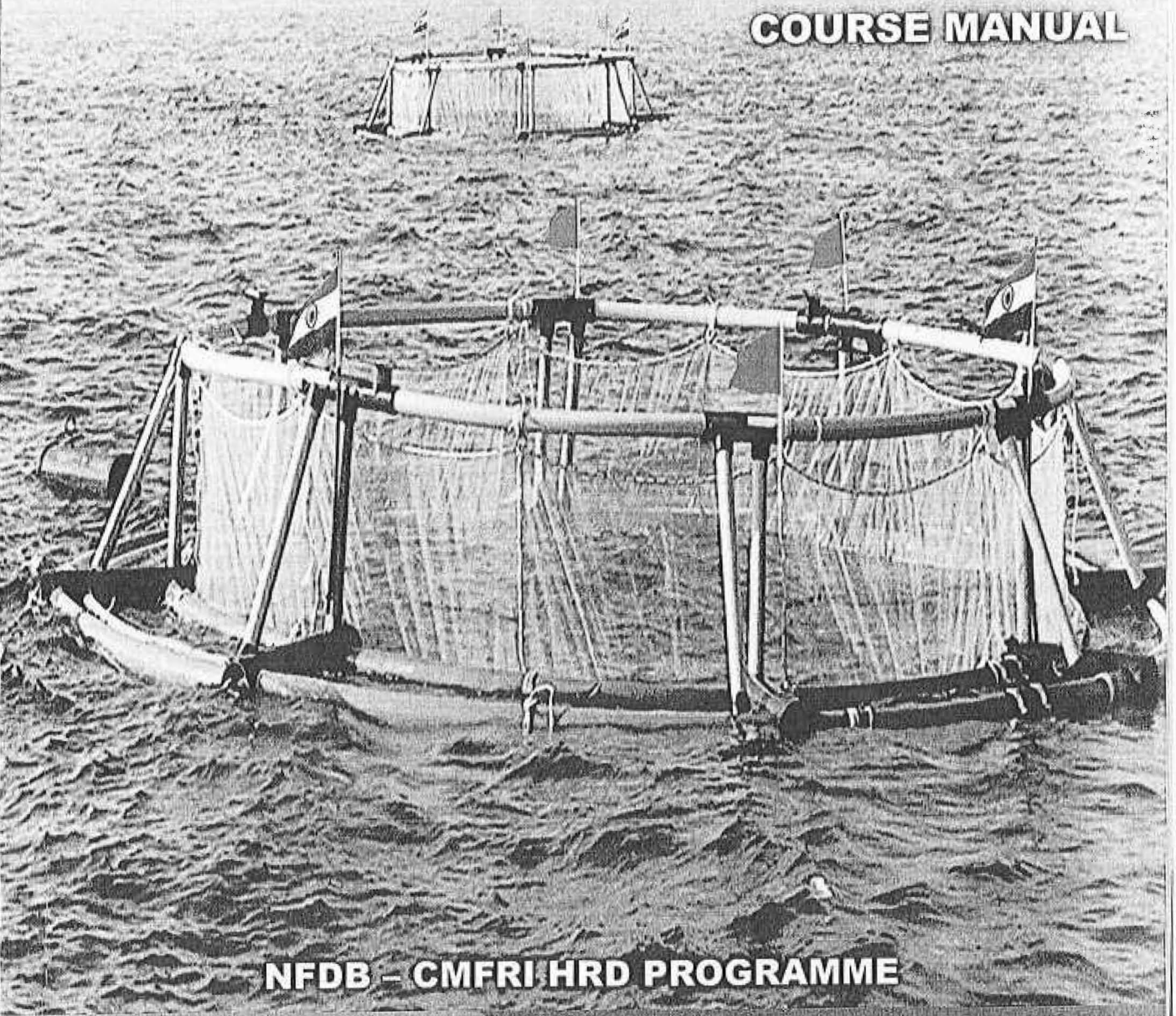
COURSE MANUAL



NFDB – CMFRI HRD PROGRAMME

NATIONAL TRAINING ON

SEA CAGE FARMING

ICAR

Vizhinjam Research Centre of
Central Marine Fisheries Research Institute
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Chapter 13

