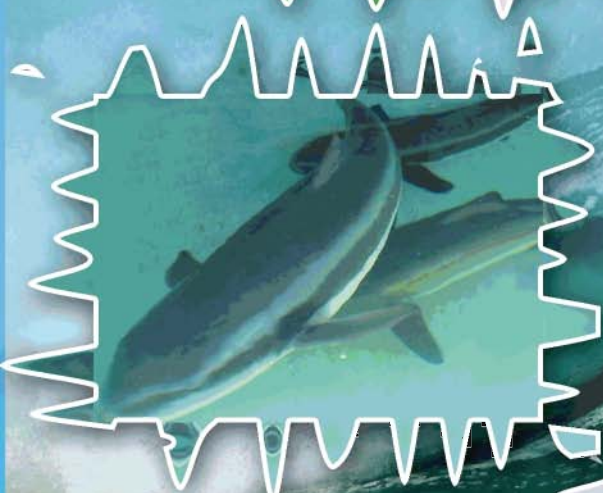
A Manual on

Entrepreneur- Ready Technologies of CMFRI



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Entrepreneur- Ready Technologies of CMFRI

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(A compilation of business proposals of entrepreneur- ready technologies)

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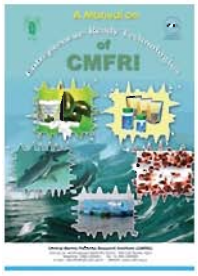
Cover page



Front cover

Back cover

A compilation of business proposals of entrepreneur- ready technologies of CMFRI presented in the "Innovation 4 Industry Meet" at Visakhapatnam on 8th September 2010, 'Rural Technology Mela' at Hyderabad during 2nd to 5th February, 2011 and ICAR -CII Industry Meet- 2011 on 23rd May 2011.

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Foreword

Being the premier Marine Fisheries Research Institute in India with its 63 years of dedicated service to the nation in the marine fisheries sector, the Central Marine Fisheries Research Institute persevered incessantly to find ways and means to sustain the potential source of food in capture and culture fisheries. Our concerted efforts were focused to supplement and enhance the natural stocks through ecofriendly mechanisms such as capture-based aquaculture (CBA) of selected commercially important species, fish aggregating devices (FADs), appropriate strategies for sustainable management and conservation of marine biodiversity of the EEZ encompassing a holistic approach to derive maximum returns from the ecosystem and strengthen the food security concerns of India. It is an unequivocal proposition that innovation is the key to sustainability and enhanced productivity in any production system. This is more relevant in the case of finite and exhaustible natural resources. The open access regime existing in the harvesting of marine fisheries resources in the country warrants stronger emphasis on invoking technological innovations as well as management paradigms that reconcile livelihood issues with concerns on resource conservation. It is heartening to note, with a sense of satisfaction and pride, that this year we could make salient achievements in this direction.

CMFRI presented five entrepreneur- ready technologies in the "Innovation 4 Industry Meet" organized by Zonal Technology Management Centre, Business Planning & Development Unit (ZTMCBPDU), South Zone, CIFT and National Fisheries Development Board held at Visakhapatnam on 8th September 2010 and in the 'Rural Technology Mela' organized by National Institute of rural Development at Hyderabad during 2nd to 5th February, 2011. A detailed presentation and exposition including prospective business proposals on the five technologies namely 'Green Mussel extract (GMe)', 'Varna (the marine ornamental fish feed)', 'Broodstock development, captive breeding and larval production of 17 species of marine ornamental fishes', 'Larval production of Cobia fish' and 'A device for breeding and culturing marine fish in open sea through cage farming' were made in the meets. 'Open sea cage farming in HDPE cage' and 'Low cost cage farming in GI cage' were show-cased in the recently held ICAR-CII Industry Meet organized at NAAS Complex, New Delhi on 23rd May, 2011. The presentation and the exhibition in these meets got the attention of many prospective industrialists/ entrepreneurs which resulted in signing up of a few business proposals.

The perseverance and hard work of highly competent scientific and technical manpower associated with the development of technologies deserve full compliments. I also complement Dr.Vipinkumar.V.P, Senior Scientist who made a presentation on these technologies and prepared this manual which is a compilation of charts and business proposals which can provide an insight into the practical application and indicative economics.

(G.Syda Rao)

Preface

The untiring perseverance of CMFRI as the premier Marine Fisheries Research Institute for more than six decades of dedicated service in marine fisheries research brought out the ways and means to sustain the potential source of food in capture and culture fisheries scenario of the country. Our efforts were focused to supplement and enhance the natural stocks through ecofriendly mechanisms such as capture-based aquaculture (CBA) of selected commercially important species, fish aggregating devices (FADs), appropriate strategies for sustainable management and conservation of marine biodiversity of the EEZ encompassing a holistic approach to derive maximum returns from the ecosystem and strengthen the food security concerns of India. The estimated marine fish landing during 2010 was 3.07 million tonnes, which showed a decline of 1.31 lakh tonnes when compared to that of the previous year. Marine fish landings have shown a downward trend due to fleet expansion, increasing fishing efforts, targeted fishing, use of selective gears and related aspects. Hence there is a great need to harness the fishery biomass from the sea through CBA to ensure food security and to find alternate livelihood options to fisherfolk.

CMFRI brought out five entrepreneur- ready technologies which were presented in the 'Innovation 4 Industry Meet' organized by Zonal Technology Management Centre, Business Planning & Development Unit (ZTMCBPDU), South Zone, CIFT and National Fisheries Development Board held at Visakhapatnam on 8th September 2010, the 'Rural Technology Mela' organized by the National Institute of Rural Development at Hyderabad during 2nd to 5th February, 2011 and 'ICAR-CII Industry Meet-2011 organised at NAAS Complex, New Delhi on 23rd May, 2011. The commercial technologies include 'Green Mussel extract (GMe)', 'Varna (the marine ornamental fish feed)', 'Broodstock development, captive breeding and larval production of 17 species of marine ornamental fishes', 'Larval production of Cobia fish' and 'A device for breeding and culturing marine fish in open sea through cage farming which includes HDPE cage and low cost GI cage'.

The presentation and the exhibition of these technologies and business proposals in these meets evoked much interest and attention of entrepreneurs and industrialists. This manual on 'entrepreneur-ready technologies' provides the techno-feasibility analysis of these technologies and their practical aspects. The indicative economics on the cost and benefits of these technologies have been worked out at realistic estimates. However, it should be noted that performance and evaluation of these technologies are to vary across different locations and usage of quality inputs.

