Pre Grow-out Rearing Systems in Farming Operations

T. Senthil Murugan
Karwar Research Centre of Central Marine Fisheries Research Institute,
Karwar - 581 301, Karnataka, India
email: drtsenthilmurugan@gmail.com

Marine finfish production is a promising industry all over the world and has significantly increased over the years and currently accounts for 394,580 tonnes, valued at nearly US$ 512 million, with China being the largest producer (FAO, 2009). Currently, salmons are the dominant species of temperate waters for cage culture. Tropical marine finfish cage culture is relatively new but is expanding, particularly in Asia. Marine finfifsh species like cobia, grouper, pompano, snappers, seabreams and seabass represent the major potential candidate finfish species for mariculture in Asian countries. In India, the production of marine finfish through aquaculture has started from 2003 onwards and gradually being increased by the introduction of several species of marine finfish having great potential in International market. Cage culture in India has been initiated by Central Marine Fisheries Research Institute, Govt. of India during 2007 by introduction of high value marine finfsihes and could succeed in large scale production of Asian seabass, cobia, grouper, pompano and snappers. In order to scale up the culture activities all over India and commercialization of the cage industry, availability of fish seed and also rearing them upto stockable size in cages is the most essential part before introducing into cages.

SIGNIFICANCE OF PRE GROW-OUT REARING:

Pre grow-out rearing is the most important phase for cage farming of marine finfishes where the fish fry (1-2.5 cm in size) can be reared to juvenile size (8-10 cm). In nurseries, the fry/fingerlings can be stocked at higher densities and reared in order to save the space and time in grow-out phase. In this transitional phase, grading of fish is the most important to avoid cannibalism, acclimatization and weaning to artificial feed and also to adapt to the environmental conditions that could be provided in the grow-out systems. It is a well established fact that the juveniles from the nurseries show better performance of growth and survival than those stocked directly into the grow-out ponds.

TYPES OF PRE GROW-OUT REARING:

The nursery rearing can be carried out either in earthen ponds, happas or cages, indoor cement tanks or fibre tanks.

Pre grow-out rearing in earthen ponds: The most important factor to be considered in nursery rearing of fingerlings to juvenile stage in earthen ponds is size of the pond which can accommodate a optimal stocking

density with a good water exchange system. The stocking density and size of fish to be reared are also important factors considered in nursery rearing in order to avoid cannibalism. Pond bottom should be flat and sloping towards the drainage gate. Ponds with a lower dike/area ratio support a higher standing crop at harvest, as supplementary feeding is the major food source toward the end of the nursing phase. Ponds are prepared and fertilized at one week before stocking, to eradicate predators and to enhance the primary production. Artificial pellet feed (6-8% of biomass) should be given twice a day as supplementary feed. The pond should be disinfected by applying quick lime and the quantity of the lime to be used also depends on the type of lime and age of the pond. Inlet and outlet gates are provided with a fine screen (1 mm mesh size) to prevent predators and competitors from entering and prevent the escape of the fry / fingerlings out of the pond. In general, the size of nursery pond ranges from 1000 to 2000 m^2 with a water depth of 80 – 100 cm. Fry ranging from 1.5 – 2.5 cm are suitable for stocking in nursery ponds. The fish after reaching 10-15 cm can be transferred to grow out cages.

Pre grow-out rearing in hapas: Fish Fingerlings can be stocked in nylon cage (2 x 1 x 0.9 m) with 0.1 mesh size; with a stocking rate of 1000 -1500 individuals and rearing can be done for a period of 45 days. The fish has to be fed with artificial pellet feed 2-3 times a day. Grading of fish is done every 7-10 days. The fish after reaching 10-15 cm can be transferred to grow out cages. It is advantageous to conduct nursery rearing of finfish in hapas because it enables closer monitoring and grading resulting in uniform size stocking and better survival compared to open-pond rearing. It is likewise easy to maintain and require very little capital investment.

PRE GROW-OUT REARING IN CAGES:

The fish fingerlings can also be grown to juvenile stage in 3 dia net steel cages. Fish seed procured either from hatchery or wild can be stocked at a density of 2,000 seeds / net cage and monitoring of the fish is easy in net cages. Artificial pellet feed has to be given @ of 6-8% biomass twice a day. The fish can be reared in cages for one to two months. The maintenance cost of the net cages is lesser than the hapas. The fish will grow faster in net cages than hapas as it facilitates more aerations and water movements inside the cages. During the nursery period, size grading should be conducted every 15 days to avoid cannibalism. At the same time, the net cages should be checked for damage to insure that fish do not escape. The fish can be transferred to grow out cages once they reach 10-15 cm.