OPEN SEA CAGE FARMING OF ASIAN SEA BASS *LATES CALACRIFER* IN THE BAY OF BENGAL, OFF CHENNAI

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Controlled captive culture of fin fishes in open water bodies (seas, reservoirs, lakes) is mostly done in pens and cages. Open sea cage culture of the Asian sea bass Lates calcarifer was carried out for the first time in the Bay of Bengal off Chennai by CMFRI during February – August 2010. The execution of the programme began with the fabrication of suitable cages with proper accessories, identification of site, procuring and nursery rearing of seed, transportation and stocking of fingerlings and open sea rearing till harvest.

Site selection

Selection of cage type depends on the degree of exposure of the farm site to high waves. Other variables, such as the strength and direction of sea currents, the depth and the nature of the bottom are decisive for arranging the anchorage and the layout of the cages. The location of installation of the cage frames was decided based on the distance from the shore, visibility range from shore, off surf-beat areas, suitable depth of 4-5 fathoms, sandy substratum and proximity to reefs to alter wave directions during fierce currents. The site selected was sufficiently away from bar mouth (3-4 km) with a curve on the shoreline preventing the influx of ground water and terrestrial discharge towards the cage site, within and area of 50 m diameter around the mooring foci). Collection of bottom soil and depth sounding the adjacent area to confirm the bottom safety were also done prior to actually launching the cage. Inputs from fishers, local knowledge on surf zone, wave heights, wind speeds, bottom nature, currents, amplitudes etc. were also taken into consideration in fixing the site.

Cage set up and mooring

Circular double-layered self-buoyant HDPE cages were used. GI chain dipped in cold water after heating was used as the moor line, with necessary shackles and swivels. A 24 mm parallel HDPE rope line along with chain was provided for additional strength 3 buoys / 1 dead weight were used to act as buffer in the moor line. 1 m x 30 cm diameter HDPE buoys / 70 cm x 30 cm diameter, 50 l Sintex can buoys were coated with redoxide and PUF-filled. 1 x 1 x 1 m HDPE Gabion was used with polished stones/granites piled one above another. The inner fish cage net was fixed to the inner cage frame with 4 mm and 8 mm twine, after checking the cage frame and reinforcing the joints, nuts and bolts. The collar net was affixed from the bird rail and hung inside the inner cage extending beyond the inner cage from the pipe by 1 m. This

additional collar net was folded to 0.5 m in double layer and mended to the frame overlapping the inner fish cage net and the lower edge was then sewn with the cage net at 0.5m depth. This gave the additional strength to the net to withstand the wave hitting at the belly of the net and resist the wear and tear due to aberration with the horizontal hold pipes, clamps and fouling on the frames. This was also the zone found to be more prone to algal growth, seaweeds, barnacles and false spats.

Two FRP canoes tied at 2 m distance apart using steel railings and 20'6" diameter casuarina poles were used to suspend the gabion box in between with 8 mm and 12 mm ropes at the 4 ends tied to the poles. 50-70 stones each gathered in one FRP boat were piled up one above the other into the suspen ded gabion at sea surface level. Roughly 180-200 stones in one gabion box completed the 3 gross tons. Later the gabion top was sealed with the cover and further strapped on the two sides by 18 mm ropes forming loops. Once the box was fully loaded, 4 people simultaneously cut the suspension ropes and the gabion was thus released to the floor of the sea at one stroke. The chains and the 24 mm rope were connected to the gabion, to the loops, before lowering. Once the mooring was set, the buoys connected to the moor line remained floating in the sea.

