

**Training Manual
on
Cage Culture
of
Marine Finfishes**

Editors

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Economics and policies for open sea cage culture in Andhra Pradesh

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Introduction

The fisheries sector plays a significant role in providing employment, reducing poverty and promoting health. Fish is an extremely nutritious, a vital source of protein and essential nutrients. The sector provides employment opportunities to nearly 14.5 lakh people directly and indirectly in Andhra Pradesh. In recent years, sea farming is gaining popularity and a couple of finfish, shellfish species and some sea weeds are now being farmed. Ornamental fish farming also has a promising future and is likely to contribute to the overall growth of fisheries sector in the coming years. Good governance and good culture practices can enable fisheries to thrive sustainably. Therefore, the Government of Andhra Pradesh is unveiling the policy to create a suitable eco-system for the rapid growth of fisheries and aquaculture for the coming years.

Andhra Pradesh stands first in total fish and prawn/shrimp production in India for the year 2015-16 in terms of production and value. The contribution of fisheries sector is 6.01 % in A.P's GSDP, whereas the fisheries contribution is about 0.83 % of GDP of the nation. The overall fish production in India has more than doubled in the past one decade from 8.14 lakh tonnes in 2005-06 to 19.64 lakh tonnes in 2014-15. The fisheries sector has also been one of the major contributors of foreign exchange earnings. The share of Andhra Pradesh in India's sea food exports has increased from about 20 % in 2009-10 to about 40 % in 2013-14.

During 2009-10 the exports from Andhra Pradesh was Rs. 2,100 crores but by 2013-14 exports have increased to Rs. 12,100 crores. During 2014-15, the marine exports have been increased to an estimated value of Rs.16,000 crores.

Nine out of thirteen districts of Andhra Pradesh are coastal districts and the total length of the coast is around 974 kms. The total continental shelf is more than 33,227 Sq.km. The total marine fishermen population in the state is around 6.05 lakh and sea going fishermen are around 1.5 lakh. The total fishing crafts in the state are around 29,195 with around 12,747 motorized crafts, 1771 Mechanized and 14677 traditional crafts. The marine fisheries sector of the state is supported 4 fishing harbours, 353 fish landing centres and 555 marine fishing villages.

Fisheries in Andhra Pradesh – Opportunities and challenges

Opportunities: There are a number of natural as well as infrastructure related aspects that have supported the exponential growth of the sector in the state in the past few years. These can be listed as follows:

1. **Market Potential:** The State has large marketing potential for fish products in urban areas within the state and in other states of India. In India, 60 % of population is non-vegetarians and hence there is demand of fish consumption. At present the per capita national fish consumption is 11 Kg and in Andhra Pradesh, it is estimated at 7.4 Kg. The world fish consumption is 21 Kg. Hence, there is a huge gap in consumption which can be filled up by Andhra Pradesh by promoting domestic market.
2. **Excellent fishing infrastructure:** The state has 4 fishing harbours, 1 major port at Visakhapatnam and 14 minor ports in different places offering vast opportunity for exporting fish products.

Challenges: Four different sets of challenges have been identified by Govt of A. P, which if addressed can quicken and improve the rate of growth in Fisheries in the state. These can be categorised as follows:

1. Sustainability

- Excessive fishing capacity causing over-fishing leading to depletion of stock and recruitment in the marine sector.
- Production of good quality seed is a major challenge.

2. Lack of access to modern technology and credit facilities

- The majority of the boats are small fishing boats and such boats lack modern fishing facilities and equipments and information and communication equipment.
- The technology used at various levels of the value chain starting from boats to cold chain is inadequate.
- The fishermen do not have access to institutional financing and new technologies.

3. Inadequate infrastructure and shortfall of skilled personnel

- Post-harvest processing infrastructure in the state is very limited.
- Cold storage and transportation services are also constrained.
- Inadequate infrastructure facilities, information and communication channels.
- Shortage of technical manpower at middle and higher levels.

