# RECENT TRENDS IN AQUACULTURE

# MARINE FIN FISH CULTURE





**National Fisheries Development Board**

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# Marine Fin Fish Culture

## Introduction:

Marine fin fish culture is one of the fastest growing sub-sectors of aquaculture in the world. In contrast to the global scenario, Indian marine fin fish culture is rapidly emerging out from its infant stage. The geographic territory of India is bestowed with a vast coastline of 8,118 km with an Exclusive Economic Zone (EEZ) of 2.02 million $km^2$. The marine fisheries sector is dominated by the socio-economically backward artisanal and small scale fishers whose lives are closely intertwined with the ocean and sea. Sea fishing is a risky occupation and causes reduction of natural resources. Marine fin fish culture has been increasingly resorted as means of enhancing the fishery resources, replenishing natural stocks whose populations have declined through over-exploitation or environmental degradation. It also maximizes the productivity of water body in an open bay/ coastal lagoon / brackish water pond.

Marine fin fish has gained much popularity due to its high nutritional profile and great demand in seafood basket both in domestic and international fish market. The goal is also to ensure doubling the income of the coastal fishers and fish farmers.

With the technical hand holding of CMFRI, NFDB has been focusing on tapping the full production potential and enhancement of productivity from mariculture sector by promoting open sea cage culture, brackish water pond culture for high value marine fin fish culture like Cobia, Pompano etc.

Under the Technology Upgradation Program, NFDB sanctioned two marine fin fish brood banks to CMFRI, i.e. Cobia brood bank at Mandapam, Tamil Nadu and Silver Pompano brood bank at Vizhinjam, Kerala. Two brood banks are now fully operational and suppling quality Cobia and Silver Pompano yolk sac/seed to farmers on demand, mitigating the seed shortage problem of coastal fishers.

With the financial assistance of NFDB, CMFRI-Vishakhapatnam Regional Centre has successfully executed pond demonstration of high value marine fin fish, Indian Pompano and estuarine cage culture demonstration of Orange Spotted Grouper, which has paved the way of alternative livelihood generation of fishers.

CIBA achieved the first successful induced breeding and seed production in landlocked systems for Asian Seabass production. State of the art hatchery facility is producing Asian seabass juvenile for more than 20 years which could augment the grow out farming area of Asian seabass to 2000 – 3000 ha in the country.

The Rajiv Gandhi Centre for Aquaculture (RGCA), under MPEDA is also producing marine fin fish seed such as Cobia, Silver Pompano, Sea bass etc.

The key factor for successful marine fin fish culture is the availability of quality seed on time as per demand. This has been taken care by establishing National level marine fin fish (Cobia and Silver pompano) brood bank and multi species marine fin fish hatcheries in the country.

### Species suitable for Marine fin fish culture

1. Cobia (*Rochycentron canodum*)
2. Silver Pompano (*Trachinotus blochii*)
3. Indian Pompano (*Trachinotus mookalee*)
4. Orange spotted Grouper (*Epinephelus coioides)*
5. Sea bass/Barramundi (*Lates calcarifer*)
6. Snapper (*Lutjanus* sp)
7. Emperor (*Lethrinus* sp)

### Advantage of Marine fin fish culture

- ➢ Socio-economic upliftment of coastal fishers by generating employment
- ➢ Enhanced production of seafood for human consumption
- ➢ Enhanced production of high value marine fin fish
- ➢ Increasing national seafood export
- ➢ Substitution of seafood imports
- ➢ Opportunity for commercially viable business opportunities for the entrepreneurs
- ➢ Alternate livelihood option for coastal fishers as catch from sea is dwindling

## I. Marine Fin Fish Rearing

The key factor for successful marine fish culture is good quality seed. To meet the requirement of fish fingerlings for cage farming in sea, brackish water and coastal aquaculture, it is necessary to establish marine fin fish nurseries for the larval rearing and fingerling production of Cobia, Silver/Indian pompano, Sea bass, Grouper, Snapper etc. Fingerling size is the ideal stocking stage for marine fin fish in sea cages/ponds to avoid crop loss. Hence, marine fin fish seed rearing up to desired size for achieving better marine fish seed growth is the need of the hour.

Seed of 2 cm (0.5 to 0.6 g) size can be stocked @ 500-800 no./$m^3$ based on the species and aeration facility available. After a culture period of 45 to 50 day, it will attain fingerling size (5-15 cm) which is ideal for stocking in sea cages/ponds.