(Authors)

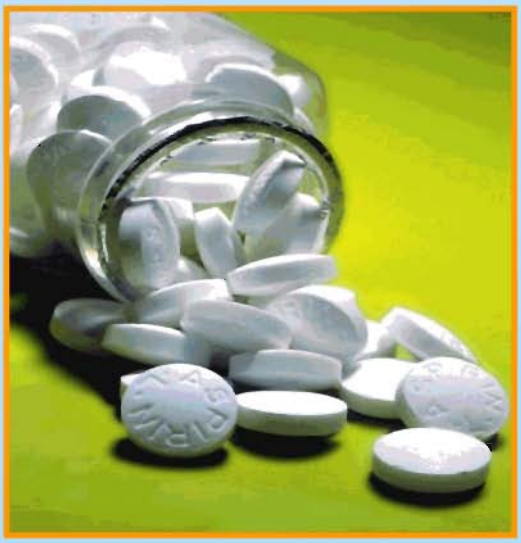
Green Mussel Extract (GMe)

Brief Description

- 'GMe' contains 100 % natural, marine, bioactive anti-inflammatory principles extracted from green mussel.
- Constituents :A blend of nutraceuticals and nutritional elements including omega 3 fatty acids, glycogen complex, phospholipids, essential amino acids, vitamins, naturally chelated minerals, antioxidants, carotenoids and enriched polysaccharides.
- Content: Each capsule contains GME active principle 600 mg supplemented with 100 % natural ingredients.
- Target Users : Those having problems with chronic joint pain, arthritis and the product improves cardiovascular functioning.
- Dosage : Two capsules per day along with food.

Technology Benefits

- A product which is effective for chronic joint pain, arthritis and inflammatory diseases.
- Free from deleterious trans-fatty acids, free radical adducts and low molecular weight carbonyl compounds.
- Improves cardiovascular functioning and is a complete nutritional supplement.
- Alternative to synthetic non steroidal anti-inflammatory drugs having undesirable side effects.
- A highly cost effective indigenous product.



Financial Aspects

- Total investment = 7.26 crores*
- Rate of Return = 45.42%
- Profitability = 50.44%
- Market Potential = 600 crores/ year

*(Project duration 20 years)

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Business Proposal of Technology :Green Mussel Extract (GMe)

GENERAL TECHNOLOGY DESCRIPTION

- Technology Abstract :

GMe (Green Mussel extract) is a product coming under the thematic area of Genetic and Biotechnological Product, which contains 100 % natural, marine, bioactive anti-inflammatory principles extracted from green mussel.

TECHNOLOGY BENEFITS

Advantages of technology/Product

- Constituents : A blend of nutraceuticals and nutritional elements including omega 3 fatty acids, glycogen complex, phospholipids, essential amino acids, vitamins, naturally chelated minerals, antioxidants, carotenoids and enriched polysaccharides.
- Content: Each capsule contains GME active principle 600 mg supplemented with 100 % natural ingredients.
- Target Users: Patients of chronic joint pain, arthritis and the product improves cardiovascular functioning.
- Recommended Dosage: Two capsules per day along with food

Uniqueness of technology (Comparison from existing tech/ competitors)

- A product with anti inflammatory properties which is effective for chronic joint pains and arthritis.
- Free from deleterious trans-fatty acids, free radical adducts and low molecular weight carbonyl compounds.
- A complete nutritional supplement which improves cardiovascular functioning

General Process description

Cadalmin^{TM} GMe contains 100% natural marine bioactive anti-inflammatory ingredients extracted from green mussel *Perna viridis*. The product is effective to combat chronic joint pain, arthritis/ inflammatory diseases, and improves cardiovascular functioning. It is an effective green alternative to synthetic non steroidal anti-inflammatory drugs (*viz.*, aspirin containing drugs having undesirable side effects). The active principle in CadalminTM GMe effectively inhibits inflammatory cyclooxygenase-II and lipoxygenase-V, and its activity was found to be comparable to the drugs available in the market. Consuming Cadalmin^{TM} GMe will avoid unfortunate side effect of these synthetic non steroidal anti-

inflammatory drugs. This product is a blend of nutraceutical and nutritional elements. Cadalmin™ GMe is designed to find a unique way to prevent the degradation by air, moisture, heat and light and to maximize the activity. The product is free from deleterious *trans* fatty acids, free radicals/free radical adducts, and low molecular weight carbonyl compounds. This product is available as capsules and packaged in food grade polypropylene bottles. Cadalmin™ GMe is an indigenous product, and is highly cost effective with that of the imported products available in the market.

Target Segment/ End user Profile

Target users of the technology are 'those who have problems with chronic joint pains, arthritis and inflammatory diseases and this product improves cardiovascular functioning.

FINANCIAL ASPECTS

Indicative Economics

Plant and machinery- details including cost, installation and availability

Plant and machinery	**Cost**	**Installation**	**Availability**
Housing (1200 sq ft)	n/a		
Industrial freeze drier	105 lakhs	Martin Christ	Yes
Automatic capsule filling machine	58.17 lakhs	Pharma Chem	Yes
Rotary vacuum evaporator or automated evaporation system	50 lakhs	Buchii	Yes
Glasswares and fixtures/furniture	20 lakhs	Local	Yes
Refrigerators/-80^{O} freezer	27.80 lakhs	Cold frost /Whirlpool	Yes
Mixer/grinder (industrial)	8 lakhs	Local	Yes
Chemicals and other ingredients (capsules, bottles)	3 lakhs	Local/imported	Yes
UPS and stabilizer	10 lakhs	Servo	Yes
Homogenisers and speedvac system	21 lakh	Local	Yes

Industrial kettle like S/S extractor with distillation and vacuum evaporation facility and chilled water circulation	40 lakhs	Local	Yes
Filtration apparatus (ANF; Agitated nutseh filter	10 lakhs	Local	Yes
Nitrogen gas purging unit	15 lakhs	Local	Yes
Consumables	10 lakhs	Local	Yes
Water purification facility (for distilled water)	5 lakhs	Local/Purit	Yes
Fume hood	6 lakhs	Locally furnished	Yes
Preparatory cum analytical HPLC	50 lakhs	Waters	Yes
Grand total:	**498.97 lakhs**		

- Presentation of "extract" (capsule, tablet, powder, etc): As CAPSULE
- For marketing: We are trying to get the knowledge partners on cost sharing basis.
- Quantum of mussel required : 10 kg raw mussel meat will be sufficient to make 60 bottles containing 31 capsules each (500 mg a.i.)
- Size of the mussel required: 5-8 cm (average).