4. Others:

- Rapid urbanization, degradation of mangroves, oil and gas exploration activities and other anthropogenic activities along and off the coast contributing to pollution, coastal erosion and livelihood destruction.
- Unreliable resource base and statistics.
- Inadequate domestic market development.
- Frequent cyclones leading to loss of man days for sea going fishermen and damage the aquaculture.

Economics for setting up of open sea cage culture

Considering the opportunities for increasing mariculture production in India, cage culture offers the farmers and entrepreneurs with the scope to lay the idle resources of Bay of Bengal and Arabian Sea for a productive use. However, the adoption of any technology depends upon its economic performance. The rate of return per rupee invested is the economic indicator that guides the investor to invest in the particular activity.

The economic performance for setting up of sea cage culture is worked out by calculating the annual fixed cost, variable cost, and return in terms of harvest from cage and revenue generated from these sales. Fixed costs are costs that are independent of the level of production, and have to be paid whether or not production occurs in a particular year. An expenditure on a resource whose quantity is not varied during the production period is a fixed cost. This includes net & material, frames, ballast, floats, anchors, chains and establishment charges. Generally fixed costs are spread out over the expected life of the production input involved. This allows the producer to take into account the long-term view of

profitability. The variable cost are cost that are dependent on the level of production and have to be paid for every cycle of culture such as cost paid towards fish seed, feed, labour etc. Returns from cage culture is the money generated from sale of harvest.

The economic analysis indicated that sea cage culture practices will work out successfully with high net income in a crop period of 5 years. It is to be noted that once the practice is further expanded to many years, the cost of production will decline due to economies of scale of operation. Thus, open sea cage farming is a viable alternative for fishermen and an economically feasible mariculture operation for the stakeholders.

Financial assistance for open sea cage culture in India

The National Fisheries Development Board (NFDB), Hyderabad is the primary funding agency for sea cage culture in India. NFDB has a scheme on mariculture aimed at increasing the marine fish production of the country. A principal component of this scheme is open sea cage culture and its popularization among fishermen of India. NFDB will provide financial assistance for setting up of a sea cage for mariculture as well as for model cage culture demonstration to traditional fishermen. The eligibility criteria for assistance for setting up of sea cage culture are:

1. Entrepreneurs/companies with a previous record of undertaking large-scale aquaculture operations and having on-shore facilities for seed rearing.
2. Sea going fishermen groups who will operate the scheme through Fisheries federations/corporations.

3. Availability of necessary clearances for undertaking the cage culture activity in the coastal areas.
4. Commitment of state fisheries federation/corporation, entrepreneur to bear 80% of the cost.

The approximate unit cost of a modern net cage system includes the cost of net material, HDPE frames, ballast, floats, anchors, chains and establishment of on-shore facilities are given in Table 1.

Table 1: Initial investment of the sea cage culture for a cage

Sl. No.	Items	Cost (Rs. Lakh)	Life span (years)
1.	HDPE cage frame	1.91	10
2.	Ballast	0.08	10
3.	Floats	0.19	5
4.	Nets	1.58	3
5.	Chains, swivel, shackles	0.80	3
6.	Stone anchor	0.64	10
7.	One time launching charge	0.80	-
	Total	6.00	

Source: Adapted from Ritesh *et al.*, 2014.

The tentative unit cost economics of cage culture operations are indicated in Table 2. The entrepreneurs / companies willing to set up open sea cage culture in a big way shall be supported by NFDB through equity participation @ 20% of the investment.

