Nursery rearing of seabass fry and importance of grading and seed transportation

Shoji Joseph

Central Marine Fisheries Research Institute, Post box No. 1603
Ernakulam North P.O., Kochi- 682 018, Kerala, India
sjben@yahoo.com

The Asian seabass (*Lates calcarifer*) is an important food fish and a potential aquaculture species in tropical countries. It exhibits catadromous habits within its areas of distribution. It is an advantageous culture species because after early larval rearing in seawater, it can be cultured in all levels of salinity, from fresh to seawater, and in a variety of culture systems from open ponds and cages to flow-through and closed recirculation systems. In addition, this species produces large number of eggs that can be reared intensively on fresh and pelleted feeds, and can reach a market size of 350 to 700 g in one year or less periods under optimum culture conditions.

Seabass spawn naturally in captivity and the fertilized eggs take 12 to 15 hours for hatching. The spherical eggs range from 0.74 to 0.80 cm in diameter with a single oil globule from 0.20–0.28 mm in diameter (Maneewong and Watanabe, 1984). The mouth opens when the larvae get to about three days old and the yolk has been almost completely absorbed. This is a sign that the fry can start to feed.

Seabass larvae and juveniles

Seabass is a carnivorous voracious feeder; and it is highly cannibalistic in the earlier stages like larvae and juveniles. Food and feeding are two of the most important factors that affect the survival rate of seabass larvae as well as juveniles. In case of inadequate feeding times not only the lack of food but also the cannibalism will work together and the survival rate will be lower in double effects. The larvae or juveniles cannot survive if there is inadequate supply of food, which comprises various live organisms, and that again varies with the development of the larvae. Most of the food that seabass larvae feed on is composed of live zooplankton. The larvae first begin to feed on rotifer. It is reported that other kinds of food have also been tried with the early larvae but without success. The supply of live zooplankton is expensive and sometimes causes problems because zooplankton culture needs time, facilities and skills. Further, the different kinds of live food required must be prepared in time to satisfy the need of the fast-growing larvae. To maintain a high survival rate, the feeding schedule for the larvae must be closely adhered to.

Nursery Management

Tank

Seabass fry and fingerlings should be reared in concrete tanks up to the size 2.5 cm or 1 inch. After that, they can be transferred for rearing in nylon net cages until they attain 25 cm or 10 inches in about 2 to 3 months of culture

period. The rearing tank should be cleaned up every time before using. The rates of water replacement in the rearing tanks depend on feeding period of each age stage. In the period of rotifer feeding to prevent the loss of rotifer through the outlet, approximately 10–20 percent of the water in the rearing tank is drained out only for the replacement of rotifer supply each day. During *Artemia* feeding period, approximately 50 percent of water is changed while almost complete change is made during trash fish feeding period. The sediment of dead organisms, larvae or leftover food is siphoned out everyday. The management of seabass nursery is shown in Fig.1.

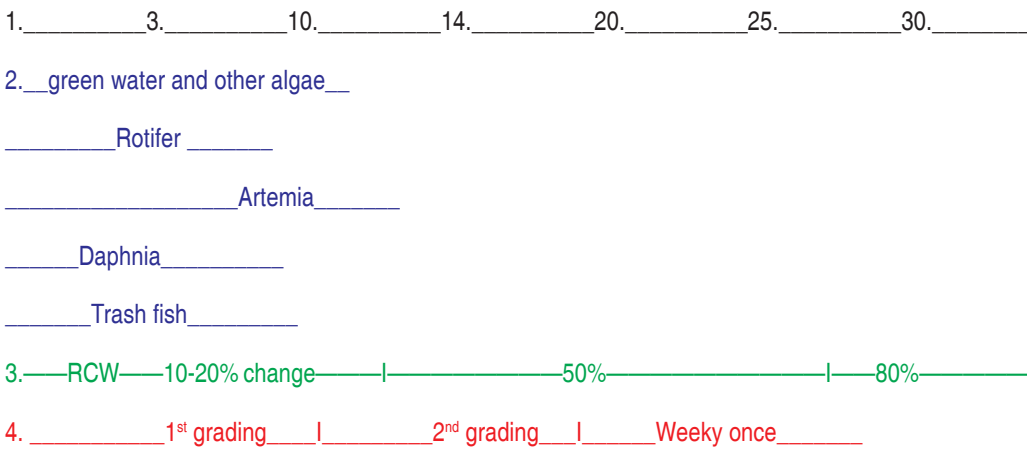

Fig. 1. Management method for seabass nursery tank within the first 40-day period 1 Time duration 2 Feed 3 Water change 4 Grading.