Cost factors: Cadalmin™ GMe [One bottle containing 31 capsules (@500 mg/capsule)].

The cost of producing one capsule is calculated to be Rs. 5.64/- thereby making the total cost as Rs 175/- (of 31 capsules) (including fixed and operational cost).

Sl. No.	**Product Cadalmin™ GME**	**Cost estimates for 200 capsules (= 100 g active ingredient)# (Rs)**
1	Variable Cost (A + B + C)	
	(A) Mussel active ingredients	Rs. 788.00
	(B) Additives	Rs. 9.33
	Additive a	0.030

	Additive b	0.006
	Additive c	0.027
	Additive d	0.056
	Additive e	0.006
	Additive f	6.40
	Additive g	2.80
	(C) Packaging material	Rs. 130.00
	Cost of capsule	100.00
	Cost of bottle	20.00
	Cost of packaging	10.00
Total Variable Cost	Rs. 927.33	
2	OPERATIONAL COST (D + E)	
	(D) Electricity/other cost	Rs. 100.00
	(E) Instrumental cost	Rs. 100.00
Total Operational Cost	Rs. 200.00	
Total cost to produce 200 capsules		Rs. 1127.33
Total cost for one capsule (excluding marketing cost)		Rs. 5.64
Marketing cost (@10% of the total cost)		Rs. 0.56 (per capsule)
Total cost for one capsule (including marketing cost)		Rs. 6.20
Total production cost of a bottle (@ containing 31 capsules)$		Rs. 192.20
Profit margin (@10% of the production cost)		Rs. 19.20
TOTAL PRICE TAG FOR I BOTTLE OF CADALMIN GME		Rs. 211.40/-

Each capsule contains 0.5 g (or 500 mg ai); $ Each Cadalmin™ GME bottle contains 31 capsules.

Dosage:

2 capsules per day along with food (one each after lunch and dinner) for 60 days till relief from pain achieved and one capsule thereafter.

Assumption:

Around 100 kg of raw mussel meat is required to produce 10 kg of active ingredient of GMe and the plant is expected to processes 10 kg of a.i of GMe daily (based on mussel availability after the domestic consumption.) 10 kg a.i is equivalent to 18,600 capsules

Expected Returns = 18,600 X Rs 6.82 = Rs 1,26,852/- per day X approximately 80 % of working days in a year= 3.65 crores

Investment Required (1) + (2) = 7.26 crores

(1) Fixed Capital = 5 crores

(2) *Working Capital = 2.26 crores*

FINANCIAL ANALYSIS (for 20 years)

- Total Cost of Production…= 5 crores + (2.26 crores for 20 years)= 50.2 crores
- Expected Returns…… 3.65 crores X 20 years = 73 crores
- Net Profit ……. (Revenue- Total Cost) = 73-50.2= 22.8
- Rate of Return = (Net Profit / Total Cost) X 100 = 22.8/50.2X 100 = 45.36 %
- Profitability % = (Net Profit / Operating Cost) X 100 = 22.8/45.2= 50.44 %
- Market Potential= No. of buyers X Av. Quantity purchased by buyers X Price / kg

Market potential of GME is based on a logical assumption that, at least 0.25 % of population i,e., 25 lakhs people will be suffering from Arthritis.

1 person consumes 12 bottles in a year. Total consumption = 25 lakhs X 12 bottles = 300 lakh bottles = 3 crores bottles x Rs 200 /- per bottle = 600 crores / year.

Mussel farming methods in brief….

The world mussel production (FAO data) during 2006 was 1.89 million tones valued at 1.2 billion US dollars. The total aquaculture production of green mussels in India (2008) is about 17,000 tonnes. The farming practice of bivalve mollusks is either on bottom or off bottom culture methods. The bottom culture system is also called the broadcast technique. The off-bottom culture system includes the stake or pole method, rack, raft and long-line method. The rack, raft and long-line method are also called the hanging or suspended culture technique. The stake and rack method are mainly used in shallow, inter-tidal waters while the raft and lone-line methods are generally utilized in deeper, open waters.

In stake culture, mussels are grown on bamboo poles (6-8m long) staked at half meter depth and one meter apart or in circle tied at the top to form a wigwam structure in soft, muddy bottoms and mussels settle on the submerged bamboo stakes. The long line culture method is very successful in open sea mussel farming. A rope is stretched horizontally near the water surface, maintained 1-2 m from the surface with buoys and mussels are grown on vertical ropes known as 'droppers' which hang from the horizontal rope for a length of 4m. The basic principle of raft culture is similar to long line culture and mussels are suspended on droppers but these are suspended from the raft instead of the long lines and the raft itself is anchored to the seabed. Rack culture is the simplest of the rope method used for green mussel cultivation in India and the main purpose of the pole is to support the structure. In between these poles, ropes are suspended either vertically or kept horizontally where the depth is a limitation.

Mussel culture is fast becoming popular in the Malabar area of Kerala since 1997 following the success achieved by CMFRI in rearing green mussel by rack culture in backwaters. One of the major constraints is the availability of seed. The seeds required for culture are presently collected from traditional fishing areas and these often cause conflicts between farmers and mussel fishermen. CMFRI has developed the scientific hatchery production technology of mussel seed and is expected to bring about the desirable results in the nearby future.

VARNA- The marine ornamental fish feed

Brief Description

- 'Varna' is a scientifically evaluated slow sinking marine ornamental fish feed.
- Constituents : 38 % protein, 9 % fat, 39 % carbohydrates, 7% ash (minerals) and less than 2% fiber. Contents are marine protein, soy protein, wheat flour, oil vitamins, minerals, colour imparting nutrients like carotenoids from natural sources, immune promoters, probionts and antioxidants.
- Availability : In particle size: 0.25mm, 0.75 mm and 1 mm.
- Target Users : Ornamental fish farmers/ Aquarium hobbyists.
- Recommended usage: Feed 2-3 % of the fish body weight once in a day.

Technology Benefits

- Capable of maintaining growth, health, colour and vigour of the fishes.
- Scientifically evaluated and standardized feed.
- Quality assured with all essential ingredients.