**Preventive measures to increase the survival rate during nursery rearing:**

1. Fish fingerlings are reared at nursery rearing unit upto 5-15 cm (depending upon the species)
2. Transport the fingerlings through oxygenated polythene bag
3. Avoid stocking during winter season
4. Water salinity is to be maintained above 20 ppt

**Model cost break up for marine fin fish rearing unit**

| Sl. No. | Items | Quantum | Cost (in Lakhs) |
|---|---|---|---|
| 1 | Shed- @ 1000 per sqft. | 400 sqft. | 4.00 |
| 2 | Rectangular Cement Tanks (25,000 L capacity) | 5 nos. | 2.25 |
| 3 | Water storage sump-50,000 L capacity | 1 | 1.50 |
| 4 | Outdoor circular nursery rearing FRP tank for fingerlings | 5 | 2.00 |
| 5 | Overhead Tank (HDPE/LDPE) 5 Tonne with accessories | 2 | 0.50 |
| 6 | Seawater pump with motor (5 HP) and accessories | 2 | 0.60 |
| 7 | Air blower with motor (5 HP) and accessories | 2 | 0.70 |
| 8 | Generator 10 KVA | 1 | 1.70 |
| 9 | Electrical works, PVC plumbing etc. | L.S. | 0.70 |
| 10 | Initial input including seed, feed, manpower, electricity etc. | L.S | 1.00 |
| 11 | Miscellaneous | | 0.05 |
| | **Total** | | **15.00** |

## II. Open Sea Cage Culture of Marine Fin Fish

Sea cage farming is viewed as a major option for increasing the seafood production and expanding rapidly in recent years at global level. Sea cage culture involves growing fish in the sea in the enclosed net cage which allows free flow of water. It is a production system comprising of a floating frame of varying dimensions and shape, net materials and mooring system, to hold and culture a large number of fish. Cage culture can be undertaken in

open seas, sheltered bays or lagoons having suitable water quality and with prior permission from concerned government authorities.

### Advantages of Sea Cage Farming

- ➢ Stock monitoring is simple in cage farming, facilitating regular observation of behavior, feeding and growth that are critical in avoiding problems related to stress and disease outbreak.
- ➢ Easy harvest
- ➢ Recurring expenditure associated with development and maintenance of infrastructure are lower in cage farming compared to shore based farming practices.

### Exclusion of areas for cage farming:

Sites which are active fishing zones and close to harbours/fish landing centres and navigation channels, defense areas, marine protected areas, coral reefs, mangroves, areas under coastal management plan, points of industrial effluent discharge, pollution, heavy freshwater discharge by rivers, presence of underwater pipelines, telecom cables, explosives dumping and areas of historic ship wreck are to be avoided during site selection.

### Water quality criteria for sea cage farming of finfish

| Sl.no. | Water Quality Parameter | Optimum range |
|---|---|---|
| 1 | Dissolved Oxygen | 5-8 mg/L |
| 2 | Water temperature | 25 – 33°C |
| 3 | pH | 7.5-8.5 |
| 4 | Salinity | 25-34 ppt |
| 5 | Transparency | < 30 cm |

**Sea cage culture of Cobia and Indian Pompano at Palk Bay, TN and Vizag, AP with technical guidance of CMFRI and Financial assistance of NFDB**

## Sea Cage components:

1. **Base Collar** including inner ring, outer ring, middle ring (catwalk), base support, vertical support, diagonal support. **Material: HDPE, GI**
2. **Handrail** (fitted about 1 m above the Inner Collar Ring and connected by vertical as well as diagonal supports with the Base Collar Rings)
3. **Mooring System includes** Anchors (embedment type) / Gabion Boxes, D-shackle, Mooring chain & ropes, Buoys, Marker line etc.
4. **Nets (HDPE Nylon) :**
   - i) Predator Protection/ Outer Net Cage – HDPE braided 3 mm; 60 mm/ 80 mm mesh.
   - ii) Fish Rearing/ Grow-out/ Inner Net Cage – HDPE twisted; 18 mm/25 mm/40 mm/60 mm mesh.
   - iii) Bird Net – HDPE twisted/ Nylon; 60-100 mm mesh

