Coastal Cage Farming of Marine Finfish, Indian Pompano

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Introduction

Cage farming technology is widely recognized as one of the most important culture technologies in mariculture for increasing fish production. High saline estuaries are one of the unified ecosystems, considered for improving the livelihood of selected rural population. In India, huge estuarine resources are available bordering the coasts and these potentially available under-utilized high saline waters bodies, could be efficiently utilized by culturing different species of finfishes in cages installed thereof. Different species of marine finfishes can be cultured in high saline estuarine cages and Indian pompano (*Trichinous mookalee*), is one such suitable potential candidate species. Pompano is a preferred species for cage culture with the following characteristics; quick adaptability to different culture conditions, ease of accepting artificial pellet feed, tolerant to wide range of salinity, fast growth rate and high consumer preference. Understanding the culture characteristics of the fish, coastal cage culture technology for the species was developed and demonstrated under blue revolution scheme by Government of Indiaby ICAR-Central Marine Fisheries Research Institute. Various steps involved in cage culture of the species are explained below.

Cage site selection

Site selection is one of the most important factors for cage culture of the Indian pompano. The selected site should be free from pollutants, away from human inhabitants, with optimum water flow, and should be at least 5 km away from sea mouth. Water temperature: 26 – 30^0, water depth: 4-10 m, continuous water movement for better dissolved oxygen content. The selected place should have easy accessibility for reaching the cage site.Optimum speed of water current during high and the low tides is essential. If the current speed is more, then continuous force will be applied on cage mooring and net structure, and may lead to frequent shifting

of cage positions. Pressure due to water current will affect the net structure, which will impact fish movement and cause stress to the fish.

Fig.1: Suitable cage site for the coastal cage based farming

Cage structure

Square shaped cages made of Galvanized Iron (GI) pipes (B-class) of 1.5-inch diameter with inner dimensions of 5.0 m long x 5.0 m wide is preferred. In cage design, the base pipes and hand rails are important, the handrail is placed at a distance of 0.8 m above the base pipes for ease of operation. Two base pipes are placed in parallel at a distance of 1.0 feet apart and working space is created with the help of wooden planks or steel plates for use during feeding and sampling. Air-filled barrels (200 lit) are attached to the cage frame for floatation, and a total of 8 such barrels are used, two each at the four sides of the cage. HDPE braided nets are suitable with outer net of 63 ply, 40 mm mesh (6 x 6 m size and 4 m depth) and 3 mm twine thickness; inner net of 63 ply, 25 mm mesh (5 x 5 m size and 4 m depth) and 3 mm twine thickness; bird's net of 80 mm nylon mesh are preferred for fish culture. The cage structure is stabilized in the water with the help of iron anchors (4 numbers; each 50 to 75.0 kg in weight). The anchors are connected to the cage with the help of 24.0 mm diameter poly propylene ropes or steel chains. As bottom in estuaries is predominantly clayey soil, use of toothed anchor is recommended to have good firm grip on the bottom. Shape and volume of the net is maintained in the flowing

water with the help of ballast pipes made of 0.5-inch diameter perforated GI pipes. Corners of the ballast pipes are blunted and wrapped with tubes for avoiding tearing off the nets due to friction associated with water movements. Ballast pipes should be directly hanged from the base pipe for ease of operation.

Fig.2: Structure of coastal cage and toothed anchors

Nursery rearing and cage stocking

Optimum size of the fish for stocking for the coastal cage based system is 20 to 25g. The fish stocked at the optimum size takes nearly 10.0 months to attain a market size of more than 750 g. However, the culture duration could be further reduced if the fish stocked are of bigger sizes. Thus, nursery culture of Indian pompano is considered as an important aspect in cage culture for reducing the culture duration. Three types of nursery systems are suitable for Indian pompano concerning cage culture: Flow-through based FRP or concrete tank culture, Recirculating Aquaculture System (RAS) based nursery systems& earthen pond-based nursery systems. These nursery facilities should be established near cage site for ease of fish transfer.

Grow-out culture

After reaching the cage site, the transported juveniles are slowly released for acclimatization. The optimum stocking density suggested is 15 nos/m^3, and thus, the cage can be stocked with 1500 numbers of fish seed. An artificial floating pelleted feed with high protein is recommended for the fish in grow-out systems. While

feeding, feed should be broadcasted in the middle of the cage to avoid feed wastage due to drifting through net mesh along with wind action. Thus, to avoid feed wastage, feed mesh of 1 meter depth should be attached in the inner cage net. For better feed digestion and assimilation, a minimum time gap of 3 hrs should be given between two feeding schedules, thus the feeding frequency should be decided accordingly. Feeding frequency of four times daily is found to be good for growth of the stocked fishes and since the estuarine cages are easily accessible, at least four times daily feeding is recommended. In grow out culture, fish growth should be monitored fortnightly and feeding rate to be adjusted based on the weight. Based on several demonstrations, if the fish fingerlings of 20 to 25g are stocked at 15 nos/ m^3, then it takes nearly 10 months for it to reach the size of 800-850g, whereas if it is stocked at 100g size, it takes 5 months to reach the same size. Most of the estuaries are abundant in small fishes and other small marine organisms; therefore, probability of feeding on these small animals by the cultured fish is more, and resulting in better growth. The fish growth and optimum feeding rate is given in the Table. 1. Most of the estuaries are prone to floods during monsoon, thus the fish culture is possible for a maximum of 8-10 months, and hence, grow-out culture should be planned accordingly by efficient management of nursery system to achieve the complete cycle.

