Successful Demonstration of —

Seabass cage culture in Karnataka

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Marine fish production is getting stagnated due to increasing fishing pressure on the natural fish stocks, while the outlook is that demand for seafood will continue to grow because of increasing population, necessitating the adoption of

Fig.1. Seed transport.

Fig.2. Grading.

Fig.3. Nursery cage installation.

Fig.4. Nursery rearing.

Fig.5. Collection of fishes from nursery cage.

Fig.6. Opensea cage.

Fig.7.Opensea cage mooring.

Fig.8. Opensea cage stocking.

Fig.9.Harvesting from marine cage.

Fig.10.Harvested fishes in scoopnet.

Fig .11. Harvested fishes in boat.

Fig. 12. Harvested fishes ready for sale.

aqua farming practices for fish supply. Under this scenario the only alternative is to adopt and practice location-specific mariculture activities. In this context, cage culture has been initiated along the Karnataka coast of India to boost the aquaculture production of the State and also to empower the fishermen by providing alternate livelihood option during lean fishing period. Kundapura Taluk in Udupi district is known for aquaculture practice since time immemorial and shrimp farming was the main vocation of many entrepreneurs in the area. Due to the recent setbacks in shrimp farming the traditional shrimp farmers are keen on diversification of farming practices with alternate candidate species like finfishes, crabs and bivalves. This new venture of cage culture has raised the hopes of several to rear quality finfishes in the marine environment. Therefore, identification of the fast growing fishes, rearing them in cages and creating awareness among the fisherfolks would go a long way in augmenting fish production in the State. Developing marine cage farming will help in extending areas for mariculture, conserving the pristine coastal area without eutrophication and pollution. The development of offshore cage culture augments not only the income generation and employment opportunities for fishermen, but also promotes ancillary employment avenues for manufacturing off-shore cages and accessory instruments/ equipments for monitoring, grading, feeding etc.

In Karnataka, marine cage culture was attempted for the first time off Uppunda, near Byndoor by the Mangalore Research Centre of Central Marine Fisheries Research Institute (CMFRI) with the financial assistance from National Fisheries Development Board (NFDB), Government of India. Primary thrust of the programme was to empower the fishermen community with alternate vocations by providing hands-on training and capacity building with continuous interaction with scientific personnel in novel technologies. Traditional fishermen society of Byndoor, was selected to take care of maintenance. Uppunda coast with unpolluted coastal waters and beach landing facilities was found ideal for undertaking such demonstration activities. The objective of the project was to design cages of reasonable size which can be hauled to the shore during off season, identify stock locally available fast growing high value fish seed, understand the socio – economic impact of mooring offshore cages along the Karnataka coast and make necessary changes according to the location-specific requirement.

Seabass culture in cages involved (i) Collection and transportation of seeds, (ii) Hatchery rearing and grading of seed, (iii) Nursery rearing in earthern ponds and (iv) culture in opensea cages.

I). *Collection and transportation of seeds*

The seabass fry (45-55 mm) were procured from Rajiv Gandhi Centre for Aquaculture (RGCA), Shirgali on 9th September, 2009 and transported to a private hatchery at Bailur, Karnataka. The seeds were packed at a stocking density of 175-250 nos/ bag and transported by road at 25 °C in 19 h. The seeds in oxygen packed bags were transported to the hatchery facility for rearing. (fig.1)

II) *Hatchery Rearing*

The rearing of seabass was carried out in 15 t indoor masonry tanks. The seeds were acclimatised to the rearing conditions by floating the bags for 30 ± 15 minutes, and thereafter slowly released into the water. The seabass seed of 45 mm size was stocked at the rate of 500 nos/ m^3 and the larger juveniles of 55 mm size were stocked at 233 nos/ m^3 in the rearing facility.

III). Nursery Rearing

During October-November, 2009, the advanced fingerlings from the hatchery with an average weight of 20 g each were stocked in nursery cages floated in the earthern pond in different batches. Earthen ponds with depth ranging from 1 to 1.5m proximate to the estuarine area at Byndoor, (Uttara Kannada District) was selected. The pond was filled with water (27 to 33 ppt) during the high tide.

Water quality: The rearing was carried out in sea water maintained under controlled conditions. The seawater was filtered using a filter layered with gravel, sand and activated charcoal. The filtration system was well maintained so as to ensure adequate nitrification. The filtered water was chlorinated, dechlorinated and stored in overhead tanks. The treated water was filled in the masonry larval rearing tanks by gravitational flow. Flow -through system was maintained at a flow rate of 500 l/h. The salinity of the seawater ranged from 26 to 33 ppt. The water temperature during the rearing period varied between 26 to 30 °C

Feeding: Fishes were fed twice daily at 12 hour interval with imported compounded feed at the rate of 8% body weight. The fishes were weaned to locally compounded pelleted feed. Pelleted feed was supplemented with mince comprising trash fish, bivalve meat and shrimps depending on its availability. Vitamin premix was added to the mince at the rate of 1%. Left-over feeds were siphoned out after feeding, along with the organic waste.

Grading: Due to differential growth and highly cannibalistic nature of the species, fortnightly grading of seabass into a uniform size was carried out to minimise loss due to cannibalism. (Fig.2)

Growth and survival rates: The seabass seed of 45-55 mm at stocking reached 110 mm in 50 days with weight ranging from 20 to 25g by the end of October, 2009. The survival percentage was 94.2%.