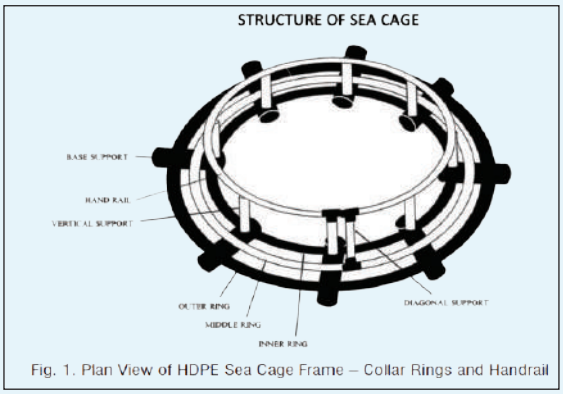

Fig. 1. Plan View of HDPE Sea Cage Frame – Collar Rings and Handrail

## Good Management Practices (GMPs)

- ➢ Avoid over-stocking of fish fingerlings
- ➢ Monitor growth rate at appropriate time intervals
- ➢ Feed fish with pellets of good quality and right quantity
- ➢ Regular cleaning and exchange of net cages for effective water exchange
- ➢ Avoid use of antifouling paints/ chemicals
- ➢ Timely removal and proper disposal of dead fish if any
- ➢ Periodic monitoring of water temperature, Dissolved Oxygen, pH, etc.
- ➢ Close observation of fish behavior while feeding, to assess health status
- ➢ Integrated Multi-Trophic Aquaculture (IMTA)/ Polyculture of compatible species in cage

## Feeding schedule:

Feeding rate, frequency and time of feeding are important factors to be considered in cage farming. Feeding rate and frequency are related to age and size of the fish. Fish larvae and

fry need to be fed with a high protein diet frequently. When fish grows bigger, feeding rates and frequencies can be reduced.

Feed consumption is influenced by time of feeding, season, water temperature, dissolved oxygen levels and other water quality parameters. Also feeding depends on biomass, protein content, feeding frequency etc.

Feed contains the following five major constituents *viz.*(i) Protein (ii) Carbohydrate (iii) Fat (iv) Mineral and (v) Vitamin. Protein is the most essential element for growth of the fish.

**The nutrient requirements of marine carnivorous fish (as %) are given below:**

| Size of Fish | Moisture | Crude Protein | Crude fat | Crude fiber |
|---|---|---|---|---|
| Fry/Fingerling (1 - 20 g) | <12 | >42 | >5 | <4 |
| Juvenile (20 - 50 g) | <12 | >40 | >5 | <4 |
| 50 - 300 gm size | <12 | >38 | >5 | <4 |
| >300 gm size (Finisher) | <12 | >35 | >5 | <4 |

Marine fish requires higher protein (35-40%) feed for their optimal growth. Based on growth of the fish, size of the feed pellet should be adjusted. Normal feeding rate is 10% of the body weight for juveniles which can be reduced to 3% of body weight as farming progresses. Only recommended ration should be given to fish, since overfeeding leads to wastage and environment pollution.

**Seed Stocking:**

- Stocking appropriate size and number of fish seed in cages is very crucial for the success of cage farming
- After allowing the hatchery produced spawn to grow for a period ranging from 30 to 60 days, fish seed can be stocked in cages
- Nursery rearing of seed is essential for all species and it can be done as a separate activity, in land based nursery ponds or hapas held in ponds or in floating nursery cages, Healthy, uniform-sized fingerlings should be procured for stocking in cages

## ➢ Model Technical Specification for Marine Fin Fish Culture in Sea Cages

| Species / Particulars | Cobia (*Rochycen- tron canoa- dum*) | Silver Pom - pano (*Trachinotus blochii*) | Indian Pom - pano (*Trachinotus moo- kalee*) | Asian Sea bass (*Lates calcarifer*) | Grouper (*Epinephelus* sp) |
|---|---|---|---|---|---|
| **Cage** specification | Dia: 6 m | Dia: 6 m | Dia: 6 m | Dia: 6 m | Dia: 6 m |
| | Depth: 4 m | Depth: 4 m | Depth: 4 m | Depth: 4 m | Depth: 4 m |
| Effective Cage volume (Cubic meter) | 100 | 100 | 100 | 100 | 100 |
| No. of cages | 5 | 5 | 5 | 5 | 5 |
| Stocking size (cm) | 15 | 5 | 5 | 5 | 10 |
| Stocking density (no/$m^3$) | 15 | 60 | 60 | 40 | 40 |
| Stocking no. (for 5 cages) | 7500 | 30000 | 30000 | 15000 | 15000 |
| Survival rate | 80% | 80% | 80% | 70% | 80% |
| FCR | 1:1.5 | 1:1.5 | 1:1.5 | 1:1.5 | 1:1.5 |
| Culture period (months) | 10 | 8 | 8 | 10 | 10 |
| Size at the time of Har- vest (gm) | 2000 | 400 | 500 | 1000 | 1000 |
| Expected total biomass (MT) | 12 | 9.60 | 12 | 10.5 | 12 |
| Total feed required (in MT) | 18 | 14.40 | 18 | 15.75 | 18 |
| Sale price (Rs.) | 350 | 350 | 350 | 400 | 350 |
| Gross income (in lakhs) | 42.00 | 33.60 | 42.00 | 42.00 | 42.00 |