PRE GROW-OUT REARING IN TANKS:

The best method of nursery rearing of finfish fingerlings to juveniles is by rearing them in cement or FRP tanks in marine hatchery systems. Fish fry or fingerlings which are transported carefully from a hatchery or wild by packing them in plastic bags. During the transportation care has to be taken for maintaining the temperature by using crushed ice and sawdust (1:1) throughout the transport. By this method, the temperature can be maintained between 20-22^{0}C, which avoids the stress and mortality during transportation. After reaching the hatchery, the fish are to be stocked with a density ranging from 2000 to 3000 fingerlings in cement tanks (10' X 6' X 5') or fibre tanks with a capacity ranging from 1 tonne to 5 tonnes based on the stocking density. The density of fish stocked in nursery rearing will be varied from size and species of fish. Continuous aeration is to be ensured throughout the rearing period. The fingerlings are reared in nursery rearing tanks up to 45 days before they are shifted to grow-out ponds or open sea cages.

Feeding regimes: During the nursery phase extruded slow sinking feed is preferred. Crumbled feed should be provided according to the requirements and subsequently the pellet size can be increased. The size

of the pellet during the nursery phase is highly correlated with the mouth size of the fry or fingerling. From second day onwards the fish should be fed with 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 has to be increased to 1 mm for next 15 days while the feeding rate and frequency remains unchanged. For the remaining 15 days, the fishes are fed with a pellet size of 2 mm. 100% water exchange should be done after feeding. It should be ensured that the feed is consumed immediately after feeding with no visible feed pellets settled at the bottom.

Grading and fish samplings:

Size selection or grading is necessary during the whole nursery period to avoid cannabolism and increase the survival of fish. Grading of fish should be done for once in a week with an automatic grader and grouped into different sizes. The mechanical grader available in the market can be used for grading the fries and fingerlings. This exercise will give more survival rate with better growth as the seabass fry are getting the suitable feed according to their mouth size. Also, the cannibalistic characteristics will drastically come down due to timely grading. Growth and health parameters of fish should be analysed at weekly intervals.

Water quality parameters:

Water quality parameters such as temperature, pH, salinity and dissolved oxygen should be monitored daily, while critical parameters such as ammonia (NH_3), nitrate (NO_3) and nitrite (NO_2) are to be measured fortnightly.

PRE GROW-OUT MANAGEMENT

Rearing the fry/fingerlings in confinement is subjected to adverse effects of over-crowding and ecological problems inherent in the culture system. As environmental parameters fluctuate and other factors extend its adaptive response, the fry attempts to maintain or re-establish its normal physiological behaviour. If this process is within the adaptive range the chance of survival of the fish will be high. The behavior and size distribution of the larvae and fry in the tank reflect the management and culture techniques that have been employed for the particular batch.

i. Swimming behavior

If the fry actively swim with head slightly downwards, and aggregate at the level near the bottom of the tank or at the certain level in the water column due to light activating, indicates healthy condition of fish fry/ fingerlings. Healthy fry also prefer staying at a certain distance from the aeration spot, and move actively.

ii. Feeding behavior

The healthy fry/fingerling shows fast swimming behavior around the tank seeking for food and accepts food vigorously. The fry swim slow and remain on the water surface after having enough food.

iii. Size distribution

If the stock is properly managed, the fry/fingerling are uniform in size. Under confinement conditions, the uneven growth of the fry promotes competition among the individuals for food, space and other essentials of survival. The resulting additive effects of stress on the smaller and weaker fry/fingerling, are witnessed by the dark to black color, making them more susceptible to infection or disease.

Uneven growth can cause a significant nursery mortality. The uneven growth could be due to the cannibalistic behavior of the species, dietary and environmental factors involved.

Pigmentation

The healthy fry have bright pigment and lively appearance. Head, body and tail are well developed. The survival rates of fish fingerlings are determined by temperature, salinity, light intensity, stocking density, feed and feeding, water quality, grading and cannibalism.

Grading techniques

Due to cannibalistic nature of the fish, size selection or grading or sorting is of prime importance. The first sorting should start at the second week, because during this period the bigger fish can eat the smaller ones. The easiest way of sorting is to use screen with various mesh sizes/mechanical graders so that the various sizes of fish can be separated easily. Stocking the same size of fish will reduce the rate of cannibalism, thus the survival rate will be increased and the growth rate of the fish could also be faster and more uniform.

References:

Krupesha Sharma, S. R., Praveen Dube and K. K. Philipose. 2012. Nursery Rearing of Asian Seabass. In Hand Book on Open sea cage culture. Edited by K.K.Philipose, Jayasree Loka, Krupesha Sharma, Divu, D. Central Marine Fisheries Research Institute, ICAR, Govt. of India. www.cmfri.org.in.

FAO: Regional sea farming project. RAS/86/024. Training Manual on Marine Finfish Net cage Culture in Singapore.