Weaning

The inclusion of artificial food in the diet of marine fish larvae is a critical stage in intensive larval rearing. The process of changing diet of the fish larvae from the live feeds to the artificial diets or *vise versa* is called weaning. Weaning reduces the dependence on live feeds, and therefore reduces hatchery running costs. Person-Le Ruyet (1991) described three weaning strategies which have been applied to different species of marine fish larvae, with different levels of success; (i) weaning at first feeding has been achieved with plaice and sole with lower survival than achieved with live feeds; (ii) larvae may be reared for some time on live feed, which is then replaced abruptly with artificial feed; this strategy is used for European seabass or (iii) the replacement may be gradual, occurring over several days, as in the culture of red sea bream and Japanese flounder. On 25th day, when the fry measures @1.0 cm, it should be transferred to nursery tanks in the hatchery or nursery hapas at the farm site for weaning. Though seabass prefers live fish food it could be weaned to trash fish within 5-7 days. Fry are stocked @ 1000 nos./m^3 in 4-5 tonne capacity tanks. The cooked and minced fish meat, made into small pieces of 1.5- 2.5 mm, should be given as feed *ad libitum* during the nursery rearing. Grading (removal of shooter fish) should be done on alternative days to reduce cannibalism.

Importance of grading and grading techniques

Cannibalistic behaviour of seabass fry can be observed after the fry completes metamorphosis, when they are about 15 days old (15 mm in total length). To maintain a uniform size and minimize the mortality of the fry, grading of fry to size groups at regular and frequent intervals must be done. Due to cannibalistic nature of the fish, size selection or grading or sorting of the larvae is of prime importance based on the size of the fish. The first sorting should start at the second week since during this period; the bigger fish can eat the smaller ones. After the first size grading at around 12-15 days old, size grading should be done every 3-5 days (Maneswongsa, 1986; Ruangpanit, 1988). The easiest way of sorting is to use screen with

various mesh size so that the various sizes of fish can be separated easily. Another material usually used for grading consists of plastic containers punched at the bottom with holes of 2, 3.5, 5, 6 and 7 mm in diameter. Fish are placed in the plastic containers which are floated in the newly prepared larvae nursing tank. The small fish can pass through the hole to the new tank. The remaining fish in the plastic containers are transferred into another tank and likewise graded with the use of a plastic container with larger holes. Different types of graders fixed as well as adjustable types are now available in the international market and a few types in the Indian markets.

Stocking same size fish will reduce the rate of cannibalism, thus the survival rate can be increased and the growth rate of the fish could also be faster and more uniform. Grading is also important in the fact that these fishes are voracious carnivorous feeders and the competition for food is very high during the feeding time. If the number of fishes in the tanks as well as in the hapa are high, the competition again increases and only the fittest will get the food. Again these are column feeder and usually they never feed on the left over food in the bottom. So all of them will have to get the food and eat in the same time, this will not be possible in the tanks or hapa. Here the weak ones cannot grasp food as efficient as the healthier ones and hence they become more weak when compared to the eating ones that grow further in size.

Growth and care of larvae as they develop to fry and Juveniles

When the fry are 50 days old or 1.0-2.0 cm length they are transferred to another tank (Ruangpanit et *al.,* 1988). The ground fish meat can be fed at age 45 days with *Artemia* nauplii. Filtered sea water is totally changed and supplied every day. The semi moist compound diet is given three times a day. The juveniles can also rear in the net cages in the open waters. They can be moved from the rearing tanks for culture in net cages of different size and shape according to the convenience and availability of the water bodies. The net cages usually uses are 2x1x1.5 m and they are usually set in open waters one day before stocking to remove the contaminants if any. Stock of 2,000–3,000 fry are raised to the fingerling size in these cages.

Survival Rate

The system of culture outlined above gives about 85 percent hatching rate and a survival rate of 1–7 days old larvae of 30 percent. For 8–15 days old larvae the survival is 80 percent, after which they can be maintained indefinitely with negligible mortality (Table 1).

Table 1 Survival rates of seabass larvae at various ages under normal stocking rates in tanks

Age (days)	No. of larvae* per liter	Survival Rate(%)
1–7	30–40	37.2
8–15	15–20	80.9
16–23	5–10	70.0
24–30	2–5	85.3

** Normal stocking density used in nursery tanks.*

Salinity acclimatization

It is a euryhaline species except in its early larval stages. These can be easily acclimatized from one salinity to any other salinity *i.e.* from sea water to fresh water within short period of time without any mortality. Thus, it is an advantageous culture as it can be cultured in all levels of salinity, from fresh water to sea water, and in a variety of culture systems from open ponds and cages to flow-through and closed recirculation systems. It can easily adjust to change of 5 – 10 ppm at a time. Therefore in a day it can be changed from sea water to fresh water and vise versa.