## ➢ Model Cost Calculation for Marine Fin Fish Culture in Cages (5 nos.)

### A. Capital Cost (Rs. In lakh)

| Species / Particulars | | Cobia | Silver Pompano | Indian Pompano | Asian Sea bass | Grouper |
|---|---|---|---|---|---|---|
| | Cost of cage including one outer net, two inner nets, one bird net, cage mooring, ballast hose, anchor @ Rs.3 lakh/cage for 5 cages (100-120 cubic me- ter volume for each cage) | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 |

| Particulars \ Species | | Cobia | Silver Pompano | Indian Pompano | Asian Sea bass | Grouper |
|---|---|---|---|---|---|---|
| **B. Operational/Input Cost (Rs. In lakh)** | | | | | | |
| 1 | Seed cost | 1.50 (@ Rs.20/pc) | 3.00 (@ Rs.10/pc) | 3.00 (@ Rs.10 pc) | 4.50 (@ Rs.15 pc) | 4.50 (@ Rs.15 pc) |
| 2 | Feed cost (@ Rs.90 /kg) | 16.20 | 12.96 | 16.20 | 14.18 | 16.20 |
| 3 | Manpower-1 no. (Rs.8000 pm) | 0.80 | 0.64 | 0.64 | 0.80 | 0.80 |
| 4 | Boat fuel and maintenance L.S. | 0.50 | 0.40 | 0.40 | 0.50 | 0.50 |
| 5 | Miscellaneous | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| 6 | Working capital/crop (B) | 19.20 | 17.20 | 20.44 | 20.18 | 22.20 |
| 7 | Total project cost (A+B) | 34.20 | 32.20 | 35.44 | 35.18 | 37.20 |
| 8 | Gross income | 42.00 | 33.60 | 42.00 | 42.00 | 42.00 |
| **9** | **Gross profit / crop (Gross income) - (working capital)** | **22.80** | **16.40** | **21.56** | **21.82** | **19.80** |

## III. Marine Fin Fish Culture in Brackish Water Pond

Brackish water aquaculture in India is an age-old practice confined mainly to the bheries of West Bengal, similar to gheris in Odisha,

pokkali/rice fields in Kerala, kharlands in Karnataka and Maharashtra, and khazans in Goa coasts. For boosting up Brackish water aquaculture, quality of fish seed is a limiting factor for intensification of fish production, which is now being taken care of by establishing Marine Fin Fish Hatcheries. PMMSY aims to boost up Marine fish species production and also to

cover more area under Brackish water sector. Fish species such as Seabass, Cobia, Silver Pompano, Indian Pompano, Orange spotted grouper have shown a lot of promises for commercial aquaculture in Brackish Water area. In India, about 13% of 1.24 million ha potential brackish water resource is under utilization at present, mainly for Shrimp culture. The country has large potential for the development of Marine Fin Fish culture in brackish water.

Nursery rearing of seed is essential for all species and it can be done as a separate activity, in land based nursery ponds or hapas held in ponds or in floating nursery cages, Healthy, uniform-sized fingerlings should be procured for stocking in Brackish water ponds for grow out culture.

