

Cost-effective Cage Farming Technology

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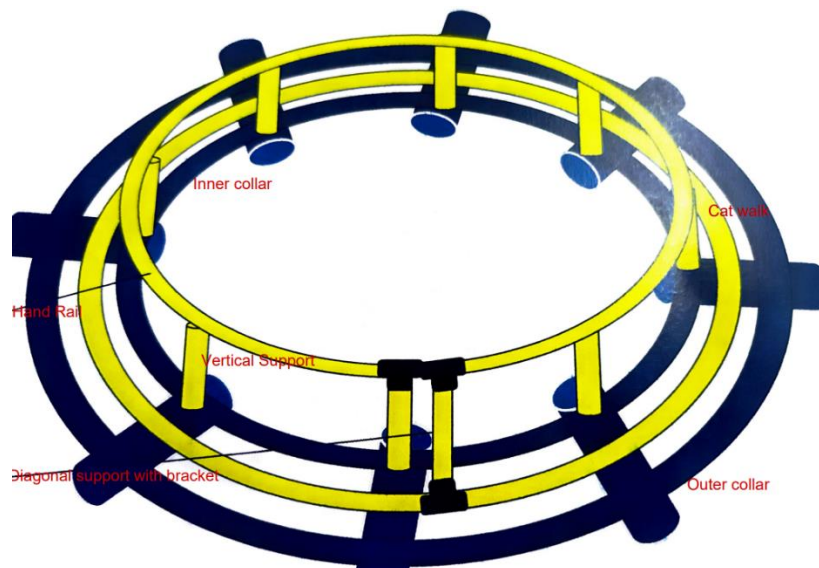
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Introduction

Cage culture is recognized as a promising farming practice and offers the fishers and fish farmers a chance for optimal utilization of existing water resources which in most cases has limited use for other purposes. It is a low impact farming practice with high economic returns. There are wide prospects of culturing different species of finfishes in cages. In India cage culture was initiated by CMFRI since 2007 and within a decade and half, the technology has been standardized and widely accepted by fishers and farmers along the Indian coasts.

ICAR-CMFRI has developed cost-effective design for cages in open waters (open sea, rivers, lakes, quarries) with many years of innovations and inputs from technical experts and has been simplified and popularized among farmers. Square shape cages have been advised widely for open waters other than sea.

Design



Circular cage for open sea

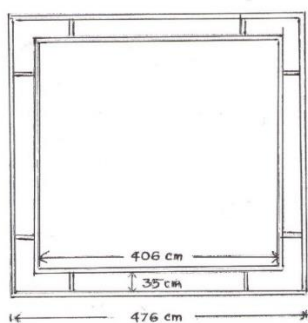
The low cost cage developed by CMFRI is made of 1.5" GI pipe (B class with ISI). The design details of the cage are given in fig below. The diameter of the cage was 6 meter and the height was 120 cm from base to the hand rail. All the joints are double welded for

ensuring extra strength. After fabrication the structure was coated with epoxy primer and epoxy grey paint to prevent rusting.

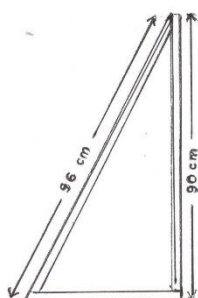
Square cage for open backwater/ freshwater/ granite quarries

The materials required for fabricating a 4 m x 4 m x 3m GI cage is given in the Table and the design details in the Figure below: The square Galvanized Iron cages are cost-effective, easy to fabricate and easy to operate in any type of open waters other than sea. The welding joints are sealed using M-seal and allowed to dry before painting. As in the case of sea cages, epoxy primer and epoxy paints are applied to these cages to prevent rusting.

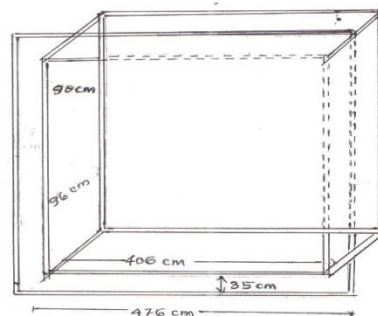
Sl. No	Item with specifications	Qty. (nos.)
1	Galvanized Iron (GI) Pipe (1.25 inch) 6 m length (B Class quality)	13
2	PVC Barrel (Used/New)	8
3	Grow-out Net (HDPE twisted twine of 1.25mm; square mesh) 4 m x 4 m x 4 m	2
4	Outer Net (predator protection net HDPE twisted/braided twine of >1.25 mm) 4.7 m x 4.7 m x 3 m	2
5	HDPE Rope (4 mm; 6 mm, 10 mm & 12 mm) as per requirement	
6.	Bird protection net (80-100 mm Nylon) 6 m x 6 m	1
7	Ballast pipe (GI, 3.7 m x 3.7 m; 1.25 inch)	1
8	Mooring materials (Anchor/ bamboo pole/Areca nut stem) depending on site	



Inner and Outer Frame



Diagonal & Vertical supports



Inner and outer frame with hand rail

The floats used for these cages are 200 L used drums, which are tied in between the base frames. The nets used are based on size of fish stocked in cages.