Depending on the tide, direction of wind and current, the fully assembled cage, along with the net (outer and inner) was pulled to the shoreline by at least 30 people lifting the whole structure. The nets were secured to the frame by rolling up and the cage was set floating in the surf zone. Imme diately, a few swimming fishers pushed it further and took a rope lead to a nearby FRP boat which later towed the cage to the required site slowly. The distal end of the mooring chain beyond the 3 floats is trifurcated and these were affixed to the outer cage frame pipe by means of GI clamps and locked by means of swivels. These swivels were secured fast by using wire rope and locking the key. Once the cage frame was floating steady, the inner and outer cage net was lowered from the main frame. The ballast weight at the bottom of the cages retains the cylindrical shape of the net. The outer net needs to have an HDPE ballast pipe perforated with holes, 3" in diameter and filled with 3 parallel lines of steel wire warp, 12 mm in diameter while the inner net has only 2 wire warps tied closely with the outer edge of the inner cage net bottom. Vertically, 8 loops of 8 mm ropes secured to the ballast of the inner cage is wound passing through SS rings on the ballast of outer cage frame pipe and the bird rail. These loops provided rib support to the cage net belly from swaying against the currents. In addition to this, a twelve mm rope was fastened to the mooring chain from the ballast pipe of the outer net in the same position where the mooring chain is affixed on to the main frame. This helped keep the cage vertically stretched and avoided swaying during drift and current. Solar lamps and flicker torch were used for night navigation.

Cage specifications

1.Seabass cage:

Outer cage: circular, made of HDPE, blue colour having twisted webbings with 2.5 mm twine/40 mm mesh size (7 m diameter x 4 m depth); top and bottom ropes with SS rings.

Inner cage: 6 m diameter x 3 m depth made of 2mm/30 mm HDPE blue webbings (1st set) outer ballast HDPE pipe 3" diameter with inner core 16mm steel warp. The pipe is circular and soldered ends with clamps and nut bolts. 6" pipe has 5mm hole drilled throughout the lengths in three parallel lines along the

circumference. The ballast is attached to the outer rim of the bottom edge of the inner cage net. The cage is suspended on the inner float pipe.

6 m diameter x 3 m depth
made of 2mm/30 mm
HDPE blue webbings (2nd set)

6 m diameter x 3 m depth
made of 2mm/30 mm
HDPE blue webbings (3rd set)

6 m diameter x 3 m depth
made of 2mm/30 mm
HDPE blue webbings (4th set)

2. Inner cage net collar:

6m diameter x 2m depth
made of 2.5 mm twine/40 mm mesh size.

3. Bird net:

Previous cage operations used bird protection nets with 1.25 mm/80 mm webbings. As the cage operations have to be carried out for 3-4 months, it has been decided to use strengthened bird nets having 6 m diameter HDPE twisted 2.5/40 mm mesh size.

4.PP rope: 32 mm

5.Gabion boxes:

1x3cu.m,with UVrays protected PP rope.

6.HDPE buoys filled with PUF.

Stocking

Sea bass stocking can be done in cages in various stages, depending on the farming duration, ease of operation and fouling rates. Sea bass essentially require grading till they attain 16 – 17 cm TL. Till then, they have to be graded in 7-10 days time to avoid cannibalism and suppression of growth. Therefore stocking at smaller sizes will necessitate holding them in smaller hapas or cages with regular grading. Pellet feeding, grading and monitoring during these stages in open sea environment is practically a tough task. Beyond 17 cm, further grading is not recommended. Therefore stocking to cages at these sizes is advantageous. However, transport of the bigger sized seed is also a challenging task.

