View of cage farm at Visakhapatnam

BRACKISH WATER CAGES

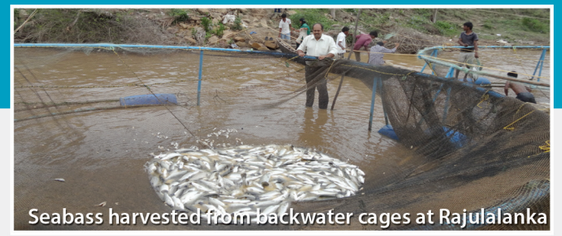
Apart from sea, cage culture technology is used in other water bodies such as estuaries, creeks, backwaters and lagoons. Cage culture of different fishes suitable for these water bodies has been demonstrated by CMFRI in different places such as Cochin(Kerala), Mangalore (Karnataka), Nagayalanka and Rajulalanka (Andhra Pradesh). A study in different places has showed that the cage culture technology is used effectively in these systems similar to the sea cages. Unlike sea cages, cost involved for installation of cages in these water bodies is comparatively less because of cage material and mooring systems. The cages suitable for the system are HDPE cages, GI cages and wooden cages, however use of the cages made by different material depends on the water current and wave action in the selected sites. The commonly used mooring is pole mooring in calm water areas, and chain or rope mooring where water current is more. Fishes suitable for these systems are mullet, milk fish, sea bass and pearl spot.

Case study – Cage culture in Godavari backwaters, Rajulalanka and Krishna backwaters, Nagayalanka, Andhra Pradesh

Under the technical guidance of Visakhapatnam RC of CMFRI in January, 2014, six galvanized iron (GI) cages measuring 6 m in diameter and 4 m in depth were installed using pole mooring in the river Godavari backwaters in Rajulalanka, Narsapuram in the West Godavari district of Andhra Pradesh. The cages were stocked in February with approximately 7200 seabass fingerlings ranging in size from 15 to 30 g. The seabass was fed with Tilapia @ 6 – 8 % of their body weight. The feeding regime followed was: 8% of body weight twice daily during the first two months, 7% of body weight thrice daily during the third and fourth months and 6% of body weight four times a day during the fifth month. The stocked seabass grew well and reached an average weight of 649±272g and 354.55±45.16mm after five months when they were harvested. Survival at the end of the five month culture period was 86% with harvest weight of around 4 tonnes. The harvested fishes fetched a farm gate price of Rs.330 per kg. Another demonstration for cage culture of seabass was carried out in back waters of Krishna river at Nagayalanka, Krishna district. A total of 13 cages were used, of which 11 were wooden cages (square shaped; 4 x 4 x 2 m size) and 2 were HDPE cages (circular with 6 m dia).

The cages were installed with help of barrels for floatation and anchor (iron and stones) for mooring. All the cages were stocked with 6 inch sized seabass in the month of August to November, 2015 and were fed with trash fishes. A total of 500 numbers of fish seeds were stocked in each cages. Fishes had grown to 0.5 kg to 1 kg in 5-8 months of culture period. The grown fishes were harvested on 15.5.2016 and Hon. Shri. Mandali Buddha Prasad, Deputy Speaker, Govt. of Andhra Pradesh flagged off the fish harvest. A total of 3 tonnes of seabass was harvested from cages and sold in live at the rate of Rs. 340 per/kg, instead of Rs. 270 per/kg for dead fish in local market. Demand based fish harvest is possible through cage culture technology, which helps for fetching higher returns.

Cage culture site at Rajulalanka



Seabass harvested from backwater cages at Rajulalanka

Backwater cage farming site at Nagayalanka

Hon. Deputy Speaker, AP with the harvest, Nagayalanka

Consultancy Services offered by CMFRI:

- Cage culture site selection
- Cage design, fabrication and deployment
- Cage culture technology for various marine finfishes & shellfishes

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CAGE CULTURE

VISAKHAPATNAM REGIONAL CENTRE
CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
Indian Council of Agricultural Research
Ministry of Agriculture, Govt of India

