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PRE-GROWOUT CULTURE OF ASIAN SEABASS *LATES CALCARIFER* (BLOCH) IN LOW VOLUME CAGE IN BRACKISHWATER ASHTAMUDI LAKE UNDER PARTICIPATORY MODE WITH TRADITIONAL FISHERMAN

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Abstract: Degradation of ecosystem and depleting fisheries resources together lead to poverty and marginalisation of traditional fishermen depending on open water bodies. Challenges related to depleting fish wealth of Ashtamudi lake has been reported to affect livelihood of fishermen using traditional methods of fishing. A pre-growout culture of Asian seabass was initiated in participation with traditional Chinese dip net fishermen in order to assess feasibility of seabass culture in low volume net cages in Asthamudi lake, Kollam District, Kerala. Fingerlings of Asian seabass (avg wt., 8 g) produced at fish hatchery, Muttukadu experimental station, CIBA, were transported in oxygen packing (5 nos/5 l) involving a transport duration of 18 h. Hundred numbers of seabass were stocked in a low volume net cage of dimensions, 1.5 x 1.5x 1.5 m and mesh size, 22 mm. Fish were initially fed twice a day @ 20% bodyweight initially approximately on trash fish obtained from the Chinese dip net owned by the fisherman. Periodic samplings were conducted to assess growth potential and survival of the fish in the small volume cage model. Size based segregation into 2 groups was done at the end of 60 days and the fish were stocked into two separate cages of equal volume, cage 1 was stocked with fish above 70 g (40 numbers) and cage 2 with fish below 70 g (20 numbers). Small seabass below 15 g were separated. At the end of the 90 day pre-growout culture, the fish attained a final average body weight of 182.07±10.94 g, with a specific growth rate of 3.38±0.08 % day^{-1}, an avg. weight gain percentage of 2175.8±136.7 and an overall survival of 63 %. The average body weight of cage 1 and 2 were 214.04±8.47 g and 95.75±8.75 g respectively. The results showed the feasibility of carrying out pre-growout culture of seabass in low volume net cages and highlights the prospects of adoption of small scale cage culture of Asian seabass as a livelihood option for augmenting the income of the traditional fisherfolk depending on the open water bodies.

Key words: Cage culture, Asian seabass, *Lates calcarifer*, livelihood, Ashtamudi lake

INTRODUCTION

Small scale fisherfolk who have contributed little to the causes of climate change will be the first to feel the negative impacts of climate change on fish and the ecosystem on which the fish and the fisherfolk depend for their livelihood and sustenance. The major threats that are anticipated include falling productivity, species migration and localized extinctions, as well as conflict over use of scarce resources, increased risks associated with more extreme climatic events (Williams and Rota, 2009). These negative impacts of climate change make the small scale fishing communities vulnerable (Islam *et al.*, 2013) especially in the lower latitudes. The brackishwater Ashtamudi lake in Kerala supports the livelihood of many traditional small scale fisherfolk including many Chinese dip net fishermen who carry out subsistence fishery in these waters. It has been widely reported that the problems related to reclamation, pollution and sand mining have had a major impact on the ecology and the fish resources of the lake indirectly affecting the livelihoods of fisherfolk using traditional methods of fishing (The Hindu, 2013).

Aquaculture can play a central role in poverty and hunger alleviation, however the initial investment costs, ownership of land or access to

water resources and technology restricts the poor from accessing these benefits through diverse aquaculture initiatives or provides limited benefits through extensive culture of relatively low value fish. However, case studies suggest that the production of high value fish in cages is emerging as a promising option for the poorer sections to improve their livelihood through aquaculture (Sheriff *et al.*, 2008). This may be especially true in case of cage culture in inland or brackishwater systems where the initial investment for cages is lower as compared to marine systems. However, for effective adoption of aquaculture technologies by the poor and new entrants in the developing countries, the use of participatory rather than technology-driven approaches have been found be highly convincing (Edwards, 2000).

With these background a feasibility study was conducted to assess the growth performance of Asian seabass during pre-growout culture in low volume-cages as an additional livelihood strategy for traditional fishermen.

MATERIALS AND METHODS

Selection of fisherman for study was done based on the information provided by the Department of Fisheries, Govt. of Kerala regarding performance and involvement in projects initiated by the state fisheries department and after personal site visits to understand the feasibility of setting up the cage in the location and safety from poaching related problems.

The study was conducted at Ashtamudi lake, Kochuthuruthu, Kollam, Kerala. The cages used in the study were simple fixed nylon cages 1.5x1.5x1 m; mesh size 22 mm, supported by PVC pipe framework at the cage bottom and top. The cage was fixed by wooden poles driven into the bottom of the water body. The cage costed approximately Rs. 4500 and was fabricated by the fisherman himself. The cages were placed at approximately 1.5 m depth. The site was selected in the vicinity of the fisherman's house to ensure protection from poaching and placed strategically to ensure gentle and steady water flow through the cages.