Table 2: Tentative Unit Cost and economics for setting up of open sea cage culture in one cage for fisherman household/ SHGs

Sl. No	Items	Apprx. Cost and returns / crop (Rs. in lakh)				
		I	II	III	IV	V
CAPITAL INVESTMENT						
1.	Fixed assets Onshore facility ; floating cage	6.0				
COST OF PRODUCTION						
2.	Depreciation on fixed assets (@10%)	0.6	0.6	0.6	0.6	0.6
3.	Seed cost	0.5	1.0	1.0	1.1	1.1
4.	Feed cost	1.8	3.6	3.6	3.6	3.6
5.	Harvesting and transporting	0.25	0.50	0.50	0.50	0.50
6.	Miscellaneous expenditure	0.20	0.20	0.20	0.30	0.30
7.	Interest on borrowed money (~@ 8% per annum) (10 lakhs borrowed)	0.8	0.7	0.6	0.5	0.4
8.	Total cost of production	10.15	6.6	6.5	6.6	6.5
9.	Annual production (t)	3	6	6	6	6
10.	Unit cost of production per tonne (8/9)	3.38	1.11	1.08	1.11	1.08
Financial Analysis						
1.	Sale price	200/kg	220/kg	2240/kg	260/kg	280/kg
2.	Revenue from sales	6.0	13.2	14.4	15.6	16.8
3.	Profit over cost of production (12-8)	- 4.15	6.6	7.9	9.0	1 0.3
4.	Repayment of loan	0	2.5	2.5	2.5	2.5
5.	Net profit	- 4.15	4.1	5.4	6.5	7.8

Source: Guidelines for mariculture (modified) 2016, NFDB, Hyderabad.

Proposal for setting up of open sea cage culture should be submitted in Form MC-II (Annexure I) which should be filled by the applicant and counter-signed by the Implementing Agency. Funds will be released in two equal installments by NFDB. The first installment will be released after approval of proposal and after applicant has utilized 50 % of his/her investment in the open sea cage culture. The second installment will be released after the applicant utilizes his/her remaining 50 % investment in the venture and also after receipt of the utilization certificate (U.C) regarding this first installment of NFDB fund from the implementing agency. All subsidy installments will be deposited to the applicant's bank account only. U.C should be submitted in form MC-V (Annexure II) on half-yearly basis i.e., during January and July of each year. The project monitoring committee of NFDB periodically reviews the progress of the activities like physical, financial and production targets.

Another scheme is sponsored by Department of Animal Husbandry, Dairying and Fisheries; Ministry of Agriculture, Government of India. The scheme particulars, pattern of assistance and terms & conditions are given in the Table 3.

Table 3: Details of open cage culture scheme by Government of India

Scheme	Unit cost (Rs.)	Pattern of assistance	Terms and Conditions
Open sea cage culture	5 lakhs/cage (6M diameter x 4M) depth for circular	50% of the unit cost with a ceiling of Rs. 2.50 lakh per cage in coastal states.	1. The applicant shall obtain necessary prior permissions from the state government and other competent authorities for installation of cages in the sea. 2. Fishermen Cooperative

	cages and 6M x 4M X 4M for rectangular cages)		<p>Societies, SC/ST cooperative societies, Women SHGs, registered companies of private entrepreneurs etc. shall be eligible for central assistance for 4 batteries of 5 cages each (20 cages) at a particular location.</p> <p>3. The unit cost includes capital, operational and maintenance costs on one time basis.</p> <p>4. The applicants shall be required to submit self contained project proposals together with documentary evidence of necessary permissions and technical knowhow to avail of the assistance.</p>
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Source: Dept of A.H, Dairying & Fisheries; Ministry of Agriculture, GOI.

Policy initiatives of mariculture by government of Andhra Pradesh

After evaluating the fishery resources in new Andhra Pradesh state, the following key aspects have been identified for policy, regulatory and other interventions are identified by the Government of Andhra Pradesh. Policy Intervention: There is a need for coherence between the policies within and outside the fisheries sector; suitable amendments shall be made in the existing fisheries acts for long-term, effective and positive governance of this sector. Coordination

mechanism for synergy with the agriculture and allied sectors to utilize the common infrastructure.