Financial Aspects

- Total investment = 74.50 lakhs*
- Rate of Return = 41.26%
- Profitability = 51.66%
- Market Potential = 200 crores/ year

*(Project duration 20 years)

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Business Proposal of Technology : 'Varna'- the Marine Ornamental Fish Feed

GENERAL TECHNOLOGY DESCRIPTION

- **Technology Abstract :**

'Varna' is a scientifically evaluated slow sinking marine ornamental fish feed containing, 38 % protein, 9 % fat, 39 % carbohydrates, 7% ash (minerals) and less than 2% fiber. It is available in particle sizes: 0.25mm, 0.75 mm and 1 mm: Feed 2-3 % of the fish body weight once in a day.

TECHNOLOGY BENEFITS

Advantages of technology/Product

- Varna is a scientifically evaluated slow sinking marine ornamental fish feed
- Constituents : Contents are marine protein, soy protein, wheat flour, oil vitamins, minerals, colour imparting nutrients like carotenoids from natural sources, immune promoters, probionts and antioxidants.
- Recommended usage: Feed 2-3 % of the fish body weight of the fish once in a day.

Uniqueness of technology (Comparison from existing tech/ competitors)

- Capable of maintaining growth, health, colour and vigour of the fishes
- Scientifically evaluated and standardized feed
- Quality assured with all essential ingredients.

General Process description

The slow sinking crubles are available in three particle sizes 0.25 mm, 0.75 mm, and 1 mm produced through twin screw extrusion technology which is the stat of art in aquatic feed production.

Target Segment/ End user Profile

Target users of the technology are 'Ornamental fish farmers' and 'Aquarium hobbyists'.

FINANCIAL ASPECTS

Indicative Economics of 'VARNA'

Economics of feed production

Sl.No	Items of cost	Amount
I	**Initial Investment**	**1500000**
	Project life	20 years
II	**Annual Fixed cost**	
1	Depreciation	75000
2	Insurance premium	45000
3	Interest on fixed capital	180000
4	Administrative expenses	30000
	Sub total	**330000**
III	**Annual operating cost**	
1	Raw materials	1260000
2	Labour charge	315000
3	Electricity	157500
4	Water charges	22260
5	Packaging cost (incl. materials cost)	3859000
6	Interest on working capital	336826
	Sub-total	**5950586**

	Cost of production	**6280586**					
V	**Annual production**	**21000**	kg	wt/ pouch	No. of pouches/	Cost/pouch	Cost of pouch /containers
a)	InSTP pouch	10000	10000	50	200000	5.5	1100000
b)	IN HDPE containers	6000	6000	50	120000	7.6	912000
c)	100`ml HDPE containers	5000	5000	100	50000	10.5	525000
VI	**Selling price**	**Average price/kg**	**457**				
						Packing cost/unit	Packaging cost
	STP pouches	400					
	(50 ml HDPE containers)	500				2.5	500000
	(100 ml HDPE containers)	471				4.6	552000
						5.4	270000
VII	**Gross revenue**						
a	STP pouches	4000000					
b)	(50 ml HDPE containers)	3000000					
	(100 ml HDPE containers)	2355000					
	Gross revenue	**9355000**		AFC	330000		
				Price/kg	457		
VIII	**Annual net profit**	**3074414**		Oper.cost/kg	283		
				Difference	174		
				BEP	1900		
IX	**Annual net operating income**	**3404414**					

IX	Break-even price (Rs./kg)	299.08	
X	Break-even production (kg)	1900	
XI	Annual rate of return (%)	204.96	
XII	Pay back period (years)	0.56	months

- Investment Required = 74.5 lakhs

  (1) Fixed Capital = 15 lakhs

  (2) *Working Capital = 59.5 lakhs*

FINANCIAL ANALYSIS

- Cost of Production……74.5 lakhs
- Expected Returns…….105.24 lakhs
- Net Profit ……. 30.74 lakhs
- Rate of Return = Net Profit / Total Cost X 100 = 30.74/74.5= 41.26 %
- Profitability % = Net Profit / Operational Cost X 100 = 30.74/59.5=51.67%
- Market Potential= No. of buyers X Av. Quantity purchased by buyers X Price / kg

= 25 lakhs (i.e just 0.25 % of population) X 1 gm / day for 3 pairs of fish = 6 gm / day X 365 days

= 25 lakhs X 2 kg X 6000 tonnes

= 6000 X 1000 X Rs 400 /-per kg of feed = 200 crores / year

Broodstock development, Captive breeding & Larval rearing of Marine Ornamental Fishes

Brief Description

- Achieved breakthrough in developing a package of technologies on broodstock development, captive breeding and larval rearing of 17 species of marine ornamental fishes.
- Clown fishes : 7 species: True percula/ clown anemone fish, *(Amphiprion percula)* Tomato clown *(A. frenatus)*, Sebae clown, False clown, Maroon clown / Spine cheek anemone fish, Orange anemone fish, and Clarkii clown.
- Damsels fishes : 9 species : Blue damsel, Striped damsel, Three spot damsel, Peacock Damsel, Yellow tail damsel, Green chromis, Filamentous tail damsel, One spot damsel and Sapphire devil.
- Dotty backs : 1 species : Read head dotty back.

Technology Benefits

- High survivability of larvae in captive condition than wild caught.
- Disease resistant.
- High fecundity.

Financial Aspects

- Total investment = 32.4 lakhs*
- Rate of Return = 300%
- Profitability = 375.29%
- Market Potential = 1000 crores/ year

*(Project duration 10 years)

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Business Proposal of Technology : Broodstock development, Captive breeding and Larval rearing of Marine Ornamental Fishes

GENERAL TECHNOLOGY DESCRIPTION

- **Technology Abstract :**

  CMFRI achieved breakthrough in developing a package of technologies on broodstock development, captive breeding and larval rearing of

  17 species of marine ornamental fishes (Clown fishes 7, Damsels 9 and Dotty backs 1).

TECHNOLOGY BENEFITS

Advantages of technology/Product

- Developed the package of technologies on broodstock development, captive breeding and larval rearing of 17 species of marine ornamental fishes.
- Clown fishes : 7 species: True percula/ clown anemone fish, (*Amphiprion percula*) Tomato clown (*A. frenatus),* Sebae clown, False clown Maroon clown / Spine cheek anemone fish, Orange anemone fish, and Clarkii clown.
- Damsels fishes : 9 species : Blue damsel, Striped damsel, Three spot damsel, Peacock Damsel, Yellow tail damsel, Green chromis, Filamentous tail damsel, One spot damsel and Sapphire devil
- Dotty backs : 1 species : Read head dotty back

Technology benefits

- High survivability of larvae in captive condition than wild coaught
- Disease resistant and hardier
- High fecundity of larvae

General Process description

Eg: Clown fishes : *Amphiprion frenatus* and *Amphiprion percula* were the very important *spp* of clawn fishes. Spawning 1-1.5hr. Egg size 1.2 mm to 3 mm in length with a width of 0.8 mm. Juveniles size: 10-12 mm : Colour Reddish brown with 3 white bands. 6 months old attained growth of 5-6 cm total length.

