

Brackishwater aquaculture for food employment and prosperity



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Brackishwater cage culture with multi-trophic candidate species in diverse rearing systems for alternate livelihood and societal development in Maharashtra

(Under Mangrove Cell Project)



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3. Potential brackishwater finfish species for Cage culture

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Cage culture of fish is a method of raising fish in containers enclosed on all sides and bottom by materials that hold the fish inside while permitting water exchange and waste removal into the surrounding water. Cage culture of finfishes has been practiced for years in countries such as Norway, Thailand, Malaysia, Singapore, Hong Kong, Singapore, Vietnam, Indonesia and the Philippines. In India, cage culture of finfishes in the brackishwater creeks, lagoons, lakes and open sea are emerging as a livelihood income generation activity for the rural folks. The advantages and disadvantages of cage culture are,

The advantages of cage culture include the following;

- ◁ Man-made or natural bodies of water e.g., ponds, reservoirs, lakes and streams can be potentially used for fish production
- ◁ Can be set up in better aquatic environmental condition than the pond system
- ◁ Can be stocked with more fish on per square meter basis to increase productivity per unit area
- ◁ Requires less investment for construction and operation
- ◁ Easily manageable in terms of feeding, sampling, observation and harvesting
- ◁ Treatment of disease is much simple than that of pond culture.
- ◁ In emergencies it can be removed from one place to another.
- ◁ Since the cage is meshed, the fishes inside have less chances of being attacked by predators.
- ◁ The pond or water resources can still be used for sports fishing, recreation and farming

The disadvantages are as follows,

- ◁ Vulnerability of crowded and confined fish to incidence of diseases and parasites
- ◁ Possibility of rapid spread of diseases
- ◁ Localized poor water quality, e.g., dissolved oxygen in and around cages
- ◁ Caged fishes need a nutritionally complete, fresh feed
- ◁ Cages area attractive to predators, vandals and poachers

Species selection:

The fish should have the following characteristics for the economical cultivation.

- ◁ It should rapidly grow in a short period of culture
- ◁ It should withstand wider ranges of salinity and temperature
- ◁ It should accept the artificial feed under culture conditions and feed conversion ratio should be low
- ◁ It should be resistant against the disease and parasitic infection
- ◁ It should have good market value
- ◁ Adequate seed should be available from hatcheries according to the demand
- ◁ The fish should have small head and less bone so that the edible part will be more

Some of the important cultivable brackishwater finfishes suggested for cage culture are

Asian seabass	-	<i>Lates calcarifer</i>
Cobia	-	<i>Rachycentron canadum</i>
Mangrove Red snapper	-	<i>Lutjanus argentimaculatus</i>
Pearlspot	-	<i>Etroplus suratensis</i>
Rabbit fish	-	<i>Siganus javus</i>
Estuarine grouper	-	<i>Epinephelus coioides</i>

Seabass *Lates calcarifer*

Asian seabass *Lates calcarifer* is distributed in Indo-Pacific region and in Australia. It can withstand the salinity from 0-40 ppt. The fish can be cultured in freshwater, brackishwater and marine condition in earthen ponds and cages. Under pond and cage condition, the fish can attain the growth of 800-1000gm in 6-8 months period either with trash fishes or artificial diet. The fish is being widely cultured in Australia, Thailand, Singapore, Malaysia, Philippines, Indonesia and India. In the recent days, seabass is also cultured in Europe. In India, the seed production technology of seabass has been standardized by Central Institute of Brackishwater Aquaculture, Chennai. In India, cage culture of seabass has been carried out by the farmers with the support of research institutions or state departments at small scale both in the open sea and in the back waters. Seabass fingerlings in the size of 3-4 inch are stocked @ 25-40nos/ m³ in small volume cages. Care should be taken to maintain the uniform size fish

in the grow out cages to avoid the cannibalism. Grading can be done whenever required and shooters can be removed and maintained separately. Feeding done with either artificial feed or low cost trash fishes and the FCR worked out to be around 1.7 and 6.0 -7.0 respectively at harvest. After 6-8 months grow out culture, mean size of 1.0 kg fishes are harvested @ 15-25 kg/m². The farm gate price of seabass varied from Rs.400 to 500/kg according to the size. The main issues which restrict expansion of seabass cage culture are non-availability of stock size seed.