Collection and conditioning of fry before transport

Fry are collected from the rearing tanks and placed in smaller receptacles. Fry are treated with 5 ppm of acriflavine solution or 0.5 ppm of copper sulfate solution for 5–10 minutes. There should be no feeding within 1–2 hours before packing.

Packing

Plastic bags of 40 × 60 cm of proper gauge are filled with 6–7 litres of fresh seawater and saturated with oxygen; 10–12 litres of oxygen gas are used for packing. The amount of transportable fry depends on size of fry, water temperature in plastic bags and duration of travel and handling from source of fry to its destination.

Transport

In transporting by truck, a mixture of crushed ice and sawdust is needed to control the water temperature in the plastic bags during transport. The mixture is spread uniformly on the floor of the truck before the plastic bags are laid upon it. The proportion of crushed ice and sawdust is 1:1 for long—period transport (12–16 hours) and 1:2 for short periods (4–5 hours). Transportation should be carried out at night time. By this method, it is possible to control the water temperature between 19–23° C.

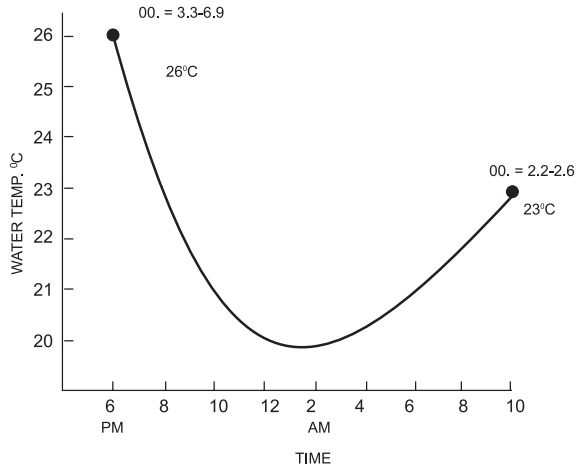

Fig. 2 shows the observed fluctuation in temperature of the water in the plastic bags during transport. It was also observed that the dissolved oxygen starting initially at 5.3 to 5.0 ppm will drop to 2.3-2.6 ppm at destination.

Pond nursery

Nursery rearing of seabass fry in ponds in hapa to the size of stocking is essential before release into the cages. Nursery ponds may range in size from 500-2000 m^2. A water depth of 1-1.5 m is desirable. Rearing of juveniles in hapa in the earthen ponds is easy and economical when it compared with that of the tank systems. This method is advantageous than other methods since it can be easily managed and installation of rearing facility requires less space and capital investment. The infrastructural facilities including the man power is very less compared to the tank systems. The huge amount of water exchange can be avoided if it is reared in hapa in the ponds. It is easy to maintain the water quality parameters in the ponds if it is having easy approach to the natural water bodies. If the ponds are provided with the water exchange facility it is well and good. The ponds with tidal fled systems are very good as the water can be entered and removed easily without any power consumption. Again the number of the hapa can be extended to any scale depending on the necessity and the capability of the farmer. It can be maintained in a corner of the grow-out pond or near the grow-out cages itself. The water flow in the cage site washes away the metabolites and excess uneaten feed.

Pond preparation

The pond is made ready three weeks ahead of the date on which the fry is expected. Adequate provision of water inlet and outlet should be provided. A slope towards the drainage side is preferred for the easy removal of the waste materials for keeping good water quality in and around the hapa. Both sluices/ the inlet and outlet channels should be guarded by 1 mm mesh nets to prevent the entry of unwanted fishes as well as escape of the fry in the case of some hapa damage. The nursery pond should be free from predators. Predators are killed by *mahua* oilcake (which is toxic for three weeks), which then acts as a good fertilizer, giving a rich crop of zooplankton which is good for the juveniles in rearing ponds. If there are no weeds, to kill predators and competitors quickly, just add 100 kg of urea followed 24 hours later by 200 kg of fresh bleaching powder (which is toxic for only a week) for a 1-ha area of a 1-m deep pond. Fish killed in this way is edible. A week after treatment with bleaching powder, add fresh cow dung (2,500 kg/ha) or a mixture of cow dung (2,500 kg/ha) and poultry manure (1,250 kg/ha). If *mahua* oilcake is used, fertilizer need not be added for

the first 15 days. The pond should be stocked as soon as it is ready and as early in the season as possible to get fry, which makes the best use of the available water and the high temperatures.