Target Segment/ End user Profile

Target users of the technology are ‘Ornamental fish farmers’ and ‘Aquarium hobbyists’.

FINANCIAL ASPECTS

Indicative Economics of Ornamental Fish Culture

The candidate species selected for economic analysis in *Amphiprion percula*

Capital investment of hatchery

No	Item	Quantity	Cost in Rs
1.	Temporary shed	144 m2 (12X12 m)	1,10,000 /-
2.	Cement tanks for		
	1.Brood stock	12	
	2. Larval rearing	12	
	3.Nursery and grow out	18	
	4. Microalgae (outdoor)	4	
	5.Rotifer (Out door)	3	
	6.Sand filter / over head tank	1	
3.	Artemia hatching tank (transparent Perspex)	3	10,000/-
4.	Power installation		10,000/-
5.	4 HP Diesel pump	1	19,000/-
6.	1/S HP submersible pump	1	6,000/-
7.	Generator 2KVA	1	30,000/-
8.	Air pumps	2	40,000/-
9.	PVC piping, plastic wares (water supply/ aeration/drainage)		45,000 /-
10.	Netting, miscellaneous etc.		40,000 /-
	Total Cost		**6,50,000 /-**

Operating expenses

No	Items	Ist year	2nd year	3rd year
1	Broodstock fishes/ anemone	25,000 /-	5,000 /-	5,000/-
2	Feeds	12,000 /-	12,000/-	12,000/-
3	Artemia	4,000 /-	12,000/-	12,000/-
4	Chemicals for microalgal culture	6,000/-	6,000/-	6,000/-
5	Electricity	36,000 /-	36,000/-	36,000/-
6	Diesel	24,000/-	24,000/-	24,000/-
7	Maintenance	12,000/-	18,000/-	18,000/-
8	Workers' salary (1X Rs 5000/-, 2 X Rs 3000/-)	1,32,000/-	1,32,000/-	1,32,000/-
9	Miscellaneous expenditure	12,000/-	12,000/-	12,000/-
	Total	**2,63,000/-**	**2,57,000/-**	**2,57,000/-**

Non operational expenses : Include depreciation and interest on capital investment.

Technical assumptions for production : there are 12 broodstock pairs and at any time there are 10 active spawning pairs. Each pair will spawn 2 times per month. An average of 400 larvae is produced during each spawn. The survival rate of larvae to transfer to grow out phase is 50 %. The period from larvae to juvenile is 30 days. There is 60 % survival rate for juveniles to market size. The period from nursery to market size is 120 days. In a month, 240 sealable sized fishes can be produced form one pair of clown fish. Each can be sold at a rate of Rs 50 /- The sale starts from 2nd year onwards. The first spawning is expected in 8th month of the 1st year. First harvest and sale will occur at the first month of second year.

Revenue & Expense	Amount in Rupees		
	Year 1	**Year 2**	**Year 3**
Revenue: Sale of clown fish fingerlings @ Rs 100 / finger lings (240 juveniles X10pairs X 12 months = 28,800 numbers) 28,800 X Rs 50 = 14,40,000/-)		14,40,000 /-	14,40,000 /-
Non Operating Expenses			
a. Depreciation (20%)	1,30,000 /-	1,30,000 /-	1,30,000 /-
b. Interest rate on capital investment @ 12 %	78,000 /-	78,000 /-	78,000 /-
Operating Cost	2,63,000 /-	2,57,000 /-	2,57,000 /-
Total Expenses	4,71,000 /-	4,65,000/-	4,65,000/-
Profit		9,75,000/-	9,75,000/-

Payback period (PP) is the number of months/years to recover the initial investment=1.5 years

Investment Required (1) + (2) = 32.4 lakhs

(1) Fixed Capital = 6.5 lakhs

(2) *Working Capital = 25.9 lakhs*

FINANCIAL ANALYSIS

- Cost of Production……32.4 lakhs
- Expected Returns…….129.6 lakhs
- Net Profit …… 97.2 lakhs
- Rate of Return = (Net Profit / Total Cost) X 100 = 97.4/32.4= 300 %
- Profitability % = Net Profit / Operational Cost X 100 = 97.2/25.9= 375.29%
- Market Potential= No. of buyers X Av. Quantity purchased by buyers X Price / kg

= 25 lakhs (i.e just 0.25 % of population) X 2 pairs = 25 lakhs (Assumption) X 2 X 2000/-

= 1000 crores / year

Larval production of Cobia

Brief Description

- Achieved breakthrough in Broodstock Development, Induced breeding and larval production of Cobia, *(Rachycentron canadum)*at Mandapam.
- Collected Fishes weighing 10 kg & above in live condition from commercial catches and transported to hatchery.
- The conditioned fishes are stocked and reared in cages with appropriate broodstock feeds.
- Cannulation of the fishes done at regular intervals & males and females about to reach the spawning stage are isolated and stocked in separate cages.
- When the ova diameter of the female reaches around 700 microns, the fish can be selected for inducing spawning. A ratio of 2 males: 1 female is ideal for spawning.
- Induction of spawning is done by administering HCG at doses of 500 IU per kg body weight for females and 250 IU per kg body weight for male.
- Successful spawning obtained within 48 hours. Eggs spawned 2.1 million, Fertilized eggs 1.9 million.
- Collected the floating eggs by a 500 micron mesh and incubated in the incubation tanks.
- The eggs hatch after 22 hours of incubation at a temperature range of 28 – 30^{0}C. The newly hatched larvae(1.5 million) are stored in the larval storage tanks for marketing.