Seabass *Lates calcarifer* cage culture

Pearl spot *Etroplus suratensis*

Pearl spot is an endemic to Indian sub-continent countries such as India, Sri Lanka, Bangladesh and Pakistan. It can withstand the salinity from 0 to 30 ppt but can grow better in lower salinities up to 15 ppt. It is an ideal candidate species for brackishwater farming. It is a detritivore fish but can accept the artificial diet. It can attain the growth of 200 to 300gm in 6-9 months depending upon the salinity. *E.suratensis* is mostly preferred for polyculture. Cage culture of pearlspot is also emerging in the backwaters of Kerala in the recent years owing to high demand from the local market. Pearlsport juveniles in the size range from 25-30g are stocked in the cages @ 100 nos/m³. Fishes are fed with low protein pellet feed @ 4-5% body weight daily and after 6-9 months, they grow to marketable size of 200-300g with the productivity of around 20kg/m³. Cage culture of pearlspot has the advantage of preventing the pair formation and breeding due to crowded and tidal movements prevailing in the open water, which will enhance the growth rate of pearlspot when compared to pond condition, where inbreeding and slow growth rate is highly expected. Pearlsport has very good market demand in Kerala and can fetch Rs. 350 to 500/kg for above 200g size. Large scale adoption

of pearlspot is a constraint due to low fecundity and non-availability of stock size seed. ICAR-CIBA has developed Modular System for Pearlsport Seed production (MSPS) in 1 tonn RAS systems and also in hapas (1 m³). The MSPS constitutes of a set of four 1 t tanks connected to a sand filter and motor, allowing water to be recirculated. A pair of pearlspot is stocked in the system and optimal conditions for breeding are provided. Using this technology, a batch of pearlspot larvae up to 2000 numbers may be harvested from the tank in at a periodic interval of 30-45 days. Larval rearing is carried out in small tanks of 100 l using *Artemia* nauplii and artificial feed. After 30-45 days, stockable sized seeds are obtained for nursery rearing. Alternatively, seed production can be carried out using a series of hapas. Eggs can be harvested from the system for further incubation and larval rearing. This allows a production similar to tank system. With minimal investment in terms of facilities and labour; hapas can produce around 1000 number of fry every 2.5-3 months.

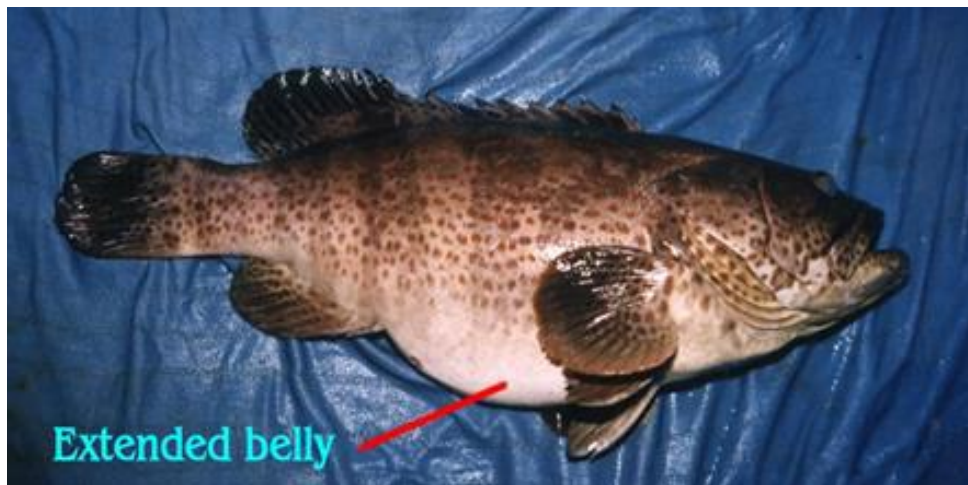


Pearl spot *Etroplus suratensis*

Grouper *Epinephelus tauvina*

The estuarine or brown spotted grouper, *Epinephelus coioides* belongs to the subfamily Epinephelinae is widely distributed in Indo-Pacific region and Kuwait waters. It is a popular table fish and widely cultured in floating cages or earthen ponds in South East Asian countries. It can withstand the salinity from 14- 40 ppt and ideally suits for open sea culture and brackishwater lagoons. The fish can attain the growth of 750-1000g in 8-10 months with either trash fish or artificial diets. Live grouper can fetch a price of 5-6 US \$/kg in Hong Kong market. Non-availability of stock size seed is the main problem to take up commercial farming of this fish. However, wild seed of this species has been reported in Kovalam-Muttukkadu backwaters during March and Tuticorin bay in Tamil Nadu. Growth rate of this species has been reported as This fish has very good domestic market as well.. It is

reported that grouper fishes of 50g size stocked were fed with two test feeds i.e. pellet feed and trash fish in separate cages with the density of 30 fish /m³ for 143 days rearing period showed better growth for fishes fed trash fish (523.71±27.95 g) than those fed pellet feed (317.53±22.10 g). Groupers have good market value even for the size of 400g and above due to its white tender meat. Research on seed production technologies of groupers has been initiated by the various organization



