

2. SOCIO-ECONOMICS

SOCIO-ECONOMIC STRUCTURAL CHANGES IN THE MARINE FISHERIES SECTOR OF INDIA AND COASTAL ZONE MANAGEMENT

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INTRODUCTION

Indian economy is undergoing rapid structural changes since 1990 due to liberalisation of our economic policies and increased tempo of globalisation. Unlike agriculture and various other industries, marine fisheries is a common property resource from time immemorial and competition among fishermen for maximum catch by adopting various technologies continuously promotes structural changes in the marine fisheries economy of our country. Further coastal aquaculture and sea farming provide immense opportunities to fishermen not only to enhance fish production, but also complement and supplement employment opportunities. Although aquaculture needs expansion, the fragile coastal eco-system should not be disturbed and degraded by unrealistic and unscientific developmental programmes. The ever changing socio-economic scenario of coastal fishermen should be accorded top priority in evolving coastal zone management plans. In this context the present study analyses the structural changes in the fisheries sector in recent years interms of fishing fleets, employment, production and earnings alongwith

the emerging scenario of aquaculture with their wider implications on the socio-economic fabric of fishermen community and Coastal Zone Management.

MATERIAL AND METHODS

The data for the study were obtained from various publications of Central Marine Fisheries Research Institute (CMFRI) from 1978 to 1997. Fishermen census including crafts and gears conducted by the institute during 1977 and 1980 were systematically used for the present analysis in addition to the Fisheries statistics published by the Ministry of Agriculture, Govt. of India during 1993. For the present study, the coastal zone adjacent to the area mentioned under CRZ 1991 (Coastal Regulation Zone Notification 1991) and the fishing area of coastal waters were included, as the human resource involvement and their development needs to be given priority in management plans. A simple logical tabular analysis is attempted to examine the structural changes in the socio-economic conditions of marine fishermen for the last few decades to bring out their implications on coastal zone management.

Table 1. Socio-economic profile of marine fishermen in India - at a glance

Parameters	1980	1997
Marine fishermen households	3.5 lakh	5 lakh
Marine fishermen population	20.5 lakh	30 lakh
Average size of fishermen household	6	6
No. of active fishermen (lakh)	4.62	10.25
No. landing centres	1630	2251
No. marine fishing villages	2397	3638
Average fishermen households per village	146	137
Average fishermen population per village	855	825
Average number of sea going fishermen per village	193	282
Ratio of active fishermen to total population	1:4	1:3
Marine fish production (million tonnes)	1.5	2.3
Percapita production per active fishermen (Kg)	3250	3240

RESULTS AND DISCUSSION

The Coastal Regulation Zone notification (CRZ) and management

Coastal Zone Management Plan (CZMP) of each maritime State has been prepared and approved as per the Coastal Regulation Zone (CRZ) Notification 1991 as amended in 1994 and also incorporating the directions given by the Supreme court Judgement dated 18-4-96. The CRZ forms only part of the coastal agro-climatic zone of India in the geographical classification. As per the CRZ, the coastal stretches of seas, bays, estuaries, creeks, rivers

and backwaters which are influenced by tidal action (in the landward side) upto 500 metres from the High Tide Line (HTL) and the land between the Low Tide Line (LTL) and the HTL as Coastal Regulation Zone". High Tide Line means the land upto which the highest water line reaches during the spring tide. The area under CRZ has been further classified into 4 distinct categories and the following activities are prohibited within the zone."

- i Setting up of new industries and expansion of existing industries, except those directly related to water front or directly needing foreshore facilities;
- ii manufacture or handling or storage or disposal of hazardous substances as specified in the Notifications of the Government of India in the Ministry of Environment and Forests No.S.O.594(E) dated 28th July 1989. S.O 966(E) dated 27th November, 1989 and GSR 1037(E) dated 5th December, 1989;
- iii setting up and expansion of fish processing units including warehousing (excluding hatchery and natural fish drying in permitted areas);
- iv setting up and expansion of units/mechanism for disposal of wastes and effluents, except facilities required for discharging treated effluents into the water course with approval under the Water (Prevention and Control of Pollution) Act, 1974; and except for storm water drains;
- v discharge of untreated wastes and effluents from industries, cities or towns and other human settlements. Schemes shall be

Table 2: Structural change in fishing fleets, active and fishermen production 1980 and 1997