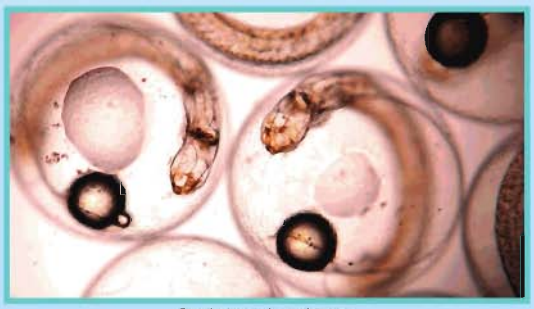
Spawning behaviour inside the spawning tank

Administration of hormones for Final oocyte maturation and spawning

Fertilized eggs collected on 500 micron mesh

Technology Benefits

- High survivability of larvae.
- High fecundity.
- The larvae can be reared to fingerlings at the idling shrimp hatcheries, which can be modified for the purpose.
- A fingerling of 6cm size can be sold @ Rs.10/-



Developing embryo of Cobia

Financial Aspects

- Total investment = 63.50 lakhs *
- Rate of Return = 74.19%
- Profitability = 89.76%
- Market Potential = 10 crores/ year

*(Project duration 10 years)

Cobia larvae on 4th day of post hatch

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Business Proposal of Technology : Cobia Larval Production

GENERAL TECHNOLOGY DESCRIPTION

CMFRI achieved breakthrough in Broodstock Development, Induced breeding and larval production of Cobia, (*Rachycentron canadum)* at Mandapam Regional Centre of CMFRI.

TECHNOLOGY PROCESS

- Collected Fishes weighing 10 kg & above in live condition from commercial catches and transported to hatchery.
- The conditioned fishes are stocked and reared in cages with appropriate broodstock feeds.
- Cannulation of the fishes done at regular intervals & males and females about to reach the spawning stage are isolated and stocked in separate cages.
- When the ova diameter of the female reaches around 700 microns, the fish can be selected for inducing spawning. A ratio of 2 males: 1 female is ideal for spawning.
- Induction of spawning is done by administering HCG at doses of 500 IU per kg body weight for females and 250 IU per kg body weight for male.
- Successful spawning obtained within 48 hours.
- Collected the floating eggs by a 500 micron mesh and incubated in the incubation tanks.
- The eggs hatch after 22 hours of incubation at a temperature range of 28 – 30^0C. The newly hatched larvae can be collected and stored in the larval storage tanks for marketing.

Technology benefits

- High survivability potential
- High fecundity
- The larvae can be reared to fingerlings at the idling shrimp hatcheries, which can be modified for the purpose. Hence the idling shrimp hatcheries in the country can be effectively utilised.
- From larvae to fingerlings only about 10-20% survival can be anticipated
- A fingerling of 6cm size can be sold at a price of Rs.10/- per piece.

Target Segment/ End user Profile

Target users of the technology are ‘Fish farmers’ and ‘Hatchery owners’

FINANCIAL ASPECTS

Indicative Economics of Cobia Larval culture

Budget Projection

S.No.	Details	Quantity	Amount (lakhs)
	Capital investment		
	Broodstock cages (6m diameter x 5m depth)	4	8.00
	Spawning tanks (100 t capacity cement tanks with roofing)	4	4.00
	FRP dinghy with OBM (15 hp)	1	2.50
	Egg Incubation tanks	6	1.00
	Larval storage tanks (2 tonne capacity)	15	2.50
	Quarantining and conditioning facility	1	5.00
	Shed with light roofing	1	5.00
	Installation of seawater intake system, filtration, air-blower, generator, etc.	1	5.00
	Broodstock fish (@20 kg /fish; @Rs.500/kg)	100 nos	10.00
	Sub-Total (A)		**43.00**
	Operating cost per year		
	Cost of additional net cages with fabrication cost, exchange cost and labour charges for maintenance		1.50
	Feed cost		2.00
	Electricity and fuel cost		6.00
	Labour cost (Rs. 400/day for 4 labourers)		6.00
	Working expenses (Hormones, chemicals, air-tubing, transportation cost, etc.,)		5.00
	Non-Operating expenses per year		
	Depreciation (20%)		8.60
	Interest on capital investment @12%		5.16
	Sub-Total (B)		**34.26**
	Revenue Generation from second year onwards		
	Sale of cobia larvae (Total Expected production 48 million per 8 months cycle; @ 6million / month; @ Rs.0.10 per larva) **(C)**		**48.00**
	Net Profit (From second year onwards) [C –B]		**13.74**

Technical assumptions for hatchery production of cobia larvae

It is assumed that the proposed facility is located in seafront area with availability of unpolluted salt and freshwater and easy transportation access to market. It is assumed that an average of three spawnings will be obtained per month for at least 8 months in a year and each spawning will yield 2 million viable larvae. The broodstock in the cages will remain in healthy condition with marginal or nil mortality for a minimum period of three years.

Payback period

The payback period can be used to measure how rapidly the enterprise can provide a return to the investors.

Payback Period (PP) = (Capital Investment/Profit) X 12 months

= (43 / 13.74) X 12 = 37.55 months

It is evident that the capital invested for the facility can be recovered fully within 38 months from the start of earning. The only assumption made are that the larval production operations are running smoothly and the price of the larvae remain stable during the period.

- Investment Required (1) + (2) = 63.5 lakhs

  (1) Fixed Capital = 43 lakhs

  (2) *Working Capital = 20.5 lakhs*

<u>FINANCIAL ANALYSIS (for 10 years)</u>

- Cost of Production……43 lakhs + (20.5 X 10 years) = 248 lakhs
- Expected Returns…….48 lakhs X 9 years = 432 lakhs
- Net Profit ……. 184 lakhs

- Rate of Return = (Net Profit / Total Cost) X 100 = 184/248= 74.19 %
- Profitability % = (Net Profit / Operational Cost) X 100 = 184/205= 89.76%
- Market Potential=

Market Potential = No. of buyers X Av. Quantity purchased by buyers X Price

If 50 million larvae survival to juveniles is = 20 million juveniles of 5 cm which can be sold at @ Rs 5 /- per juvenile = 10 crores / year

A device for breeding and culturing marine fish in open sea: Open Sea Cage Farming in HDPE Cage

Brief Description

- A promising venture which offers the fishers a chance for optimally utilizing the existing water resources.
- The open sea cages are used for cultivating marine fishes with domestic and export orientation.
- Make: High Density Poly Ethylene (HDPE). Dimensions: Diameter 6 m, Height 120 cm, Depth 6 m.
- Candidate species grown in cages: Sea bass, Red snapper, Chanos, Mullets, Cobia, Pompano, Groupers, Koth, Pomfrets, Lobsters etc.