Cage farming involves rearing of fishes in a net cage mounted on a floating frame, installed in an open water body by mooring using anchors/ poles, and other accessories like ropes, buoys *etc.* with feeding and 24 h water exchange.



Cage frame with floats attached

Site selection

Selection of suitable site is the most important criteria in cage culture because it determines investment, running cost, final production and the ultimate success of the farming.

- Cage site should be free from any **sources of pollution** (industrial, agricultural or domestic)
- The depth at the site should be minimum 3.5 m to keep the net cages well above the bottom (minimum clearance of 50 cm) and allow water exchange from all sides and bottom of the nets.
- A minimum flow rate of 0.5m/sec will be ideal.
- Tidal amplitude from 0.5 to 1.5 m.
- Water quality parameters such as temperature, salinity, pH, suspended solids and algal blooms influence the growth and survival of the cultured fish.
- Bottom characteristics also have some role in site selection as sandy and rocky bottom is more ideal than muddy bottom.
- Weather at the farming site can impact both the cage structure and farmed fishes.

Cage structure and mooring

Indigenously fabricated Galvanized Iron (GI) cage frames of circular, rectangular/ or square dimensions are used for cage fish farming. Two nets required for a cage culture unit are; one to hold the fish and the other a protection net for the fish during grow-out culture. The nets are of High density polyethylene (HDPE) twisted twine of 1.5 mm thickness with 28-40 mm mesh (outer protection net) and HDPE 1.5 mm twisted 18- 40 mm mesh (inner grow-out net) based on the size of the stocked fish. To protect the fish from the attack of birds a bird protection net of 60 – 80 mm mesh is provided at the top of cage. A ballast pipe frame at the bottom of net cage is provided to maintain the shape of the inner net. Square mesh is recommended for cage nets instead of diagonal mesh to avoid escape and gilling of undersized fishes and also for better water exchange through the nets.

For mooring the cages, poles or anchors are used depending upon the site selected. Mooring is done at single point (in sea), at opposite sides or at all four sides (in open waters other than sea) to keep the cage in place. Mooring is done in such a way that the fixed cages will have only vertical movements during tidal flow. Side wise movement is possible depending on the length of the rope tied between the poles and the cage.

Seed stocking

Fish seeds are procured from hatchery/ suppliers. Size above 12 cm are recommended to stock in cages. Nursery rearing in *hapas* in ponds/ cages are needed for under sized seeds. Sea bass *fry* measuring <10 cm (usually 3-5 cm) are stocked in nylon *hapa* measuring 2 x1 x 1.5 m erected either in pond or tied inside the cage. About 2,000-3,000 *fry* can be raised to fingerling size (>10cm) in a *hapa* in 45 days. The *fry* are fed *ad libitum* with micro particulate high protein nursery feeds or minced shrimp/ fishes 3-4 times a day. Periodic grading (every 4-7 days) is done to sort fishes of varying sizes and stocked in different *hapas*



to prevent cannibalism. Clogging of the *hapa* has to be taken care to allow free flow of water to remove the waste accumulated in the bottom of the net.

In grow-out cages, 35-40 numbers of fish can be stocked per cubic metre. *Cobia* can be stocked @ 8-10 fish per cubic metre. The grow-out period for *L. calcarifer* in open water cages is standardized as 6- 8 months when the fish attains >750 g mean weight. Pellet feeds with high protein (37-40%) or chopped low value fishes can be fed to the stock thrice a day @10% in the first three months. After attaining 100 g, feeding is reduced to 8% and on attaining >600 g it is further reduced to 5% biomass. Care should be taken to feed slowly so that each and every fish would get the feed.

Cage management

Cage management involves cleaning and maintenance of minor damages to the net, cage frame and other accessories through regular monitoring. Net change is recommended if the net gets clogged due to fouling or when the fish grows bigger During culture, inner grow-out net with mesh size of 18 mm, 22 mm and 40 mm can be exchanged for better growth and efficient water exchange. Behaviour of the stocked fish has to be observed regularly to act when emergencies occur. In case of occurrence of any disease timely intervention has to be done.

Harvest

Once the fish has attained marketable size (>750g- 3kg depending on species), harvesting can be done. In cage farming, harvesting is simple and less labour intensive compared to harvesting in ponds. Sophisticated harvesting mechanisms are not required in cages. The cage can be towed to a convenient place and harvest can be carried out with less manpower. Harvesting can be done in a single lot or in batches based on demand and market price.