In prepared nursery ponds, fry of 2.5 to 4.0 cm size can be stocked @ 1500-2000 nos/hapa of 2 x 2 x 1 m. The most convenient cage design is a rectangular cage made of synthetic netting attached to wooden, GI pipe or bamboo frames. It is either a) kept afloat by styrofoam, plastic carbuoy or b) stationary by fastening to a wooden or bamboo pole at each corner. The size of cage varies from 0.9 × 2.0 m and a depth of 0.9 m to 1.0 × 2.0 meters and a depth of 1.0 meter (Figure 1). The mesh size of the nylon net is 1.0 mm. The mesh size of the hapa should be appropriate with the size of the fishes as well as it should allow the water movement. Water exchange to the extent of 30% is required daily to the pond. Fry must be fed with supplementary feed of chopped and ground fish (4-6 mm size) @ 100% of the body weight, thrice a day, in the first week. The feeding rate is gradually reduced to 60% and 40% during second and third week respectively. The minced fish meat, made into small pieces of 1.5-2.5 mm, should be given as feed *ad libitum* during the nursery rearing. Grading (removal of shooter fish) should be done on alternative days to reduce cannibalism. At this stage the nets of the hapa should be cleaned for 3 – 4 days as it gets clogged with algal materials which reduces the water flow and the water quality within the hapa. The expected survival rate would be 80-86% with an average size of 5 to 7.5g in 30-35 days of rearing in the hapa. However, after a month of nursing, they can be transferred to cages with nylon net with mesh size of 0.5 cm. Stocking is done separately for each size group. This would minimize the losses from cannibalism. Fingerlings of 2.5–5.0 cms should be fed with ground trash fish at 8–10 percent of body weight daily or about 4 to 5 times a day. After that, they can be fed with finely chopped trash fish.

The mesh size as well as the size of the hapa can be changed as the fishes grow to bigger sizes which will increase the growth and at the same time reduces the clogging and the cleaning due to it. This would allow water to pass through the cages more freely. Nursery cage size may range from 3 m (3x1x1 m) to 10 m (5 x 2 x 1 m) with a mesh size of 10 mm. Cages/ hapa should be checked and cleaned regularly. The fry on reaching a size of 25 -40 g at the end of another rearing period of 30-45 days can be stocked in the open sea cages for the grow-out system. Usually a survival rate ranging from 50-70% could be obtained. The net cage should be checked daily to ensure that it is not damaged by crabs or clogged with fouling organisms. The cage should be cleaned every other day by soft brushing in order to allow water circulation in the cage.The survival rate for the nursery period would be 50 to 80 percent. This would depend on feeding, aquatic environmental conditions, and the expertise of the fish farmers.

Trash fish is the main feed for seabass culture. Trash fish should be fresh and clean. Trash fish used are sardines and other small marine fish. The trash fish should be chopped and fed thrice a day, in the early morning, afternoon and evening. The size must be suitable for the size of the mouth of the fish. The farmers should give the feed slowly and watch the fish. Feeding should be stopped when the fish no longer come up to the surface; it shows that the amount of feed is enough for them.

Diseases

If hygienic conditions are maintained, the juveniles are generally resistant to diseases. However, since the larvae are stocked in the tank for a long period, sometimes they show their abnormal swimming character, stop feeding, and turn black. These are signs of disease or poor health so that if these occur, they should be treated with 1:2,000 parts formalin solution for 10–15 minutes

for 2–3 days continuously. It is commonly known that the seabass fry when collected from natural areas are big enough so that they can be suitable for stocking grow out ponds and cages. As now it is able to spawn the fish and grow the larvae and juveniles under controlled conditions, better knowledge is available on their growth. It is also successfully completed the nursing of the seabass larvae and juveniles in controlled conditions with relatively high survival rates without much health problems at present.

Collection, conditioning and transport of juveniles to the grow-out systems

Fry are collected from the rearing tanks and placed in fiber glass tanks in the same salinity. There should be no feeding within 1–2 hours before packing. If the salinity of grow out is different the fishes should be acclimatized to the salinity of grow-out first before transportation. As the fishes are now grown to a bigger size, it is better to transport them in the bigger containers like syntax tanks with aeration in good quality waters.