

Sea Cage Farming of Marine Finfishes: Special Emphasis on Indian Pompano

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Introduction

Sea cage culture involves growing marine fishes in sea and it is one of the intensive culture methods available for fish production, which is also considered as boon for landless farmers. This technology helps to reduce mounting pressure on land for producing fish. Globally, the cage aquaculture sector has grown very rapidly during the past 20 years and is presently undergoing rapid changes in response to pressures from globalization and growing demand for aquatic products in both developing and developed countries. In India, sea cage farming was initiated as a research and demonstration activity in 2005 by Central Marine Fisheries Research Institute, Indian Council of Agriculture Research. The cage culture technology thereafter underwent several modifications, in-terms of establishment, stability under different climatic conditions and standardisation with different culture methods. Presently, sea cages manufactured using High Density Poly Ethylene (HDPE) is considered the best suited for cage frame, to withstand the diverse climatic condition across the Indian coast. In India, marine cage farming is practiced in selected locations by individual fishermen, fisheries co-operatives, and non-governmental organisations through support of state and central governments. The major fish species used for culture are Asian seabass, cobia, silver pompano, Indian pompano, orange spotted grouper and mangrove red snapper. In this chapter, sea cage-based farming technology developed for Indian pompano and Orange spotted grouper at Visakhapatnam Regional centre is detailed.

Cage site selection

Indian pompano and orange spotted grouper being a tropical species, the selected site should meet the following criteria: Water temperature: 26-30°C, water depth 6-10 m, continuous water movement for sufficient dissolved oxygen, away from polluted waters and industry run offs and finally easy accessibility with jetty facilities.



Cage structure

With an objective to have better stability against adverse climatic conditions in different sea, especially in north east coast and also to provide congenial environment for the cultured fish, the following cage specifications are recommended. Circular shaped HDPE cages of 6.0 meter dia inner collar and 8 meter dia outer collar pipes are supported by 8.0 numbers of base pipe, vertical and diagonal supports each. HDPE braided nets are suitable with following specification: Outer nets of 7.0 m dia and 4.0 m depth, 40 mm mesh of 3.0 mm twine thickness; Inner nets of 6.0 m dia and 4.5 m depth with 25.0 mm mesh. Bird net of 80 mm nylon mesh is preferred. The cage structure is stabilized in the sea with the help of mooring systems supported by 2-3 tonnes capacity cement blocks/gabion boxes/anchor systems with the help of mooring chain (long link alloy steel chain of 14 mm dia with 22 tonnes shearing strength), D-shackles and swivel. Ballast pipes help to maintain the cage structure intact in proper shape against the water movement. In order to provide sufficient space for fish movement, the inner net has to be tied with two ballast pipes at bottom and middle and outer net with single ballast pipe at the bottom.

Part -1: Cage Culture of Indian pompano (*Trachinotus mookalee*)

Indian pompano belonging to the family Carangidae, is a potential candidate finfish species for marine cage aquaculture. This species is mostly available in the Indian sub-continent. The fish possesses potential culture characters: quick adaptability to different culture conditions, tolerant to wide range of salinities, fast growth rate, quick acceptance to artificial feed, pleasant appearance, good meat quality and high consumer preference. Most importantly, the species readily accepts artificial pelleted feed and completes the culture cycle with artificial pelleted feed alone. Hatchery seed production technology for the species was developed in 2016 by Visakhapatnam Regional Centre of ICAR-CMFRI, and the culture technology was subsequently standardised, and demonstrated, mostly along the east coast of India. Additionally, domestic preference for the species is moderately high in different states of India. Marine cage farming for the species includes several important management aspects, and all management measures are to be meticulously performed for achieving maximum production from a unit area. The important management measures are given below.

Nursery rearing of Indian pompano

Optimum size of the fish for stocking in cage is 20 to 25g. The fish stocked at the optimum size takes nearly 10 months to attain the market size of 750-850 g. However, the culture duration could be further reduced if the bigger size (up to 100g) fish is stocked. Thus, nursery culture of Indian pompano is considered as an important aspect in cage culture for reducing the culture duration. The nursery reared fish seeds are transported to cages either in oxygen filled polythene bags or in containers supported with oxygen. The suitable transportation strategy is depending on the distance and size of the fish. The fish size above 10.0 g is recommended to shift via containers supported with pure oxygen (~ 10 ppm) for better survival after stocking.



Fig.1: Nursery rearing of Indian pompano in indoor tank facility

Grow-out culture of Indian pompano

After reaching the cage site, the transported juveniles should be slowly released for acclimatizing. The optimum stocking density suggested is 25 nos/ m^3 , and thus, 6 meter cage with 4 meter net depth will have to be stocked with 2500 -2750 numbers of fish seed. Artificial floating pelleted feed with high nutrient (40% Crude Protein & 10% Crude Fat) is recommended in grow out systems. To avoid feed wastage while feeding via meshes of inner cage net, feed mesh (small mesh (1.0 mm) net) of 1.0 meter depth should be attached in the inner cage net at water and air interface. For better feed digestion and assimilation, a minimum time gap of 3.0 to 4.0 hrs, should

be given between two feeding schedules, thus the feeding frequency should be decided accordingly. In grow out culture, fish growth should be monitored fortnightly and feeding rate to be adjusted based on the weight gain after every sampling. Based on several demonstrations, if the fish fingerlings of 20 to 25g are stocked at 25 nos/m³, then it takes nearly 10 months to reach the size of 750-850g, whereas if it is stocked at 100g size, it takes 5 to 6 months to reach the same size. The fish growth and optimum feeding rate is given in the Table.1.