Transportation of sea bass juveniles (more than 10-12 cm) in plastic bags is risky. Sea bass is very sensitive to ammonia and nitrite level in their water. Prior to transport and handling of seed is done, starvation or non-feeding for at least ten hours is essential. Transportation of fish seed should always be carried out in the early morning hours (between 5-7 a.m.). From the nursery tanks, seed of the required size can be transferred to another holding tank where the water temperature is lower by atleast 2°C from the ambient temperature and the water is mixed with 1 ml Aquis or clove oil to1 ton of sea water. This water is set with thorough aeration at least one hour prior to loading of fish. Nursery-sized fishes are always to be handled using knotless textile kind of material for making scoop net and bag nets to carry the fishes and to dip the fishes in the cooled anaesthetiser-mixed water. These nets reduce the loss of scales.

200 l HDPE barrels cut on the lateral side with a window roughly of 25 – 20 cm were used for transportation of sea bass seed from the nursery to the cage. Each barrel was tied with 2 casuarina poles, each of 8' length and 3" diameter, using coir ropes. The poles were fastened to the barrels in such a way that the barrel lay horizontally, with the window positioned upwards and the poles extended as two arms on either end. These arms facilitated lifting the barrel and transporting it to the shore, from where it was carried on FRP boats further to the cages. The barrels were loaded

with 100 l of seawater, and sea bass seeds were stocked in the following densities –

25-40 g : 300 nos.

40-70 g : 200 nos.

70-100 g : 100 nos.

Once on board, oxygen was diffused into the water from an oxygen cylinder and this system held good for 3 hours. On reaching the cage site, the barrels were kept inside the cage at the surface of the water and slightly tilted to one side for transfer of sea bass seed into the sea cage without any damage. Bird cover was placed over the cage after stocking.

Feeding

The sea bass seed were nursery raised on pellets and live shrimps and this feed was – continued from the second day after stocking, for 13-14 days. Weaning was done gradually to small sized *Stolephorus*, supplied 2 times a day (6 a.m. and 4-5 p.m.) @ 2.5% sea bass biomass. About 20-25 kg of *Stolephorus* was used for each feeding. The fish were broadcast at the side, against the tide direction so that by drift the feed settles into the cage. The dropping of seed had to be slowly towards the pyramid formation typical to sea bass at the time of feeding, when the bigger ones topped the pyramid formation, and the smaller ones remained at the lower level. Hence, at each drop, some portion of feed had to be scattered around the pyramid to ensure uniform availability to the stocked sea bass.

After nearly 40 days of culture, sar dines, cut into small pieces were introduced. Up to the 4th month, when the sea bass were mostly of about 200 g size, sardines cut into 3-5 pieces each were fed @ 2% of sea bass biomass. By the end of the fifth month of rearing, when most of the fishes measured about 600-800 g in size, the sardines were usually cut into two and fed@ 2% sea bass biomass. By the end of the culture period, the body weight of the stocked sea bass ranged 800 – 1300 g and whole sardines were given @ 1.8% sea bass biomass. While three-times-a day feeding was practiced in the initial months, feed was given twice a day in the final phase of culture. For each feeding, the sardines were packed in polythene bags @ 2-3 kg per bag and transported to the cage sit for feed application. Care was taken to avoid feeding on cloudy days with overcast skies, since feeding activity was found to decline on such days. High wave action, excessive rainfall and strong winds also created a dip in the feeding activity. Poor feeding was also observed when external factors like sea turbidity, human interference (diving/angling) induced turbulence. On normal days satiation rates provided feedback on biomass / stock status.

Net maintenance

The nets were examined regularly for damages. Weekly cleaning of frame and collar nets halfway into the water level is to be done using brushes and scrapes. Checking at the net ballast (outer & inner) for any tear or slits should be done by periodical diving. It is necessary to pull up the loop ropes and check for the mobility of nets up and down. The solar lamp on the must be wiped clean of bird droppings.

Check for the buoyancy - initially 6 persons can stand; gradually the sinking rate will be more and the cage should hold good for 4 normal persons at least, otherwise change the net after checking the bottom fouling or adding buoys intermittent to the HDPE rings (0.7 m x 0.3 m HDPE hermetically sealed). Pick up all the plastics and jelly fishes and remove excess feed / moribund fishes / dead fishes etc. Infected / scaly / white patchy / sleek and emaciated / fishes showing swim ming disorder / surfacing fishes should be clea red. Check for oil films / nets / drifted buoys and ropes and tangling on the cage nets, entangled snakes, eels and crabs.