## Pond preparation and water treatment:

Step 1: Dry the Pond with lime

**Step 2:** De-weeding, cleaning and desilting (after drying generally 10-12 cm mud to be removed)

**Step 3:** Apply lime (quick lime @ 250 kg/ha)

**Step 4**: Fill the pond with water up to a depth of 30-50 cm and apply fertilizer (SSP /Urea @30-50 kg / ha)

Step 5: After the plankton bloom increase (approximately after 7 days), fill the pond at a depth of 1.5-2 m

**Step 5**: Stock the fingerlings after acclimatization

## Best Management practices for grow out culture of Indian Pompano

1. Good quality fish fingerlings should be stocked to obtain maximum survival
2. Pond should be fertilized to maintain water quality and water color. Optimum increase in phytoplankton will allow development of zooplankton, which in turn will help to reduce feed cost and enrich the fish with high EPA and DHA (n 3 fatty acids)
3. Creation of feeding zone with the help of feed tray will acclimatize the fish to feed in particular area, which will reduce the feed cost
4. Water exchange should be done during the culture period to maintain water quality
5. 2-paddle wheel aerators in a single pond can be used depending upon the Dissolved Oxygen (DO) level

## Best Management practices for grow out culture of Grouper

1. Grouper is demersal fish, which always remain at the bottom of the pond or hapa. Additionally, the larvae are having the grouping behaviour and feeds as group. So, it is recommended to stock more numbers for effective feeding. Immediately after

stocking into the hapa the fish fingerlings remain at the bottom and they need to be acclimatized for feeding by giving sinking feed or moist feed which can reach the bottom. Once acclimatized, slowly the fish fingerlings come up for feeding and the floating feed can be given

2. The fish is temperature sensitive, so shifting or fresh stocking to the pond from hatchery to be avoided during winter season – which reduces survival
3. Transportation of Grouper fingerlings in the polythene bags should be avoided, because at this stage the dorsal spine of the fish is hard, which pierces the polythene bag
4. Grouper is prone for size variation in different stages, this variation in size in the group leads to cannibalism and further low survival. Thus, grading of fingerlings at every fortnight is recommended during the nursery rearing
5. Aerator need to be used in the nursery pond

**Feed specification:**

| Species / Particulars | Silver Pompano (*Trachinotus blochii*) | Indian Pompano (*Trachinotus mookalee*) | Asian Sea bass (*Lates calcarifer*) |
|---|---|---|---|
| Pond area (Ha) | 1 | 1 | 1 |
| Average Depth (m) | 1.5-2 | 1.5-2 | 1.5-2 |
| Stocking size (cm) | 5 | 5 | 5 |
| Stocking density (no/Ha) | 25000 | 25000 | 15000 |

| Species / Particulars | Silver Pompano (*Trachinotus blochii*) | Indian Pompano (*Trachinotus mookalee*) | Asian Sea bass (*Lates calcarifer*) |
|---|---|---|---|
| Stocking no. | 25000 | 25000 | 15000 |
| Survival rate (%) | 80 | 80 | 70 |
| FCR | 1:1.5 | 1:1.5 | 1:1.5 |
| Culture period/crop duration (months) | 8 | 8 | 10 |

| Species / Particulars | Silver Pompano (*Trachinotus blochii*) | Indian Pompano (*Trachinotus mookalee*) | Asian Sea bass (*Lates calcarifer*) |
|---|---|---|---|
| Cost of Seed (Rs./ Pc) | 10.00 | 10.00 | 15.00 |
| Cost of feed (Rs./Kg) | 90.00 | 90.00 | 90.00 |
| Total feed required (MT) | 12 | 15 | 15.75 |
| Size at the time of Harvest (gm) | 400 | 500 | 1000 |
| Expected total Biomass (MT) | 8 | 10 | 10.50 |
| Sale price | 350 | 350 | 400 |
| Gross income (in lakh) | 28.00 | 35.00 | 42.00 |

## Model Technical Specification for Marine Fin Fish Culture in Brackish Water Pond

## Model Cost Calculation for Marine Fin Fish Culture in Brackish Water Pond

| A. Capital Cost break up | | |
|---|---|---|
| **Sl No.** | **Particulars** | **Total Amount in (Rs. Lakhs)** |
| 1 | Ground cleaning, de-weeding, levelling | 0.20 |
| 2 | Earth work excavation and construction of bund | 2.00 |
| 3 | Inlet, outlet and sluice structure | 0.50 |
| 4 | Pump house-100 sqft | 0.50 |
| 5 | Pumps-2 nos. 5 HP | 1.00 |
| 6 | Aerator-5 nos. @Rs.35,000 each | 1.75 |
| 7 | Nets and accessories | 0.40 |
| 8 | Water testing kit | 0.20 |
| 9 | Electrification L.S. | 0.50 |
| 10 | Watchman shed-100sqft | 0.50 |
| 11 | Miscellaneous | 0.45 |
| | **Total** | **8.00** |