Cobia Rachycentron canadum

The cobia *Rachycentron canadum* commonly called as Kingfish in India, is a species of carangiform, the only representative of the genus *Rachycentron* and the family Rachycentridae. Other common names include black kingfish, black salmon, lemonfish and crab eater. Cobia is a migratory predatory pelagic fish and widely distributed in the tropical and subtropical countries except central and eastern Pacific Ocean. It is a promising fish for aquaculture and considered as one of the fastest growing finfishes can attain the average weight range of 4.0 to 6.0 kg in one year culture period. Fast growth rate and quality flesh makes cobia as one of the most preferred finfishes for cage culture among the farmers in the recent years. It is reported that currently, cobia are cultured in nurseries and grow-out offshore cages in many parts of Asia and off the coast of the United States, Mexico and Panama. In Taiwan cobia weighing 100 to 600 grams are cultured for 1 to 1.5 years to reach the 6 to 8 kilograms. In India, ICAR-CIBA has developed seed production technology for cobia using pond reared broodstock. ICAR-CMFRI and RGCA have developed hatchery technology for cobia seed production using broodstock fishes reared from the Sea cages. Since, cobia can withstand the salinity in the range from 15-35 ppt to attain the normal

growth, it is highly suitable for farming in sea cages rather than backwater or brackishwater cages, where the salinity fluctuations can be wider during monsoon. In India, Sea based cage culture of cobia is emerging in states such as Tamil Nadu, Kerala, Karnataka and Andhra Pradesh. Cobia can fetch the local market price of Rs.250 to 350/kg based on the size. In India, large scale cage culture of cobia is restricted due to non-availability stock size seed. Participation of more private hatcheries for commercial scale seed production of cobia would enable to meet seed demand and enhance the cobia cage farming in India.



Cobia *Rachycentron canadum*

Mangrove Red snapper *Lutjanus argentimaculatus*

The mangrove red snapper *Lutjanus argentimaculatus* is considered as one of the high-value marine fishes with great potential for export and domestic market. Snapper is important to coastal fishery and ideal for aquaculture particularly in Southeast Asian countries and India. *L. argentimaculatus* is also used as sport fish throughout the Indo-Pacific region, but never found in large quantities. They caught mainly with hand lines, bottom longlines and trawls. Aquaculture importance of this species has been well documented due to high demand in the international market. Mangrove Red snapper can be farmed both in the pond and cages. In India, farming of this species has been carried out by stocking the wild caught assorted size fingerlings and feeding with trash fishes. On the other hand, cage farming of this species with hatchery produced seed has been reported in Philippines and Australia. Cage culture of *L. argentimaculatus* is being practiced in Karnataka and Maharashtra by stocking the wild collected seed in the cages/ponds either by monoculture or polyculture methods. In India, open sea cage culture of Red snapper on experimental basis in the West Coast of India by stocking the wild caught seed has been reported. Wild caught juvenile snapper with size

range from 2.0 to 3.0 inch are stocked in the cages in varying densities. They fed with locally available low cost trash fishes and harvested after reaching to the marketable size of 500g to 1.0 kg in 6-8 months. Red snapper can fetch good market price even in small size fishes from 250g due to preferred flesh quality. The fish can be sold @ Rs.250 to Rs.500/kg at the farm gate price. However, the culture of this species is still exclusively dependent on wild fry where the supply is limited, seasonal and unpredictable. This limits the sustainability of its aquaculture. Thus, a reliable breeding and fry production technique must be developed to ensure consistent production of good quality fry to meet the demand of the industry. ICAR-CIBA has taken up research programme to standardize breeding and seed production of *L. argentimaculatus* under captive condition. Captive maturation of this species has been observed under tank based rearing system in fish hatchery at Muttukkadu Experimental station of CIBA. Seed production technology of this species would enhance more choice for the farmers to select finfish species for farming practice to achieve the sustainability in this sector.



Mangrove red snapper *Lutjanus argentimaculatus*

Rabbit fish *Siganus javus*

The rabbitfish, family Siganidae, is considered to be an excellent food fish that holds promise for open water cage aquaculture. By virtue of their herbivorous feeding habit and consequent ability to feed low on the aquatic food chain, this can be farmed intensively using low-cost feeds and supplementary feeding with a variety of seaweeds. They are good candidates for farming because of their high tolerance to environmental factors, rough handling, and crowding. Moreover, this can also be grown as supportive species along with other saltwater carnivorous fishes in its outer net. This will ease the cleaning of the cage net

and we can get this fish additional along with the main species. Along with seabass in open water cages, they have grown to a size of 600-800 g from an initial weight of 2 g size, by feeding the excess feed from seabass and the seaweeds grown on the net materials.



Rabbit fish *Siganus javus*