Technology Benefits

- Optimally maintains the size and quality of the marine fishes.
- Eco-friendly system without any human intervention.
- Sustained survival rate of above 75%.
- Great potential of expanding the scale of mariculture production.

Financial Aspects

- Total investment = 8.61 lakhs*
- Rate of Return = 33.80%
- Profitability = 62.71%
- Market Potential = 2000 crores/ year (for increasing fish production by 1 lakh tonnes)

*(Project duration 1 year)

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Business Proposal of Technology : A device for breeding and culturing marine fish in open sea:

Open Sea Cage Farming in HDPE Cage

GENERAL TECHNOLOGY DESCRIPTION

Technology Abstract :

- Open sea cage farming is a promising venture which offers the fishers a chance for optimally utilizing the existing water resources. The open sea cages are used for cultivating marine fishes, and may be used in domestic and export oriented marine sea farming in cages. The present invention describes a cage culture device for open sea fish farming in High Density Poly Ethylene (HDPE) cages.

- By integrating the cage culture system into the aquatic eco system, the carrying capacity per unit area is optimized because the free flow of current brings in fresh supply of water and removes metabolic wastes and excess feed. Thus economically speaking, cage culture is a low impact farming practice with high economic returns.

TECHNOLOGY BENEFITS

TECHNOLOGY BENEFITS

- These interventions optimally maintain the size and quality of the marine fishes.

- The system is eco-friendly without any human intervention, and a higher survival of above 75% was achieved and sustained.

- The mariculture in open sea cage devised under the present invention will expand a new mariculture space, thereby the mariculture scale can be expanded greatly; simultaneously the self-pollution of mariculture can be solved.

Target Segment/ End user Profile

Target users of the technology are 'Fish farmers'.

FINANCIAL ASPECTS

Indicative Economics of Open Sea Cage Farming in HDPE Cage

The success of the adoption of any innovation or new technology lies in its economic performance. The rate of return per rupee invested is the economic indicator that guides the investor to choose a particular enterprise or practice. In this background, the economic performance of the cage culture demonstration of CMFRI carried out at Balasore of Orissa was worked out and is detailed in the table.

Table : Economic performance of cage culture of sea bass

Sl. No.	Details of cost and returns	Amount (Rs)
1	Initial investment for a 6m diameter cage	2,50,000
2	Fixed cost (For crop duration of six months)	
	a)Depreciation	25,000
	b)Insurance (2% on investment)	3,000
	c) Interest on Fixed capital (12%)	18,000
	d) Administrative expenses	3,000
3	Total Fixed cost (A)	49,000

4	Operating cost	
	a) Cost of seed	50,000
	b) Labour charges including cost of feeding	1,75,000
	c) Interest on working capital (6%)	6,750
5	Total operating cost (B)	2,31,750
6	Total cost of production (6 months)	2,80,750
7	Yield of sea bass (kg)	3,032
8	Gross revenue from 3032 kg	5,75,760
9	Net income (8)-(6)= (Gross revenue-Total Cost)	2,95,010
10	Net operating income (Income over operating cost)	3,44,010
11	Cost of production (Rs kg^{-1}) (6)/(7)	92.60
12	Price realized (Rs kg^{-1}) (8)/(7)	189.89
13	Capital Productivity (Operating ratio) (5)/(8)	0.50

- **Economics in brief assuming 2 crops are taken in a year**

  - Investment Required (1) + (2)

    (1) Fixed Capital = 2.99 lakhs

    (2) *Working Capital = 5.62 lakhs(Operational Cost for 2 crops)*

    (3) *Total Cost = 2.99 +5.62 = 8.61 lakhs*

FINANCIAL ANALYSIS

- Cost of Production……8.61 lakhs
- Expected Sales…… ..11.52 lakhs
- Net Profit ……. (GR-TC) 11.52 – 8.61 = 2.91 lakhs
- Rate of Return = (Net Profit / Total Cost)X 100 = 2.91 / 8.61 = 33.8 %
- Profitability % = (Net Profit / Operational Cost) X 100 = 2.91 / 4.64 = 62.71 %

Market Potential

- India has tremendous potential for fish production through cage culture. To increase our marine fish production by 1 lakh tonnes we require require a minimum of 20,000 cages. The HDPE cage developed by CMFRI, has remarkable market potential to spread the cage culture technology in the coastal waters of India. To express in money value, the total number of cages required 20000 X 10 lakhs revenue approximately in a year = 2000 crores / year.

Cost effective open sea cage

Brief Description

- Developed at Karwar with dimensions: Diameter 6 m, Height 120 cm, Depth 6 m, Total weight 700kg.
- Make : Good quality 1.5" GI pipe (B Class), Joints double welded for extra strength, Structure provided with single coat epoxy primer & double coat epoxy grey paint to prevent rusting.
- Additional floatation with fibre barrels of 200 litres filled with 30 lb air & inflated barrel provides stable platform for operations.
- Outer net at 60 cm above water level prevents predatory fish entry to middle space.

Technology Benefits

- Low Cost cage of Rs 1 lakh including netting & mooring and a single crop can recover the investment of input cost.
- Less Weight : 700 kg.
- Can take the weight of 20-25 persons at a time on the platform safely for managerial operations.
- As the size is same as HDPE cage, area wise both cages give the same performance.

Financial Aspects

- Total investment = 5.89 lakhs*
- Rate of Return = 69.78%
- Profitability = 88.58%
- Market Potential = 2000 crores/ year
  (for increasing fish production by 1 lakh tonnes)

  *(Project duration 1 year)

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Business Proposal of Technology : Low Cost Open Sea Cage Farming

GENERAL TECHNOLOGY DESCRIPTION

Technology Abstract :

- Developed at Karwar with dimensions: Diameter 6 m, Height 120 cm, Depth 6 m, Total weight 700kg.
- Make : Good quality 1.5" GI pipe (B Class), Joints double welded for extra strength, Structure provided with single coat epoxy primer & double coat epoxy grey paint to prevent rusting.
- Additional floatation with fibre barrels of 200 litres filled with 30 lb air & inflated barrel provides stable platform for operations.
- Outer net at 60 cm above water level prevents predatory fish entry to middle space.

TECHNOLOGY BENEFITS

- Low Cost cage of Rs 1 lakh including netting & mooring and a single crop can recover the investment of input cost.
- Less Weight : 700 kg
- Can take the weight of 20-25 persons at a time on the platform safely for managerial operations.
- As the size is same as HDPE cage, area wise both cages give the same performance

Target Segment/ End user Profile

Target users of the technology are 'Fish farmers'.