| B. **Operational Cost (Rs. In lakhs)** | | | | |
|---|---|---|---|---|
| **Sl.No** | **Species Particulars** | **Silver Pompano (Trachinotus blochii)** | **Indian Pompano (Trachinotus mookalee)** | **Asian Sea bass (Lates calcarifer)** |
| 1 | Seed cost | 2.50 | 2.50 | 2.25 |
| 2 | Feed cost | 10.80 | 13.50 | 14.18 |
| 3 | Manpower-1 nos. (@ Rs.8000 pm) | 0.80 | 0.80 | 1.00 |
| 4 | Electricity | 1.00 | 1.00 | 1.00 |
| 5 | Miscellaneous | 0.20 | 0.20 | 0.20 |
| 6 | Working capital/crop (B) | 15.30 | 18.00 | 18.63 |
| 7 | Total Project Cost (A+B) | 23.30 | 26.00 | 26.63 |
| 8 | Gross income | 28.00 | 35.00 | 42.00 |
| **9** | **Gross profit / crop (Gross income) - (Working capital)** | **12.70** | **17.00** | **23.37** |

## Scheme under PMMSY for Marine Fin Fish Culture

| **Beneficiary Oriented Sub-Components and Activities** | | | | |
|---|---|---|---|---|
| **S.No.** | **Sub-Component and ctivities** | **Unit** | **Unit Cost (Rs. Lakhs)** | **Page No. in the Pmmsy Guidelines** |
| **A** | **Enhancement of Production and Productivity** | | | |
| **1.** | **Development of Inland Fisheries and Aquaculture** | | | |
| 1.7 | Construction of new Ponds for Brack- ish water Aquaculture | (Ha) | 8.00 | 82-85 |
| 1.9 | Inputs for Brackish water Aquaculture | (Ha) | 6.00 | 85 |
| **2** | **Development of Marine Fisheries Including Mariculture and Seaweed Cultivation** | | | |
| 2.3 | Marine Finfish Nurseries | (No) | 15.00 | 92-94 |
| 2.4 | Establishment of open Sea Cages (100- 120 Cubic Meter Volume) | (No) | 5.00 | 94-96 |

## How to avail subsidy?

➢ Beneficiary needs to submit the Self-contained proposal (SCP) along with required documents including documentary evidence of availability of requisite land (either own/ registered lease document to the concerned District Fisheries Office (DFO) for further process. In case of leased land, proper registered lease document for a period of 7(seven) years from the date of submission of SCP will have to be submitted. Also, permission from Coastal Aquaculture Authority (CAA) if the proposed area is within the jurisdiction of CAA, shall be submitted.

- Project report (PR) shall be submitted with full justification & techno-economic details such as the species to be cultured, capital cost and the recurring cost. Project report should also contain details of anticipated direct & indirect employment generation to local population, enhancement of fish production, specific time lines for implementation of project etc. has to be furnished to DFO.
- The governmental assistance is restricted to (a) 2 ha per individual beneficiary, (b) 2 ha multiplied by the number of members of the group/society with a ceiling of 20 ha per group/society in case of Groups of fishers and fish farmers i.e. fisher SHGs/Joint Liability Groups (JLGs)/Fisher Cooperatives etc. or those undertaken in a cluster/area approach.
- The governmental assistance is restricted to (a) a maximum of 5 cages per individual beneficiary (b) In case of Groups of fishers and fish farmers i.e. fisher SHGs/Joint Liability Groups (JLGs)/Fisher Cooperatives etc. or those undertaken in a cluster/ area approach, the number of cages for governmental assistance will be limited to 2x number of members of such group with a ceiling of 50 cages per group.
- However, a cluster/area may have multiple groups/societies. As far as FFPOs/Cs are concerned, the modalities of implementation and upper ceiling on the total area eligible for support would be decided by the CAC.
- Beneficiaries will be provided governmental assistance for input costs for the initial crop only in the newly constructed ponds/tanks

