Cage culture of seabass and pearlspot in mangrove-based creeks as an alternate livelihood for the mangrove coastal community of Sindhudurg, Maharashtra – A success story

Pankaj Patil, Tanveer Hussain, Kedar Palav, M. Kailasam, C.V. Sairam, R. Subburaj, K. Ambasankar, N. Vasudevan and K. K. Vijayan

Background

Sindhudurg accounts for only 3% of Maharashtra's total mangrove cover but houses more of its coastal biodiversity that any other district in the state. The coastal community of this region depend mainly on agriculture and marine fisheries for their livelihood. However, the depletion of natural fish stocks as a result of unsustainable fishing practices, an expanding tourism sector, and pollution from fishing vessels and other maritime traffic is seriously affecting the livelihood security of the coastal community. Similarly, deforestation of mangroves timber for boat fabrication, fuel-wood, human settlements, illegal aquaculture activities have also impacted the nursery and breeding grounds of marine fish, mammals, birds, etc. Hence, for mangrove protection and regeneration through coastal livelihood and ecotourism activities, the Mangrove Foundation, Mumbai have initiated several conservation and livelihood programmes through self-help groups (SHG) for selected coastal villages of Maharashtra.

Need for intervention

The fishers of Hadi, Talashil, Tondavali and Kothewada villages of Malavan Taluk in Sindhudurg worked mostly as labourers for the unsustainable Purse Siene and Trawl fishing activities in the area, while most of womenfolk

worked as agriculture labour. Their daily income and livelihood depended entirely on the availability of fish catch and agriculture work. Fishing ban during the monsoon season often affected their livelihood and income and therefore a provision for a fishery based alternative avocation could ensure a secure livelihood and nutritional security to the fisherfolk. Inculcating the skill of low volume low cost cage culture of fish could be one such option if they are provided with an opportunity and support to adopt it. In order to achieve this objective, ICAR-CIBA, Chennai in collaboration with the Mangrove cell, Government of Maharashtra formed several SHGs comprising of both men and women at different locations, for low cost and low volume cage culture of Asian seabass and Pearlspot in the creeks and mangrove areas in all coastal districts of Maharashtra.

Low volume-low cost seabass and pearlspot cage culture

High initial investment, ownership of land and access to water resources are major limiting factors in adoption of land-based aquaculture as a livelihood option. Considering these problems, ICAR-Central Institute of Brackishwater Aquaculture, Chennai has developed a comprehensive low volume low cost cage culture technology for sustainable and viable farming of seabass and pearlspot, which can be adopted by small farmers and fisherfolk. Brackishwater cage culture has additional advantages due to its ease in adoption, higher profits, utilization of unutilized water bodies and playing a role in conservation of biodiversity. Low volume cage culture is a low venture setup which can be adopted in home backyard creek/water bodies.

The key aspects in the cage culture technology is the stocking size, culture period, feed used and cage management, which have a direct impact on production and sustainability of the production system. Cage frames can be fabricated using Galvanized Iron, PVC or bamboo and floated with barrels while the nets can be either knotted or knotless cage nets, based on the size, species and budget availability. The cage culture rearing phase takes about 240-300 days depending upon the environmental conditions at the site. Production of high value fish using low volume cages in brackishwater bodies can thus be a potential livelihood option for small farmers and fisherfolk as these cages are easy to fabricate and can be done by the farmers themselves and is increasingly becoming popular among small fish farmers, Self Help Groups and tribal communities in the coastal states of Andhra Pradesh, Tamil Nadu, Kerala, and Maharashtra.