FINANCIAL ASPECTS

Indicative Economics of Low Cost Cage

- **First Crop**

Sl.No	Head of expense	Cost
	Cage and Net	
1	Cage	50000
2	Mooring	15000
3	Nets (2 Inner net and one outer net with ballast pipe)	60000
	Seed	
1	Cost of 3500 seeds @ Rs 8/seed	28000
2	Transportation	15000
3	Nursery rearing charges @ Rs.8/seed	28000
4	Transportation from Nursery to farm	5000
	Feed	
1	Cost 10 tonne oil sardine @ Rs.7500/Tonne	75000
	Labour (2 Persons per cage)	
1	Labour Charges @ Rs.200/ 2 Person for 140 days	56000
	Other Expenses	
1	Fuel Charges	20000
2	Harvesting Charges	5000
	Total	**3,57,000**

- **Second Crop**

Sl.No	Head of expense	Cost
	Cage and Net	Nil
1	Cage	Nil
2	Mooring	Nil
3	Nets (2 Inner net and one outer net with ballast pipe)	Nil
	Seed	
1	Cost of 3500 seeds @ Rs 8/seed	28000
2	Transportation	15000
3	Nursery rearing charges @ Rs.8/seed	28000
4	Transportation from Nursery to farm	5000
	Feed	
1	Cost 10 tonne oil sardine @ Rs.7500/Tonne	75000
	Labour (2 Persons per cage)	
1	Labour Charges @ Rs.200/ 2 Person for 140 days	56000
	Other Expenses	
1	Fuel Charges	20000
2	Harvesting Charges	5000
	Total	**232000**
	Total for 2 crops	**5,89,000**

- **Economics in brief**

Sl.No	Head of expense	Cost
1	First Crop 2.5 Tonnes per Cage @ Rs 200/ Kg	5,00,000
2	Second Crop 2.5 Tonnes per Cage @ Rs 200/ Kg	5,00,000
3	**Total Income from one Cage / Year**	**10,00,000**
5	**First year expenses**	**5,89,000**
6	**Net Income***	**4,11,000**
	Four lakh and eleven thousand only	

- _ **Net income calculated without considering the depreciation of the capital investment**

  - Investment Required (1) + (2)

    (1) Fixed Capital = 1.25 lakhs

    (2) *Working Capital = 4.64 lakhs(Operational Cost)*

    (3) *Total Cost = 1.25 + 4.64 = 5.89 lakhs*

FINANCIAL ANALYSIS

- Cost of Production……5.89 lakhs
- Expected Sales…… ..10 lakhs
- Net Profit ……. 10- 5.89 = 4.11 lakhs
- Rate of Return = (Net Profit / Total Cost)X 100 = 4.11 / 5.89 = 69.78 %
- Profitability % = (Net Profit / Operational Cost) X 100 = 4.11 / 4.64 = 88.58 %

Market Potential

India has tremendous potential for fish production through cage culture. To increase our marine fish production by 1 lakh tonnes we require a minimum of 20,000 cages. With the present cage the cage cost alone is going to be Rs.900 crore. By adopting CMFRI low cost cage the cost for cage is going to be reduced to only Rs.200 crore, giving a saving of Rs.700 crore. Reduced input cost makes cage culture more profitable with less investment. Being a developing country we require technologies that are more users friendly and CMFRI's low cost cage is just one technology in that direction. This cage has tremendous potential to spread the cage culture technology in the coastal waters of India. To express in money value, the total number of cages required 20000 X 10 lakhs = 2000 crores / year.

Conclusion

The Central Marine Fisheries Research Institute (CMFRI) brought out five entrepreneur ready technologies such as 'Green Mussel Extract' (GMe), 'Varna' the marine ornamental fish feed, Larval production of 17 species of ornamental fishes and Cobia fish and 'a device for breeding and culturing marine fish in open sea through cage farming' which includes 'Open sea cage farming in HDPE cage' and 'Low cost cage farming in GI cage'. An effort was made on the economic analysis of these technologies for ensuring the practical feasibility of commercial application. These entrepreneur ready technologies of CMFRI possess clear cut uniqueness and specifications. GMe is 100% natural marine bioactive anti-inflammatory ingredients extracted from green mussel and product is effective to combat chronic joint pain, arthritis/ inflammatory diseases, and improves cardiovascular functioning available as capsules. It is cost effective and does not carry side effects. 'Varna' is a scientifically evaluated slow sinking marine ornamental fish feed of fine quality containing all essential ingredients which is available in particle sizes: 0.25mm, 0.75 mm and 1 mm: to feed 2-3 % of the fish body weight daily for ornamental fishes. CMFRI also achieved breakthrough in developing a package of technologies on broodstock development, captive breeding and larval rearing of 17 species of marine ornamental fishes (Clown fishes 7, Damsels 9 and Dotty backs 1). The fourth technology was the breakthrough in broodstock development, induced breeding and larval production of Cobia fish (*Rachycentron canadum)* at Mandapam and larvae are at present ready in the deliverable form. The fifth technology is a device for breeding and culturing marine fish in open sea through cage farming which is a promising venture which offers the fishers a chance for optimally utilizing the existing water resources where the open sea cages are used for cultivating both domestic and export oriented marine fishes. 'Cage farming in HDPE cage' and the 'low cost cage farming in GI cage' are the two types of cage culture technologies developed by CMFRI which are low impact farming practices with high economic returns. The 'low cost open sea cage farming technology' developed at Karwar with quality GI pipe with double welded joints for extra strength, with additional floatation with fibre barrels of 200 litres filled with 30 lb air which was tested and found suitable in west coasts is of a low cost of Rs 1 lakh including netting & mooring and a single crop can recover the investment of input cost. The technologies are in the pre commercialization evaluation phase approaching the marketable stage and CMFRI anticipates the entrepreneurs and knowledge partners for sharing the technologies.

A Manual on

Entrepreneur- Ready Technologies of CMFRI

Green Mussel extract (GMe)


Varna: The marine ornamental fish feed


Broodstock development, Captive breeding & Larval rearing of marine ornamental fishes


Larval production of Cobia


Cost effective open sea cage

g syda rao

v p vipinkumar

shyam s salim

r sathiadhas

r narayanakumar

kajal chakraborty

p vijayagopal

k k vijayan

k madhu

rema madhu

g gopakumar

k k philipose

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