Net exchange

Net exchange is to be done at regular intervals, depending on the fouling rate. Pull the old net / half the area of the cage, secure the new net cage in the next half and gradually shift the fishes to the new portion by pulling up the new net underneath the old net and cover up (advisable at a small density and small sizes).

Encircling method – the new cage net is made with a cut on one side vertically and has an additional 1-2 m window source to later wrap up and sew. The new net is encircled by towing a rope underneath the old net and encircled on all sides and the lateral slit is stitched in the water and once the old net is released the inner side of the window is also stitched. Outer net can be removed directly and encircled unless it has some escaped fish. If so, encircle the net first and then release the old net as done earlier. Regular net cleaning and net exchange during the culture period are imperative.

Limiting factors

The Asian sea bass is a euryhaline fish with high tolerance to a wide salinity range (0-38 ppt). It can also withstand high turbidity levels. Temperature however, is major limiting factor and the fishes are easily susceptible to stress and infections at temperatures lower than 25° C. Freshwater influx into the coastal waters will bring about drastic changes in salinity, temperature and turbidity and juveniles are highly vulnerable when exposed continually to such conditions. Hence the site of cage mooring must be sufficiently away from areas of freshwater run-off. Stocking density is a major factor determining the performance of the production system The ideal stocking densities for sea bass of different lengths could be -

- 100-120 nos.percu.m for fish of 15-20 cm length
- 80-100 nos. per cu.m for fish of 20-25 cm length
- 60-80 nos. per cu.m for fish of 25-35 cm length
- 50 nos. per cu.m for fish of >35 cm length

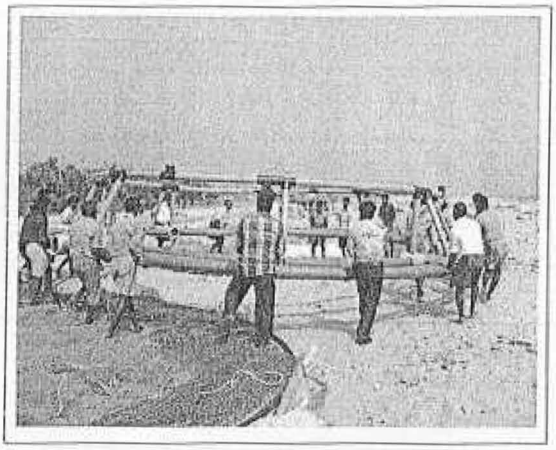
The ideal net dimensions are:

Outer		Inner
6 m diameter	x	3 m depth
40 mm green mesh		25 mm blue mesh
6 m diameter	x	3½ m depth
60 mm green mesh		30 mm blue mesh
6 m diameter	x	3½ m depth
60 mm green mesh		35 mm blue mesh
6 m diameter	x	4 m depth
80 mm green mesh		40-45 mm blue mesh

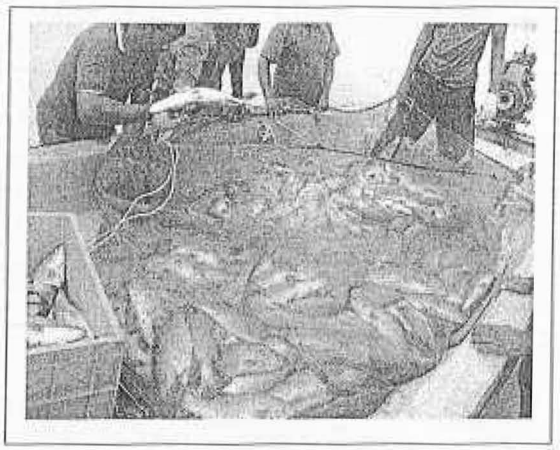
Depending on the growth of the stoc ked sea bass, partial or complete harvesting can be done Periodical sampling at feeding time using scoop nets must be done to assess growth, density infections/infestation etc. Loss of fish due to escapement to outer net and beyond should also be monitored.