## Training/Technical Guidance:

### For Training and experience the below may be contacted:

| | |
|---|---|
| **1. Dr. Abdul Nazar**<br>Principal Scientist<br>ICAR-CMFRI, Mandapam Regional Centre, Marine Fisheries Post, Mandapam,<br>Tamil Nadu 623518, Moble No.: 9443541632<br>Email: aknazar77@gmail.com | **2. Dr. Rengarajan Jayakumar** Principal Scientist & SIC ICAR-CMFRI Mandapam RC<br>Marine Fisheries Post, Mandapam,<br>Tamil Nadu 623518,<br>Moble No.: 9489036516<br>Email: jayakumar.cmfri@gmail.com |
| **3. Dr. Shubhadeep Ghosh**<br>Principal Scientist & SIC<br>ICAR-CMFRI Visakhapatnam Regional Centre, Pandurangapuram, Andhra University, P.O.,<br>Visakhapatnam, Andhra Pradesh – 530003.<br>Mobile No: 9494572980<br>Email: subhadeep_1977@yahoo.com | **4. Dr. Sekar Megarajan**<br>Scientist, Mariculture Division<br>ICAR-CMFRI Visakhapatnam Regional Centre, Pandurangapuram,<br>Andhra University, P.O., Visakhapatnam,<br>Andhra Pradesh – 530003.<br>Mobile No: 09505768370<br>Email: sekarrajaqua@gmail.com |

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|---|---|
| **5. Dr. Imelda Joseph**<br>Principal Scientist & Head-in-Charge,<br>Mari- culture Division, CMFRI HQ,<br>P.B. No. 1603, Ernakulam North P.O.<br>Kochi - 682018, Mob: 9447228514<br>Email: imeldajoseph@gmail.com | **6. Dr.Shoji Joseph**<br>Principal Scientist, CMFRI HQ<br>P.B. No. 1603, Ernakulam North P.O.<br>Kochi - 682018<br>Tel: +91 484 2776587; Mob:9495336852<br>Email: sjvben@yahoo.com |
| **7. Dr.Prathibha Rohit**<br>Principal Scientist & SIC<br>CMFRI-Mangalore Research Centre<br>Post Box No. 244, Bolar Mangalore-575 001,<br>Dakshina Kanara, Karnataka, Mob: 9916129255<br>Email: rohitprathi@yahoo.co.in | **8. Dr Akshaya Panigrahi.**<br>Principal Scientist, ICAR-CIBA<br>#75, Santhome High Road, MRC Nagar, Chennai, Tamil Nadu 600028.<br>Phone : +91- 044 – 24618817<br>Email: Akshaya.Panigrahi@icar.gov.in |
| **9. Dr. S. Kandan, Project Director**<br>Rajiv Gandhi Centre for Aquaculture (RGCA),<br>3/197, Poompuhar Road, Karaimedu Village,<br>Sattanathapuram Po, Sirkali Taluk. Pin : 609 109,<br>Nagapattinam Dist. Tamil Nadu<br>Tel : 04364-265200, E-mail: rgcaho@gmail.com | |

## List of Marine Fish Seed Suppliers (Hatcheries/Brood banks)

| Name of the Brood bank/Hatchery | Species available | Contact details |
|---|---|---|
| CMFRI Cobia Broodbank, Mandapam, Tamil Nadu | Cobia,<br>Silver Pompano | Dr. Jayakumar, Principal Scientist<br>E-mail: jayakumar.cmfri@gmail.com<br>Mob: 9489036516 |
| CMFRI Silver Pompano Brood bank , Vizhinjam, Kerala | Silver Pompano | Dr. M. K. Anil, Principal Scientist<br>E-mail: mkanil65@gmail.com<br>Mob: 9447048219 |
| Rajiv Gandhi Centre for Aquacul- ture (RGCA), Nagapatinam District Sirkali Taluk – 609 109, Tamil Nadu. | Asian Seabass | Dr. S. Kandan, Project Director<br>E-mail: rgcaho@gmail.com<br>Tel: 04364-26520 |
| M/s MSR Aqua Pvt. Ltd. Marine Fin Fish Hatchery, Konapapapeta East Godavari, Andhra Pradesh | Asian Sea bass,<br>Cobia, Pompano | Mr. Venkat<br>E-mail: msraquapvtltd@gmail.com<br>Mob: 9848011451, 9441575757 |
| Azhikode Hatchery,<br>Kodungallur, Kerala | Silver Pompano | Mr. Prasanth<br>Director, Azhikode Hatchery<br>Mob: 8943270075 |