Hundred numbers of Asian seabass fingerlings (avg. wt. 8 gm) produced at fish hatchery, Muttukadu experimental station, Central Institute of Brackishwater Aquaculture (ICAR), Chennai were transported in oxygen packing (5 nos/5 l) involving a transport duration of 18 h. Hundred numbers of the fish were stocked per cage. Fish were initially fed twice a day @ 20% bodyweight approximately on trash fish obtained from the Chinese dip net owned by the fisherman. Periodic samplings were conducted to assess growth potential and survival of the fish in the small volume cage model. Size based segregation into 2 groups was done at the end of 60 days and the fish were stocked into two separate cages of equal volume. At the end of 90 days of trial, the body weight of all the fish and survival were recorded. Weight gain (%) was calculated as [(final weight- initial weight)*100/ initial weight]. Survival rate (%) was calculated as [100- (number of fish stocked- number of fish harvested) x 100/ number of fish stocked)]. Specific growth rate (% day^{-1}) was calculated as [ln (final weight of fish)- ln (intial weight of fish) x 100]/ days of culture. Daily growth coefficient (DGC) was calculated as 100 x [final body weight $(g)^{1/3}$-initial body weight $(g)^{1/3}$)/days of culture. Coefficient of variation $_{weight}$ was calculated as standard deviation $_{final\ body\ weight}$ x 100/mean $_{final\ body\ weight}$.

RESULTS AND DISCUSSION

Seabass fingerlings were reared for 90 days in low volume cages in brackishwater Ashtamudi lake in participation with a traditional fisherman. After 60 days of culture seabass fingerlings were segregated based on size into 2 cages, cage 1 was stocked with fish above 70 g (40 numbers) and cage 2 with fish below 70 g (20 numbers). Few small seabass below 15 g were separated. At the end of the 90 day pre-growout culture, the fish attained a final average body weight of 182.07±10.94 g, with a specific growth rate of 3.38±0.08 % day^{-1}, an avg. weight gain percentage of 2175.8±136.7 and an overall survival of 63 % (Table 1). The average body weight of cage 1 and 2 were 214.04±8.47 g and 95.75±8.75 g respectively. The percentage of survival could have been slightly improved with an initial grading being conducted after 30 days of stocking and a major fraction of losses can be attributed to cannibalism.

Table 1. Growth and survival of Asian seabass *Lates* calcarifer fingerlings after 90 days of pre-growout culture in low volume-net cage in participation with traditional fisherman at brackishwater Ashtamudi lake, Kerala.

Initial weight (g)	8
Biomass at stocking (g)	800
Final weight (g)	182.07±10.94
Biomass at harvest (g)	11470.41
Weight gain (%)	2175.8±136.7
SGR (% day^{-1})	3.38±0.08
Daily growth coefficient (DGC)	184.97±11.78
Coefficient of $variation_{weight}$ (%)	37.13
Survival (%)	63

In a similar study on cage culture of Asian seabass (3.5g) for 120 days using more sophisticated cages (6m dia, 6m depth) as per the requirements of marine culture conditions, and a feed constituting of chopped shrimps and trash fish, an average weight gain of 315.5g, an SGR of 3.75% and an average survival of 20 % were obtained. It has been observed by the authors that the growth rate was maximum during the last phase of the culture period and that seabass enters the exponential growth phase post 100 g size (Imelda-Joseph *et al.*, 2010). In comparison the specific growth rate obtained in the present pre-growout culture is slightly lower (3.38±0.08 5 day^{-1}) yet comparable to the earlier study. In contrast, the specific growth rates have also shown a steady but declining trend (Fig 1). In a similar experiment on nursery rearing in marine floating net cages (15 m dia, 4.5 m depth) seabass attained 113.75 ± 57.05 g weight from an initial weight of 1.19 ± 0.07 g in a period of 145 days with an overall survival of 81% using live artemia, artemia flakes and shrimp feed (Maheswarudu *et al.*, 2011). In experiments on nursery rearing in small hapas (2x1.5 x 1 m) in brackishwater ponds seabass juveniles (2.5-3 cm) stocked at 1500-2500 nos per hapa fed on chopped trash fish, pellet feed resulted in attaining an average body weight of 90-120 g in 90 days, an overall survival of 90% was recorded (Shoji Joseph *et al.*, 2011).