Asian seabass (*Lates Calcarifer*)

Popularly known as Bhetki in India, Asian Seabass (*Lates Calcarifer*), is one among the most popular finfish species caught from inshore areas, estuaries, backwaters, lagoons and fresh water ponds. It is a high valued fish having great demand in both domestic as well as international seafood markets. Seabass is a fast-growing species with an ability to tolerate wide fluctuations in environmental conditions and is rapidly

Asian Seabass (*Lates calcarifer*)

gaining in popularity as a candidate species for coastal aquaculture in India. While adult Seabass is carnivorous in nature, juveniles are omnivores and they reach to an average size of 1.5 kg in 10 to 12 months of culture. It is an ideal candidate species for farming in both saline as well as freshwater environments, be it either ponds or cages. The culture of seabass involves nursery rearing in happas, pre grow-out culture and grow-out culture in ponds or cages.

Pearlspot (*Etroplus Suratensis*)

Pearlspot *Etroplus suratensis* (common name - green chromide), is a highly relished fish species, popularly known as Karimeen in Malayalam and Kaalundri in Marathi. It is the state fish of Kerala, but has a high market demand all along the west coast. It is an economically important food fish with a market price ranging between Rs. 250 and Rs. 500/kg depending upon the size and season. Pearlspot is adaptable to different culture systems such as ponds, pens and cages. Being omnivorous in nature and easy to farm, aquaculture of pearlspot is economical and highly suitable, especially for small-scale fishfarmers.

Pearlspot Etroplus suratensis

Features of the innovation

ICAR-CIBA and Mangrove Cell of Maharashtra government had initiated a Brackishwater cage culture programme for the benefit of fisherfolk in coastal Maharashtra with different candidate species in diverse rearing systems with a view to provide them with an additional/alternate livelihood option and societal development, as well as to enhance brackishwater aquaculture production in the area. This programme involved low cost-low volume cage culture of Asian seabass *Lates calcarifer* and Pearlspot *Etroplus suratensis* in the mangrove areas in Sindhudurg district of Maharashtra. CIBA carried out a demonstration and provided training to the members of the SHGs on cage frame fabrication, cage frame and net installation, seed stocking, seed grading, feeding, net cleaning, water quality and cage management. The SHGs were also provided with important tools required for cage culture operations such as, brushes for daily cleaning of cage nets, fish grading tanks, feed storage containers and water quality monitoring equipment such as pH meter, refractometer and thermometer for regular monitoring of water quality at the cage sites.

A total of 65 cages of 4 x 4 x 2 m ($32m^3$) dimensions were fabricated using Galvanized Iron (GI) pipes (1.5" and 1.25") and allotted to 8 SHGs units of Sindhudurg, comprising of 206 men and 14 women. The cage frames and structures were coated with epoxy paint to avoid rusting of the GI pipes in salt water.

Wielded Cage frame

During the culture period, two types of cage nets were used, viz. pre-grow out nets and grow out nets. This is to ensure good survival and higher productivity in the system. For pre-grow out culture of small fish fingerlings (1-5 inch & 2-15 g), for a period of 60-90 days, HDPE knotless cage nets of 4 x 4 x 2 m dimension made of 24ply & 18 mm diamond /hexagonal shape mesh webbing mounted with 3-6 mm rope and 2000-3000 kg tensile strength, were used. For grow-out culture of above 50-100 g fingerlings till they attain harvest sizes, HDPE knotless cage nets of 4 x 4 x 2 m dimension made of 45 ply & 30 mm diamond /hexagonal shape mesh webbing mounted with 6-12 mm rope and 3000 kg tensile strength, were used.

Partitioned net cages for seabsass pre-grow out cage culture in creeks

Asian seabass is highly cannibalistic in nature and therefore, to prevent cannibalism and survival drop during the pre-grow out phase, internal partitions were provided in the net cages to have two internal compartments of 2 x 2 x 2 m within the cage nets which facilitated stocking of two different size grades of seabass fishes in each compartment.