Marine fishery

- i. The government shall establish fish landing centers with modern infrastructure facilities for hygienic handling of fish in coastal villages.
- ii. Mariculture will be promoted aggressively to augment the fish production from coastal waters. Open sea cage culture and sea weed culture shall be undertaken to promote mariculture.
- iii. Leasing Policy for promotion of mariculture in the state to be introduced through private sector. Feasible locations of bays, creeks, back waters, mangroves in the coastal region have to be identified.
- iv. The government shall take steps to install a large number of artificial reefs/ FADs (Fish Aggregating Devices) for augmenting depleted fish stocks to safeguard small scale fishers.
- v. The government shall undertake measures to promote deep sea fishing while protecting the rights of small scale fishers.
- vi. The Government shall explore the opportunities for alternate livelihoods for coastal fishers in view of the dwindling of fishing grounds due to establishment of coastal based industries and other activities.

- vii. To ensure the safety of fishermen at sea and to catch more fish, sea safety and navigational equipment are proposed to be supplied. INCOIS display boards for Potential Fishery Zone (PFZ) information will be displayed. The shore station facilities shall be effectively utilized for the benefit of fishing communities.
- viii. Ban period notified by government will be followed strictly for rejuvenation of fish stocks.
- ix. Present fishing harbours and landing centers shall be provided with facilities for hygienic handling of fish as per the International standards.
- x. Construction of landing, berthing, bunkering and post-harvest handling facilities shall be considered on a priority basis by the government.
- xi. Infrastructure facilities like fish drying platforms, solar drying, dry fish storage sheds, boat building yards, village approach roads shall be implemented at all coastal villages.
- xii. Orientation training will held in all 555 coastal fishermen villages, women members of SHGs, 353 fish landing centers on hygienic handling of fish, tuna processing and conservation of fishery wealth in a phased manner.

Fiscal incentives

The following fiscal incentives shall also be given to various stake holders

- Processing units
- Feed manufacturing units / fishery related equipment manufacturing

- Ease of doing business
- Insurance facility
- Research and development
- Infrastructure strengthening
- Domestic market development
- Quality up gradation
- Export promotion
- Welfare
- Human resource development

Others

- Sea cage culture and diversification into high value fish culture shall be prioritized and encouraged by importing technology already developed elsewhere with buy back agreement from importing country.
- Government shall explore establishment of “Mid Sea Fish Processing/bunkering units” on a pilot basis under PPP mode for high value fin fish like tuna.
- Linkage with MPEDA will be developed for storage/ refrigeration/ Harbor Facilities/ Fiscal Incentives etc.
- Effort will be made to develop fisheries infrastructure for promotion of fish and fish products exports in Bhimavaram and Visakhapatnam which are recognized as the towns of export excellence (marine Sector) in trade policy of Government of India, 2015-2020.
- Government shall issue biometric identification to all fishermen.

- Appropriate steps shall be taken to ensure that quality education and healthcare, housing shall be made available to the families of the fishermen. Fishermen habitations will be provided with safe drinking water, roads etc.
- The extension of subsidies to SCs, STs and women shall be on par with industrial policy vis a vis this policy.
- Information and Communication Technology (ICT) shall be implemented in the department to act as a cost-effective and interactive mechanism for delivering relevant information and knowledge to the stakeholders.

Policy outcomes

The implementation of the A. P. fisheries policy, 2015 is expected to yield the following outcomes:

- i. Increased production and productivity thereby increasing the GSDP contribution off fisheries sector.
- ii. Prevention of post harvest losses.
- iii. Better infrastructure and logistics facilities in the sector ensuring the availability of fish products in all the days.
- iv. Increased marine exports and domestic trade thereby increase in foreign exchange earnings.
- v. Enhanced capacity building to manage the resources
- vi. Better nutritional support through good protein and micronutrients intake can reduce malnutrition among poorer sections.
- vii. Gainful employment in fisheries and allied ancillary industries.
- viii. Diesel subsidy will benefit many families.
- ix. Promote research in frontier areas of mariculture.
- x. Better fish farmers welfare.
- xi. Empowerment of women fishers.

xii. Enhanced skill of the personnel / fishers

Pattern, mode of implementation of the sponsored development and welfare schemes of Andhra Pradesh marine fishermen are given in the Table 4.