INTRODUCTION

In India, open sea cage culture technology is a new and relatively recent activity. Understanding the importance of cage culture, the Central Marine Fisheries Research Institute has initiated cage culture as a research and development activity to identify appropriate design and suitability of cages under Indian context in the year 2006-07. The first open sea cage was launched in Bay of Bengal off Visakhapatnam coast during May 2007, but because of technical problems it failed. After several modifications, a 15 m cage was launched in December 2007. This cage was stocked with sea bass and harvested after 6 months with 75% survival. This was the first successful harvest from open sea cage in India and this success has given motivation and encouragement to the researcher and fish farmers. For ease of operation, later 6 m diameter cages were designed, installed and successfully demonstrated in several states of India with different commercially important finfishes and shell fishes. Presently, cage culture has become one of the important fish culture methods and it is envisaged that this method will help to enhance marine fish production in India. Success in cage culture depends on the selection of suitable sites, species and cage design. Therefore, selection of these parameters play important role in cage culture.

SITE SELECTION

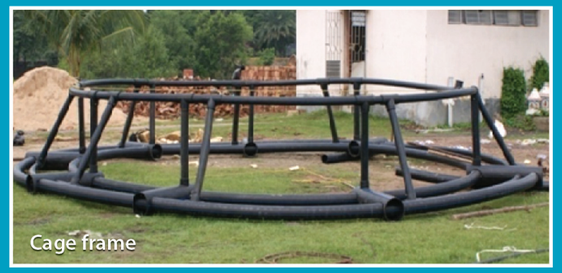
Site selection is the most important factor for the commercial viability of mariculture systems. A suitable place for cage culture should meet the following criteria: water temperature of 26°-30°C, depth of up to 10 to 15 m, close to the shore and away from polluted waters. Bays, straits and inland seas protected from strong winds and rough weather are ideal sites for cage culture. The sites should have adequate circulation of water, with wind and wave action within moderate limits. Flowing waters with a slow current of 0.5 to 1.0 m per second are considered ideal for cage operation. In addition to water quality and topographical parameters, legal aspects, access to the site, proximity to hatcheries or fishing harbor, security, social and market parameters are also to be considered.

SPECIES SELECTION

Selection of an appropriate fish species is necessary for the success of cage culture system. Species selected for culture should meet the following criteria: 1) availability of seed and seed production technology 2) good consumer demand and high market value 3) hardy and tolerant to crowded conditions 4) should be able to accept external source of food and 5) fast growth rate. Fish species fulfilling above mentioned criteria will perform better in cages, and bring good returns to the farmers. Some of the important potential candidate species available in India for open sea cage culture are different species of groupers, snappers, sea breams, cobia, pompano, Asian seabass and lobsters.

CAGE DESIGN

Presently, the floating HDPE (high-density polyethylene) cages are identified as most suitable in east and west coast of the Indian seas. However, in some regions where protected sea exists the GI (Galvanized Iron) cages are used. The HDPE cages have a buoyant frame or collar that support the net bag; can be made in a variety of designs, and are the most widely used in rough sea conditions. The floating HDPE cages are having following components:


Cage frame

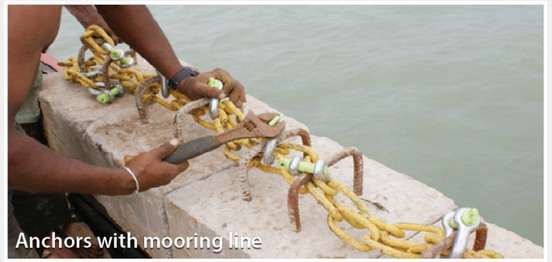
Cage frame: After conducting several experiments, CMFRI has identified the long lasting and high durable HDPE pipes as suitable material for cage frame design. It provides appropriate shape/structure to the cage. In addition, it also provides buoyancy and holds the system at a suitable level in the water surface. CMFRI has developed sea cages of 6m and 15m dia for grow out culture and 2m dia HDPE cages for seed rearing. However, the ideal size suggested for grow out culture is 6m dia due to its easy operation.