## List of Cage Manufacturers/Net/Polythene suppliers

| Address | Contact details |
|---|---|
| M/s. Das & Kumars<br>D-63/1D, Mahmoorganj,<br>Varanasi – 221 010,<br>Uttar Pradesh | Contact Person:<br>Mr. Pulkit Agarwal,<br>Mob: 9839098484<br>Email: daskumars@yahoo.com |
| M/s Garware Technical Fibres Ltd.,<br>(Formerly Garware-Wall Ropes Ltd.),<br>Plot No 11, Block D1,M.I.D.C, Chinchwad,<br>Pune – 411019, Maharashtra-411019 | Mr. Butt Zia<br>Tel: +91-20-30780000/27990301<br>Mob: 9325342448<br>E-mail: sales@garwarefibres.com |
| M/s. Roopak Plastics Pvt. Ltd. Plot No. 51,<br>AIE Pedagantyada, Visakhapatnam - 530 044, AP | Phone: 0891-2750517 |
| M/s. Poorvi Fabrications D.No. 50-80-22,<br>Flat No.11, Anjana Residency, Seethammapeta<br>Visakhapatnam - 530016, Andhra Pradesh | Contact Person:<br>Mr. Y.V. Satyanarayana<br>Mobile: 9849829264<br>Phone: 0891-2752926<br>Email: poorvif@yahoo.com |
| M/s. TTK Fiber Glass Works Plot No. 32,<br>F- Block, 3rd Lane, APIIC, Industrial Park,<br>Auto Nagar,<br>Visakapatnam – 530 012, AP | Contact Person:<br>Mr. K.V.N. Raju,<br>Mobile: 94403 19197<br>Email: ttkfibreglass@gmail.com |
| Mr. Seeni Mohideen<br>2/8, Marakayarpatnam – 623 520,<br>Ramanathapuram, TN | Contact Person:<br>Mr. Seeni Mohideen<br>Mobile: 8344927487 |
| M/s. Catamaran Cage Fabrications 5-3592,<br>Raja Nagar, Thangachimadam – 623 529,<br>Ramanathapuram District, Tamil Nadu | Contact Person:<br>Mr. S. Ebi<br>Mobile: 9600436334<br>Email: ebipachek90@gmail.com |
| M/s. RVR & Co<br>Residency Plaza, 5th Floor, No. 41/42,<br>Residency Road, Bengaluru – 560 025, Karnataka | Contact Person:<br>Mr. R V Ramana V. Reddivari<br>Mobile: 91 98861 34567 |
| Mr. Sreekumar Vasudevan<br>Theruvilparambil House, Pizhala, Kadamakudy,<br>Ernakulam - 682 018, Kerala | Contact Person:<br>Mr. Sreekumar Vasudevan<br>Mobile: 918943909469 |

## List of Feed suppliers

| Sl.No | Contact details |
|---|---|
| 1 | M/s. Growel Feeds Pvt. Ltd. Survey. No. 64-67, Chengicharla Village Road Hyderabad.500039, Andhra Pradesh, India |
| 2 | M/s. C P Aquaculture (India) Private Limited 47/D4 Gandhi Mandapam Road, Kotturpuram Chennai 600 085, Tamil Nadu, INDIA. |
| 3 | M/s. Uni-President Enterprises Corp. UPES (India) Foods Pvt. Ltd., 83/A, G.N.T. Road (NH-5) Ponniyamman Medu, Madhavaram, Chennai – 600 110 |
| 4 | M/s. Uno Feeds Komarada Village, Bhimavaram Mandal, West Godavari District, Andhra Pradesh |
| 5 | M/s Devee Biologicals Private Limited (for Biomar feed, Denmark) Plot No-1307, Ist Floor, YellaReddygudda, Ameerpet, Ameerpet, Hyderabad, Telangana 500073, Contact person: Mr. Dushyanth Kumar, Mob: 984912265 E-mail: deveenutrilinc@gmail.com |
| 6 | M/s Skretting India Private Limited 12th Floor, B Wing, Embassy 247, Lal Bahadur Shastri Marg, Vikhroli West, Mumbai - 400079, Maharashtra, Mob: +91 70451 12255 |
| 7 | M/s Sheng Long Biotech India Pvt. Ltd Plot no. A-11/1, Part A, Sipcot Industrial Park, Thervoy kandigai, Gummidipoondi Taluk, Thiruvallur district, Tamil Nadu-601202, Tel: 044 67906017 E-mail: sales@shenglongindia.com/ info@shenglongindia.com |


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Ministry of Fisheries, Animal Husbandry & Dairying,
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