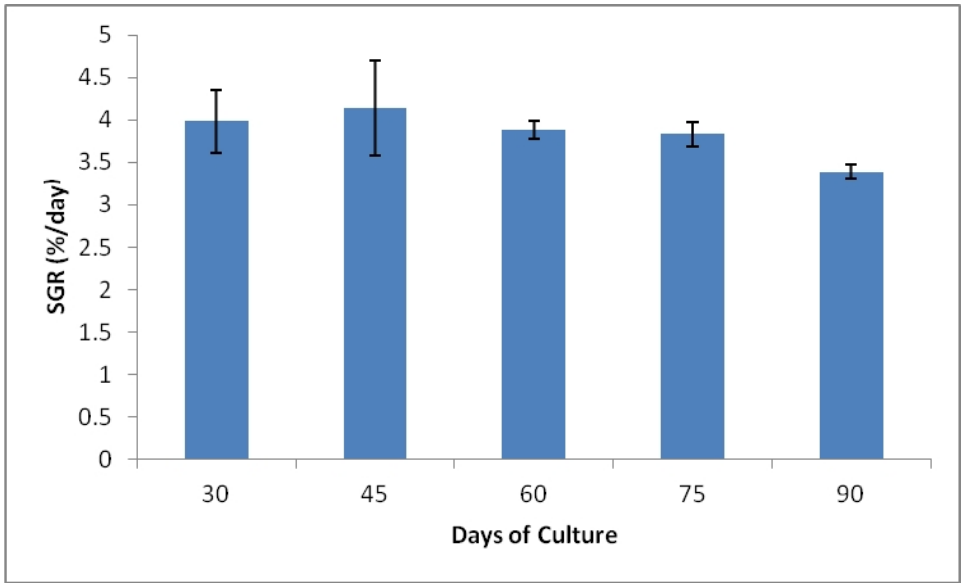

Fig. 1. Specific growth rate of Asian seabass fingerlings in low volume cage culture during 90 days.

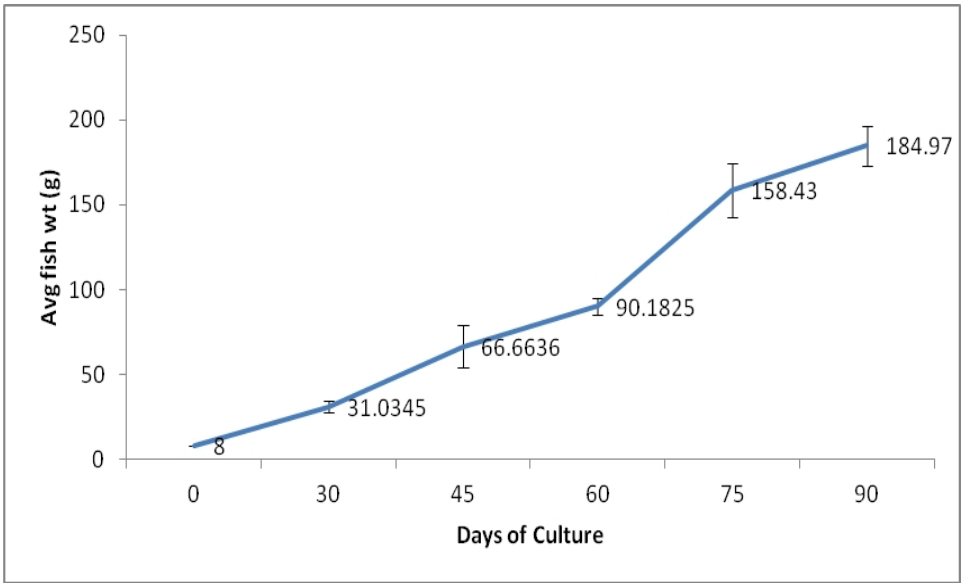

Fig 2. Average body weight of Asian seabass fingerlings in low volume cage culture during 90 days

Average body weight attained during each sampling in this trail is presented in Fig.2. Thus, we observe some variability in different studies based on environment, feed and growth stage of the fish cultured in cages. However, it can be concluded that the growth performance of seabass fingerlings in low volume cage system was comparable to the different studies.

It is also observed that involvement of fisherfolk in cage culture of seabass a promising livelihood strategy considering their access and constant presence in the open water systems on which they depend, enabling them to keep steady guard to avoid poaching related problems which is a major challenge in cage culture of high valued fish species. In the present study, the fishermen used trash fish (small shrimps, anchovies) obtained as by-catch in Chinese dip net to feed seabass, which were earlier either discarded or fed to ducks. Involvement of fisherfolk in seabass cage culture has the advantage of minimising culture costs as the feed forms the major fraction of the operational cost in seabass aquaculture. This is due to the steady availability of trash feed to fishermen which can be used as feed for seabass or other carnivorous fish during cage culture. Increase in the number of fishermen and depleting fish stocks have resulted in lower catch per unit efforts and fluctuating landings causing high insecurity to the livelihood of fishermen. This feasibility study of small scale pre-growout cage culture trail in low volume cages conducted in participation with a traditional fisherman promises that the culture method can be an additional livelihood strategy for small scale traditional fishermen who are facing numerous challenges due to depleting fish stocks in addition to the anticipated future challenges posed by climate change impacts.

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