Net cage: The function of the net bag is to contain and protect the fish. The nets are kept stretched vertically with weights (ballast) at the bottom. Nets of varying dimensions and materials were tested for suitability of net cage in India. CMFRI has identified and used braided and twisted HDPE nets for grow out purposes. It can last for five or more seasons. Nylon net also can be used economically, but it is light weight, requiring high load in the ballast to keep its shape intact. The depth of net ranges from 2 to 4m for nursery rearing and 5 to 6m for grow out.

Mooring system: This holds the cage in the suitable position according to the direction and depth decided in the design, and sometimes helps to maintain the shape of the cage. The mooring joins the cage at the anchor system. The materials used in the mooring systems are steel lines, chains, reinforced plastic ropes and mechanical connectors. A mooring system must be powerful enough to resist the worst possible combination of the forces of currents, wind and waves without moving or breaking up. Presently, in India 14 mm alloy steel link chains with C hook or U shackles are used in cages. In mooring system, 2-3 barrels (1 m length and with 220 cm dia) filled with air or foam material is used for floatation.


Mooring line with float

Anchor system: It holds the cage and all other components in a particular site in the seabed and is connected to the cage by the mooring system. In India, dead weight anchors are commonly used. These are usually concrete blocks and the major advantage with this type is that they are fairly consistent in holding. Initially, gabion boxes were used by CMFRI for anchoring purpose; but now concrete blocks of ~200 kg weights are being used. The anchor system is connected to the mooring system by 80 grade alloy steel link chain of 14 mm thickness. The anchor system is formed by a system of concrete blocks of minimum 3 tonnes joined together by chains to provide appropriate strength and connected to a buoy by a braided rope.


Anchors with mooring line

SEED RESOURCES FOR CAGE CULTURE

Open sea cage culture has been successfully demonstrated in different parts of India, and it is expected to grow in the coming years. Availability of adequate number of marine finfish seeds is most important for cage culture operation. Presently, seeds are either sourced from hatchery or wild caught. In India, hatchery production technology is available for only few marine fishes like Asian seabass, cobia, orange spotted grouper, silver pompano and Indian pompano. However, commercial scale hatchery operations are available only for sea bass and cobia with limited number of seeds in a year. Cage culture has also been demonstrated for other finfish species like mullets, milk fishes, mangrove red snapper, some species of carangids and different species of lobsters using wild collected seeds. Cage culture of these species depend upon wild caught seeds since hatchery technology has not been developed for these species in India.

DEMONSTRATION OF CAGE CULTURE IN INDIA

Successful demonstration of open sea cage culture for finfish and shellfish was carried out by CMFRI in the coastal states of Gujarat, Maharashtra, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Odisha and West Bengal. Lobster culture was successful at Veraval (Gujarat), Kanyakumari and Mandapam (Tamil Nadu) and Vizhinjam (Kerala). Asian seabass culture has shown highly encouraging results at Karwar (Karnataka), Cochin (Kerala), Chennai (Tamil Nadu), Narsapur (Andhra Pradesh) and Balasore (Odisha). Mullets, Asian seabass and pearl spot were also successfully harvested from backwater cages at Cochin and Mangalore (Karnataka) and seabass & silver pompano culture was a success in Krishna backwaters (Andhra Pradesh). Cobia was successfully demonstrated and harvested in Mandapam and Karwar. Malabar grouper was successfully harvested in Palk Bay (Tamil Nadu). Apart from grow-out culture, presently marine fish brood stocks are also being developed in cages with successful gonad development in different places. At present, Visakhapatnam Regional Centre of CMFRI is maintaining brood stocks of orange spotted grouper, Indian pompano in cages and have shown good growth and maturation.

CONSTRAINS IN CAGE CULTURE DEVELOPMENT

Several constrains are currently limiting the expansion and development of marine cages in India. The following constrains include: availability of adequate quantities of seeds, availability of low cost feed for marine finfishes, poaching, unstabilised market & non-availability of policies for cage culture. However, recently government of India has considered cage culture as one of the important technologies for increasing fish production, to meet the food fish demand in future. Thus, several initiatives have been taken by the government in the past few years to address the issues in cage culture through several government schemes.