Table 1: Growth and feeding of Indian pompano in coastal cages

DOC	Fish Size (g)	Feed Size (mm)	Feeding Rate (%)	Feeding Frequency (time/day)
0-30	25 -50	1.2-1.8	8-6	5
30-120	50 -200	1.8-3.0	6-5	4
120-180	200-400	3.0-4.0	5-4	4
180-210	400-650	4.0-6.0	4-2.5	4
210-300	650-900	6.0-10	2.5-1.5	3

Fig 3: Grow-out farming of Indian pompano in coastal cages

Cage structure management

Cage culture of Indian pompano requires culture duration for 10 months, thus the cage structure should be managed well and it includes net exchange, cage frame cleaning and mooring checking. The cage net is the structure which holds the fish, and is prone to barnacles, mussel seed attachment and silt accumulation. Thus the net needs to be exchanged periodically depending on the accumulation. This attachment and accumulation depends on the season and the location. Based on

Fig.4: Cage maintenance of coastal cages

the experience in backwaters of Andhra Pradesh, silt accumulation is the major problem. On the other hand, in small creeks, cage nets are mostly infested and attached with green mussel seeds. Periodical cage net exchange is required in places where mussel attachment is more, whereas, in places with mostly silt accumulation, washing of cage nets by water spray using jet pipes is sufficient and net exchange is not required. Cage mooring helps to keep the entire cage structure in position, thus the mooring chain requires continuous monitoring, at least once in a month.

Indian pompano – management in coastal cage culture system

The cage cultured fish should be periodically checked for its feeding and health status, and thus sampled fortnightly. Apart from critical monitoring, daily observation while feeding is essential for understanding their feeding behavior, which is a good indicator for the health status of the fish. The major possible health issues in estuarine cages are bacterial infections and gill choking. Bacterial infection is mostly by Vibrio species and occasionally by other bacteria, occurs during peak summer season. Hence, stocking of fish during summer should be avoided and the net depth should be maintained at least 3 to 4 m in water to avoid heat transmission to the stocked fishes. Bacterial infection in fish could be controlled by the use of medicated feeds and probiotics. Fish mortality due to gill choking by silt accumulation is another major problem and can be avoided by frequent cleaning of the cage net.

Fish harvest and marketing

Cage cultured fish remains in a small confined environment, so harvesting the fish is easier than any other culture methods. The fishes in the inner net are harvested with the help of a hand scoop net, after lifting inner net from four corners. Immediately after harvest, washing in clean water and chill killing is suggested to maintain the freshness and quality of the harvested fish. Harvested fishes are packed in plastic trays or thermocole boxes by adding layers of ice in equal quantities at the bottom and top of the fish. Apart from bulk harvest, the estuarine cages are also suitable for batch harvest, based on local market demand. Hence, required amount can be harvested daily based on demand.

The most potential states for marketing the fish are Kerala, West Bengal, and selected pockets in Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra. Some of the selected buyers are Maxwell exporters, Kochin, Kerala; MATSYAFED, Kerala; West Bengal Fisheries Development Corporation, Kolkata.

Fig.5: Fish harvest from coastal cages

Fig.6: Harvested Indian pompano from coastal cage for packing

Economics

The total operational expenditure and profit for culture of the fish in a battery of 10 cages is given in Table. 2. Culturing the fish at the stocking density of 15/m^3 will support the farmer with net profit of approximately Rs 8.0 lakhs and price realization of Rs 325/kg.

Sl. No.	Particulars	Cost in (INR) (lakhs)
1	Depreciation value on cage and accessories with an average life of 5 years (Cost of cage and accessories: 1,36,400/unit) and depreciation is 23,700/unit/year	2.73
2	Seed cost - 15750 nos @ Rs 15/seed (Including transportation): 1500 nos/cage and additional 5% to compensate mortalities till nursery rearing	2.36
3	Nursery rearing in hapa	0.5
4	Feed @ FCR 1:1.60; Total of 17.30 tons of feed (based on FCR and production from column 8) @ Rs 110/kg	19.03
5	Labor cost @ Rs 12,000/labor/month (12 months) (Including watch and ward)	1.44
6	Miscellaneous expenditure including electricity and feed medicines and probiotics	1.0
7	Expenditure (Sl no: 1-6)	27.06
8	Production: 10.80 tones @ 85% survival with harvest size of 850 g at selling price @ Rs 325/kg	35.1
9	Net profit: (8-9)	8.04

Best Management Practices (BMP) for backwater cage culture of Indian Pompano

The following best BMP are recommended for sustainable culture with better economic return

- Cage should be installed at a location with optimum current speed and the location should be at least 5 km away from sea.
- Fish fingerlings of > 20g should be stocked to obtain maximum survival.
- Feed mesh of 1 mm mesh size should be attached with inner cage net for avoiding feed wastage.

- Feed should be broadcasted slowly in cages to ensure its accessibility to all fishes and avoiding feed wastage.
- Periodical monitoring of fish, cage net and other cage system is essential.
- Continuous observation for vibriosis and gill chocking to ensure that the fishes are free from the disease, and immediate treatment of the infected fishes.

Suggested reading

Megarajan, S., Ranjan, R., Xavier, B., Dash, B., Ghosh, S., Gopalakrishnan, A. 2022. Good Aquaculture Practices (GAP) in sea cage farming of Indian pompano and orange-spotted grouper; CMFRI, special publication number. 143, pages 71.

Sekar, M., Ranjan, R., Xavier, B., Ghosh, S., Viji, P., Ignatius, B., Joseph, I., Gopalakrishna A. 2021. Species validation, growth, reproduction and nutritional perspective of Indian pompano, *Trachinotus mookalee*– A candidate species for diversification in coastal mariculture. Aquaculture, 545, 737212.