of ponds was completely altered during the culture operation with the changes in transparency, total suspended solids, dissolved oxygen, BOD and water nutrients (Amirkolaie, 2008).

The fluctuation of Total Suspended Solid (TSS) and transparency in water were rarely caused by plankton bloom in the culture ponds. Hariati *et al.* (1996) stated that transparency is inversely related to the concentration of algae and suspended particulate matters. The buildup of uneaten feed, faeces, humic acid and tannic acid in the culture ponds may increase the TSS and decrease the transparency. Total suspended solid and transparency in pond water also depends on the quality and amount of sediment in the supplied water. Since both experimental culture ponds were situated in the stagnant water body, therefore, TSS and transparency may not be affected by the supplied water quality. Studies by Boyd (1979) suggested that 25-60 cm of water transparency is acceptable for fish culture. The transparency of water governed the light penetration into the pond which is related to total suspended solids. Total suspended solids influenced the levels of chlorophyll that in turn depend on nutrients. These ecological linkages in the pond are related to algal growth and concentrations of biological oxygen demand. Generally, the increasing TSS through the activities of culture system normally affects the primary productivity of ponds and production performance of culture species.

Growth performance of *E. tetradactylum*: The equation that predicts weight gain of fish was; weight gain (g) = 6.45 (salinity)-94.75%. This equation revealed that increase salinity may affect positively on the weight gain of fish in the ponds and probably salinity could be an important factor for the culture of this fish. Therefore, further study on the effect of salinity on the growth of *E. tetradactylum* is needed to clarify this statement. The average daily growth rate of fish was marginally higher in the treatment ponds compared to controls. Observation showed that the variation in fish growth within the ponds was probably related to the natural food availability and level of total suspended solids during the earlier of culture period. Fuss and Ogren (1966) stated that the differences in growth rate of aquatic organisms are probably due to water quality, stocking density and other environmental factors which probably the case for present study. This study demonstrated that *E. tetradactylum* was capable to grow nearly 80 g in one and half months with the stocking density of 0.5 individuals m^{-2} in ponds. The average daily growth rate (0.56-2.80 g day^{-1}) of present study was comparable with the findings reported elsewhere while satisfactory (80%) survival rate was achieved (Mohapatra *et al.*, 2007).

Feed is one of the most important components in grow out of fish. The feed conversion rate was related to stocking density as well as culture duration of the ponds. Sometimes, lower food conversion rate is achieved because of the presence of natural food availability in the culture ponds. Nevertheless, this contribution on Feed Conversion Ratio (FCR) and total fish production is inevitable which is still unknown in the earthen culture pond and needed future study to clarify this idea. The FCR values in this study were comparable to those obtained from the culture ponds of sea bass in the coastal area of Bangladesh (Professor Nani Gopal Das Personnel Communication).

CONCLUSION

The development of marine fish culture in subtropical and tropical countries is however, very slow and less dominance. Therefore, there is great hope and commercial importance for the culture of marine finfish in the coastal belt of those countries. This study concludes that the production in the present experiment for four finger thread fin could still be increased up to the marketable size if it is done for 5-6 months culture period. If the higher yielding culture technology (mono or poly) of *E. tetradactylum* becomes established in the coastal abandon shrimp ponds of sub-tropical and tropical countries with encouraging economic profits for farmers, a noteworthy and huge fish industry could come forward.

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