Table.1: Fish growth and feeding at different growth stages in grow-out

DOC	Fish Size (g)	Feed Size (mm)	Feeding Rate	Frequency (times/day)
0-30	25 -50	1.2 to 1.8	8-7%	4-5
30-120	50-100	1.8 to 3.0	6-5%	4
120-180	100-300	3.0 to 4.0	5-4%	4
180-210	300-500	4.0 to 6.0	4-3%	3
210-300	500-750	6.0 to 7.0	2.5%	3
300-360	750-1100	7.0 to 10.0	2%	2



Fig. 2: Indian pompano grow-out culture in floating marine HDPE cages

Cage management

Cage culture of Indian pompano requires culture duration of a minimum of 10 months, thus the cage structure should be managed well with net exchange, cage frame cleaning and mooring checking. The cage net is prone to barnacles, algal and silt accumulation and the rate of accumulation is depending on the season and the location. However, the net should be exchanged at least once in two months to avoid net damage. The cage frame is another structure and is prone to barnacle's accumulation. Thus, this structure requires monthly cleaning. Cage mooring helps to keep the entire cage structure in position, thus the mooring chain requires continuous monitoring, at least once in a month. The mooring system specified for the cages will remain without much of a problem for a minimum of two years, and then slowly the chain starts eroding and then, based on the conditions, the chain needs to be changed.



Fig.3: Cage management: Cleaning of cage frames

Cage-farmed fish management

The cage-cultured fish should be periodically checked for its feeding and health status by fortnight sampling. Apart from critical monitoring, daily observation while feeding is essential for understanding their feeding behaviour, which is a good indicator for the health status of the fish. The major diseases associated with marine cage farming of the fish are vibriosis by selected species of *Vibrio* bacteria and parasitic infestations by ectoparasites. Fish affected by vibriosis, exhibits the symptoms of moving on the water surface and eyes, fins become reddish in colour. Whereas in

parasitic infestation, a visible ulceration appears on the external surface and also parasitic attachment can be noticed on the body surface, which ultimately kills the fish. Vibriosis in fish could be controlled by the use of probiotics and medicated feeds. The parasitic infestation can be controlled by freshwater dip treatment or using medicated feed with Praziquantel.



Fig.4: cage farmed Indian pompano with parasite infestation

Fish harvest and marketing

Cage cultured fish remains in a small confined environment, so harvesting is easier than any other culture methods. While harvesting, the fishes are removed with the help of a hand scoop net. 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 at the bottom and top of the fish. The cultured fish can be harvested based on the demand, and most preferably during the lean fishing or the trawl-ban season. The most potential states for marketing the fish are Kerala, West Bengal, and selected pockets in Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra and Goa. Some of the selected buyers are Maxwell exporters, Kochin, Kerala; MATSYAFED, Kerala; West Bengal Fisheries Development Corporation, Kolkata.



Fig.5: Harvest of Indian pompano



Fig.6: Harvested Indian pompano for transportation

Economics

The total operational expenditure and profit for culture of the fish in a battery of 10 cages is given in the Table.2. Culturing the fish for 10 months at the stocking of 25/ m³ will support the farmer with net profit of approximately Rs 16.9 lakhs with an average minimum price realization of Rs 325/kg at farm gate. The farm gate price varied with market demand and maximum of Rs 380/kg was realized for domestic marketing.

Sl. No	Head of expenses	Cost (lakh)
1	Depreciation value on cage and accessories with an average life of 10 years for cage frame, five years for cage mooring and nets (Cost of cage and accessories including installation: INR. 300,000/unit) and depreciation is INR 43,000/unit/year	4.3
2	Cost of 32,500 numbers of pompano seeds @ INR 20/seed (including nursery rearing expenses)	6.5
3	Cost of 35.7 t of extruded pelleted feed (Survival 85%; Average Body Weight 750 g at harvest) @ FCR 1:1.70 @ INR 100/kg	35.70
4	Labour charges @ INR 30,000/ month for 10 months	3.00
5	Boat hiring and fuel charges @ INR 6000/month for 10 months	0.60
6	Charges for net exchange @ 500/person for 3 persons, five times in the production cycle for each cage	0.75
7	Miscellaneous expenditure feed medicines and probiotics	0.5
8	Expenditure: (Sl no: 1-7)	51.35
9	Total income: Production of 21 tonnes @ 85% survival with harvest size of 750g at selling price of INR 325/kg	68.25
10	Net profit: (9-8)	16.90

Best Management Practices (BMP) for cage culture of Indian pompano

The following important BMP must be implemented while practicing grow-out culture in floating marine cages for better production with high economic returns.

1. A cage should be installed where the water movement is adequate for getting optimum concentration of dissolved oxygen and for washing away the accumulated waste generated from cultured fish
2. Fish fingerlings of > 30g should be stocked to obtain maximum survival

3. Feed mesh of 1 mm mesh size should be attached with inner cage net for avoiding feed wastage
4. Inner cage net should be additionally supported with a middle ballast pipe for maintaining the round shape and for avoiding net folding.
5. Feed should be broadcasted slowly in cages to ensure that all the fishes get the required feed and for avoiding feed wastage.
6. Periodical monitoring of fish, cage net and other cage system is essential.
7. Continuous observation for vibriosis and parasitic infestation to ensure the fishes are free from the disease, and immediate treatment of infected fishes.
8. Demand based fish harvest is recommended for better profit.

Suggested readings

Megarajan, S., Ranjan, R., Xavier, B., Ghosh, S., Shiva, P., Sadhu, N., Venkatesh, R.P., Joseph, I. 2021. Coastal pond farming of Indian pompano. CMFRI-100/2021

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