Results of sea cage farming off Chennai

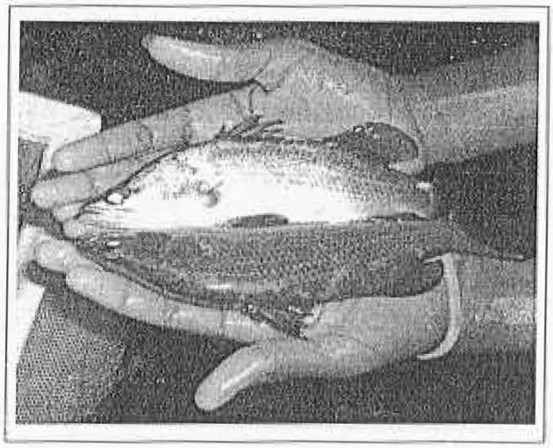
The cage moored in the sea off Chennai at 12°46.815'N; 080 15.521E in February 2010, about 1 km from the shoreline was stocked with about 7000 numbers of sea bass juveniles. The size at the time of stocking in the cage was 17-22 cm (60-100 g). The rearing period was six months. The ration size increased as the biomass of the fish inside the cage increased. Periodical sampling was done to monitor growth and survival of the fish. At the time of harvest, the fishes had attained sizes ranging from 0.8 kg to 1.8 kg weight (25-49 cm total length) with an average weig ht of 1.3 kg. More than 90% of the fishes were in the weight range of 1.1 to 1.5 kg. The harv ested fish were sold at prices ranging from Rs.180/- to Rs. 200/- per kg.



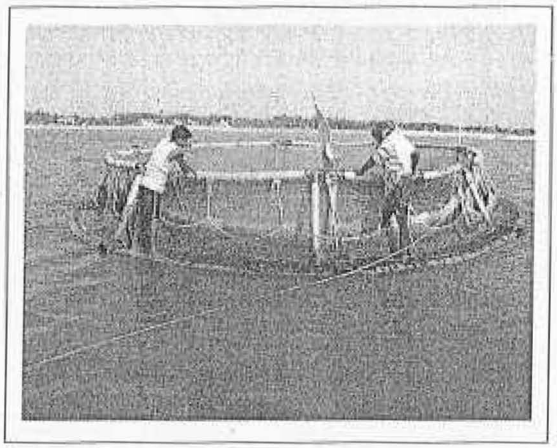
CONSTRUCTION OF CAGE



HARVESTED SEA BASS

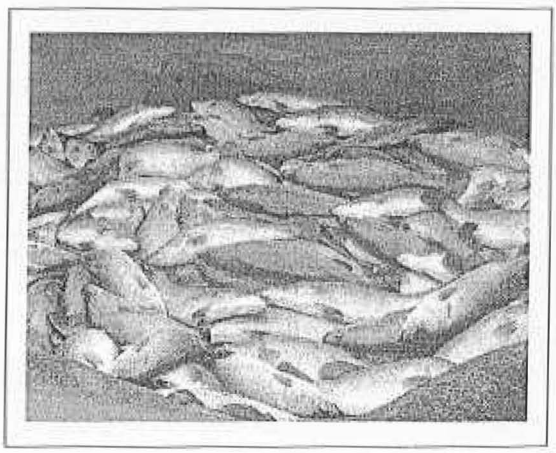


SEA BASS FINGERLING READY
FOR STOCKING



MONITORING OF CAGE

TRANSPORTATION OF FINGERLINGS
TO CAGE



HARVESTED SEA BASS