All four sides of the pregrow-out and grow-out cage nets were supported with nylon strap of 3 mm width and 1 mm thickness with inbuilt 6 mm and 12 mm polypropylene ropes for tying the nets to the cage main frame. To protect the fish from wild crabs and other predatory organisms, each cage was provided with an outer protection cage net of 4.3 x 4.3 x 2.5 m dimensions, made of nylon knotted net of 40 mm mesh size. The whole cage structure was floated with six HDPE barrels each of 210 L capacity and anchored in creeks with mild stainless-steel anchors (85 Kgs) having five legs to withstand strong water currents and to avoid displacement of cages during tidal flow.

From October 2018 to February 2019, seabass fingerlings (6-18 cm & 4-14 g) were procured from commercial seabass nurseries in Andhra Pradesh and the CIBA Nursery units, Sindhudurg and stocked in cages @1000 nos./cage, while pearlspot fingerlings (1-2 inch and 2-5g) were sourced from pearlspot nurseries in Kerala and stocked in cages@1000 nos./ cage.

Barrels fixing and cage frame installation by SHG members

Anchoring cage frames

Anchored Cage frame in creek

Fish seed transportation and stocking in cages by SHG members

Asian seabass fingerlings

Pearlspot fingerlings

The fish were fed with seabass slow sinking nursery and grow-out feeds (Seebass Nursery ^{Plus} 45% CP and 10% Lipid; and Seebass Growout ^{Plus} 40% CP and 8% Lipid) of size 2-6 mm @ 8% body weight twice a day. Pearlspot, being a herbivorous fish, was fed with floating feed Etro Growout ^{Plus} (30% CP and 5% lipid) of 0.6 -2 mm size @8-10% body weight, also twice daily.

Artificial feeding to cage cultured seabass and pearl spot by farmers

To achieve good growth, prevent survival loss and to avoid cannibalism, regular grading of fingerlings was carried out at 15-day intervals. During grading, all fingerlings from each cage nets were removed and taken into grading containers where shooters were separated from the small size fingerlings group and kept separately. The graded fish are then stocked in two separate compartments within the cages. Grading is done mostly during early morning hours (07:00 - 11.00 hrs) and late evenings (16:00-18:00 hrs) to prevent stress to the fish. Cages nets were cleaned daily with brushes to avoid clogging. Pearlspot are not cannibalistic and hence fish grading was not underatken by the SHGs. However cage nets were inspected every fortnight for recording mortalities and cleaning.

Cage Cleaning by men and women SHGs beneficiaries

Seabass grading by by SHG members

Graded small Seabass

Graded Seabass shooter

After a rearing period of 150-240 days, seabass fingerlings attained a growth of 300-800g with survival of 30-71%. The harvest size of pearlspot was about 100-150g. All the cages were harvested in June 2019 and both pearlspot as well as seabass were sold @ Rs. 200-350/- kg to a local vendor.

Fish harvesting from cages by mangrove coastal self-help groups

CIBA Scientists, Mangrove Officials, members of SHGs and other officials display harvested Seabass

Economics and impact

The SHGs of Sindhudurg, Maharashtra, who ventured into cage culture activities earned an amount of Rs.12,75,880/- from the production and sale of seabass and pearslpot as an additional income. This brackishwater cage culture programme with Technology Transfer from CIBA was a first of its kind and unique activity which also involved the participation of womenfolk in cage operations.

Income cheque distribution to mangrove coastal self-help groups of Maharashtra towards production and sale of seabass fishes from cage culture

Conclusion

Coastal fisher communities definitely require an alternative/additional option for secure livelihood and income generation owing to the uncertainty in fish catches from the wild. Vast brackishwater areas such as creeks, lagoons and estuaries are available for utilization for activities such as cage culture of different brackishwater finfish species. Adoption of such simple technologies as sustainable enterprises by the coastal communities of Maharashtra can effectively elevate their social and economic status. The on-going cage culture demonstrations and training across coastal Maharashtra being implemented through a participatory approach of SHGs with technology support from ICAR-CIBA and funding from the Mangrove Foundation, Maharashtra has emerged as successful livelihood enhancement model for the unemployed fisher communities including women.