Pre-stocking management: Pond preparation was carried out by drying, tilling, sediment removal, fertilisation, bottom raking and disinfection, ten days prior to stocking. The earthen pond was dried by draining the water during low-tide by opening the sluice gates as well as by pumping. The pH of the pond was maintained at around 7.5 by liming. The ponds were filled with water during high tide after two days. The water depth of 1.5m was maintained by pumping water from the intake point. The catwalk was constructed in the pond for feeding and monitoring purposes, by erecting Casuarina poles vertically into the pond bottom. Bamboo poles were placed horizontally connecting the vertical poles to serve as a working platform. (Fig.3)

Nursery cage fabrication: The net cages were fabricated using PE net webbing of 15 mm initially. Square cages of 2×2×1 m were kept afloat by hanging from HDPE frames of 3" diameter. Each square cage was attached with a sealed 1" diameter HDPE frame filled with sand at the bottom as counterweight. The units were allowed to float in the water column of 1.2 to 1.5 m depth for facilitating easy removal of food material and water exchange in the bottom. A bird barrier netting with 2×2m square frame was

placed on the top of the cage to protect the fishes in cage.

Stocking: The seabass fingerlings were transported from the hatchery during early morning hours by road in oxygenated tanks. They were transferred to the floating cages in the pond at the rate of 700 nos/ cage, with an effective stocking density of 175 nos./ cu. m. The cages were fastened to wooden poles fixed near the catwalk.initially to facilitate feeding. Eventually the cages were allowed to float freely inside the pond for continuous flushing of water inside the cage. This also avoided accumulation of waste under the net cage.

Water quality: Water exchange was carried out by opening the sluice gates and draining the pond during the low tide. The sluice shutters were opened to facilitate the exchange of feed laden bottom water. Fresh seawater was pumped daily only during high tide to avoid mixing of pond effluents. The paddlewheel aerators were operated in the pond to increase oxygen level and to prevent thermal stratification. The temperature ranged from 28-30°C, salinity 26-28 ppt, pH 7.8-7.96 and Dissolved oxygen 5 - 6.26 mg/l.

Feeding: Feeding began one day after stocking at the rate of 7% of the body weight twice daily. The quantities fed weekly followed a theoretical regime starting at 7% and declining to 5% for compounded feed mixed with trash fish mince. The net cages were checked daily after feeding and periodically cleaned to allow water circulation inside the cage (Fig.4)

Collection from nursery pond: The seabass reared in the nursery were collected in batches by lifting the net cages and transported in oxygenated tanks to the grow-out site during December, 2009, after rearing for 45 to 50 days. Average weight of fish in pond while harvesting was about 80-100 g and survival rate was 80 % (fig.5).

IV). Grow-out in open-sea floating cages

comprehensive survey was conducted with the view of identifying the ideal site for open sea cage farming in Upunda. The survey covered the water level during the lowest low tide, bottom topography, sediment characters, salinity profile etc. Particulars of current using pattern of the cage site was collected to make sure that the cage installation did not hamper existing fishing activity and regular movement of boats in the area.

Cage Installation: Circular cages of 6m diameter were installed at the site selected during pre-survey. The inner net comprising 24 mm mesh sized net webbing was fixed to the upper cage frame. The outer predator net fabricated using 40 mm mesh size was fixed to the outer cage frame. The counter weight consisted of a 2.5" HDPE pipe filled with 100 kg iron chain, fixed to the predator net. (Fig.6)

The fishes collected from nursery ponds were initially reared in two circular cages which were temporarily installed in the saline creek, due to delay in mooring of marine cage at a stocking density of @ 3,500/ cage, until last week of January, 2010.

Mooring: One cage was moored in open waters of Uppunda during the last week of January, 2010 at 6 m depth, but 2 km from the shore. The net cages were moored using gabbion boxes filled with 70 nos of geo-bags. Each of the geo-bags were filled with 45 kg of gravel and secured by fastening the opening with 0.5 mm twine. The gabbion box was placed on sandy bottom by visually examining the area with the help of a diver. The cage was moored to the gabbion box using alloy steel moulded 14 mm chain long-linked and 16 mm short-linked, moulded with 5t threshold swivels (fig.7)

Stocking: After the mooring of open sea cage, seabass of 160-205 mm length (which were temporarily reared in saline creek) were pooled together and stocked in opensea cage at a stocking density of 6,082/cage. (fig.8).

Feeding: Fishes were fed *ad libitum* with mince comprising trash fish, bivalve meat and juvenile shrimps (approximately at the rate of 8-10% of the body weight) along with compounded feed.

Monitoring: The net webbing was periodically cleaned by involving the local fishermen. The inner net was exchanged for removing the epibionts once in a month.

Growth and Production: The fishes were reared in marine cage till 1st June, 2010. Harvesting was carried out in three batches (fig.9). First partial harvest was carried out on 20-04-2010, during which 1,720 numbers of fishes weighing 300 to 600g were harvested. In the second partial harvest conducted on 24-04-2010 1,994 nos. of fishes were harvested with 350 to 600 of each. The final harvest was carried out on 01-06-2010. At this harvest, 480 numbers of seabass weighing 500-680 g each were harvested (fig.10). Total harvested number from opensea cage was 4,194, registering a survival of about 70 %. Maximum size attained was 680 g (380 mm) and the total production from a 6 m dia. cage with- a depth of 2.5 m was 2.085t (fig. 11 and 12).