Table.4. Developmental and welfare schemes available for marine fishers in Andhra Pradesh.

Sl. No	Scheme	Unit cost (Rs.)	Pattern of assistance	Terms and conditions
Developmental schemes				
1.	Motorization of traditional craft	Up to 0.60 lakh/ craft)	50% of the unit cost with a ceiling of 30,000/- per Out-board motor/ In board motor	<p>1. Beneficiary fisher should own the traditional craft & possess a valid registration certificate and valid fishing license.</p> <p>2. IBM/OBM (2-stroke and 4- stroke) of capacity up to 10 HP is allowed.</p> <p>3. This assistance shall be provided to beneficiaries only once in 5 years.</p>
2.	Promotion of deep sea fishing (Hook and line)	Rs. 3 lakh for mechanized boats Rs 60,000 for motorized boats	50% of the unit cost	For providing hook and line to fishing at deeper waters.
3.	Assistance to traditional /Artisanal fishermen for procurement of net and net material	Rs. 10,000 – 50,000		Only traditional/ Artisanal fishermen are eligible for the benefit under this component. Beneficiary should possess Biometric ID fishers ID card

4.	Safety of fishermen at sea (Life saving appliances and electronic equipment)	Rs. 30,938 for GPS, Rs. 23,229 for echo sounder, Rs.1,755 for life bouys, Rs 1,480 for life jackets, Rs 25,500 for vhf sets	75% of the unit cost	Beneficiary should possess valid (a) Ownership certificate, (b) Registration certificate (c) Fishing License and (d) Biometric ID fishers ID card.
5.	Supply of insulated ice boxes.	As per actual cost	Rs. 2,000/- for insulated ice box or 90% of the cost, whichever is less.	The choice as to the capacity and company is given to beneficiary. Fish vendors are identified by the district fisheries officers.
6.	Exemption of Sales Tax on HSD oil	Rs.6.03 per liter	The ceiling limit of HSD oil is 3000 liters per month per boat only	This scheme is applicable to mechanized boats only.

Welfare schemes

1.	Relief to marine fishermen during ban period	Rs.4,000 per crew member	100%	Relief to marine fishermen belongs to mechanized and motorized boats. Crew members should have aadhar card, biometric card and phone number. Govt of A.P observes ban on fishing at sea from 15 th April to 14 th June.
2.	Revolving fund to Matsya Mitra Groups (MMGs)	Rs.1 lakh per group	100% grant to society / MMG	Fund will be given to fisher women groups (MMGs) for doing fresh and dry fish business.

				Working capital for fish vending / marketing.
3.	Motorcycle with ice box(RKVY)	As per actual with a ceiling of 0.4 lakh per unit	90% of unit cost	Only for S.C fishery business men.
4.	Establishment of retail fish markets with modern hygienic facilities	Rs. 15 lakhs for municipality area. Rs. 7.5 lakhs for Gram Panchayat area	100% of unit cost	The beneficiaries shall complete the planning, designing of the market facilities and cost estimates etc.
5.	Setting up of retail fish outlet	Rs. 2.5 lakhs	Rs. 2 lakhs	For the purpose of S.C fishermen employment.
6.	Group accident Insurance for active fishermen	Insurance premium@ Rs.20.34/-per fisher per year. (The rate of insurance premium is subject to change on year to year basis)	Premium of Rs. 20.34 to each fisher is shared by the GoI and GoAP equally.	(i) Licensed/ registered fishers shall be eligible for insurance for Rs.2.00 lakhs against death or permanent total disability, Rs.1.00 lakh against disability and Rs.10,000/towards hospitalization expenses. (ii) The insurance cover shall be for a period of 12 months. (iii) All the active fishermen and women either by caste or profession in the age group of 18-70 years are covered under this scheme.
7.	Maintenance of relief boats		39 relief boats	Relief boats with outboard motors located at designated place to be used in natural calamities

				for evacuating of public and relief arrangements.
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Source: Office of the Joint Director of Fisheries, Visakhapatnam (A.P)

Suggested readings:

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