Item	1980	1997
Fishing Fleets		
Non mechanised	137000	160000
Motorised	-	32000
Mechanised	19013	47000
Total	156013	239000
Active Fishermen (Lakhs)		
Non mechanised sector	3.48	6.5
Motorised sector	-	1.7
Mechanised sector	1.14	2.0
Marine fish production (%)		
Non mechanised sector	60	13
Motorised sector	-	19
Mechanised sector	40	68
Annual average production (Tonnes)		
Non mechanised units	6.57	1.7
Motorised units	-	13
Mechanised units	32	33
Annual percapita production per active fishermen (kg)		
Non mechanised sector	2590	420
Motorised sector	-	2390
Mechanised sector	5260	8130

implemented by the concerned authorities for phasing out the existing practices, if any, with in a reasonable time period not exceeding three years from the date of this notification;

- vi dumping of city or town wastes for the purposes of land filling or otherwise the existing practice, if any, shall be phased out within a reasonable time not exceeding 3 years from the date of this Notification;
- vii dumping of ash or any wastes from thermal power stations;
- viii land reclamation, bunding or disturbing the natural course of sea water with similar obstructions, except those required for control of coastal erosion and maintenance or clearing of waterways, channels and ports and for prevention of sandbars and also except for tidal regulators, storm water drains and structures for prevention of salinity ingress and for sweet water recharge;
- ix mining of sand, rocks and other substrata materials, except those rare minerals not available outside the CRZ areas;
- x harvesting or drawal of ground water and construction of mechanisms therefore within 200 m of HTL: in the 200 m to 500 m zone it shall be permitted only when done manually through ordinary wells for drinking, horticulture, agriculture and fisheries;
- xi construction activities in ecologically sensitive areas as specified in Annexure I of this Notification;
- xii any construction activity between the LTL and HTL except facilities for carrying treated effluents and waste water discharges into the sea, facilities for carrying sea water for cooling purposes, oil, gas and similar

pipelines and facilities essential for activities permitted under this notification; and

xiii dressing or altering of sand dunes, hills, natural features including landscape changes for beautification, recreational and other such purpose, except as permissible under the Notification.”

The strict adherence and compliance of CRZ Notification will ensure the protection of the degrading environment, depleting genetic diversity and natural beauty. However, the coastal zone management plans prepared by each maritime States failed to spell out the developmental aspects to be taken care of by them. Now about 5000 sq.km area of the coastal zone is freezed and private investment for developement is absolutely not possible . Since 2251 marine fish landing centres are located in this region it is requiring substantial

Table 3. Marine fish production in India (1950-'97)

Year	Production (lakh tonnes)
1950-'51	5.34
1960-'61	8.80
1970-'71	10.86
1980-'81	15.15
1990-'91	21.6
1991-'92	22.8
1992-'93	21.8
1993-'94	23.3
1994-'95	22.3
1995-'96	24.1
1996-'97	23.0

infrastructure development for maintaining the quality of the perishable products caught from the sea. Hence, public investment strategies in this zone by the government without violating the CRZ notification is essential and the proposed development aspects should be integrated with the CZMP. Marine fisheries being the sole sector wholly depending on the development of this zone, experts concerned with fisheries research and development should be associated not only in the preparation of the coastal zone development plans, but also in the Coastal Zone Development Authorities at National and State levels.

Fishermen households and HRD

The Human Resource Development (HRD) in the coastal zone requires foremost and immediate attention in the Coastal Zone Management Plans of our country. The marine fishermen households located along our coastal belt increased from about 3.5 lakh during 1980 to 5 lakh during 1997. Fishermen population living in our coastal villages enhanced from 2 million in 1980 to 3 million in 1997 (Table 1). At present, there are about 2251 fish landing centres and 3638 marine fishing villages in our country (Anon., 1993) . While the average fishermen households per village declined from 146 to 137 from 1980 to 1997, the active fisherman per village increased from 193 to 282 during the same period. Similarly when the total marine fish production increased from 1.5 million tonnes in 1980 to 2.3 million tonnes in 1997, the annual percapita production per active fishermen declined from 3250 kg to 2240 kg during the same period. The human resource-base of India is a source of strength as well as weakness. The huge and rapidly

growing mass of population along the coastal belt is a potential labour force which, if properly harnessed, can be a massive productive asset.

Currently the opportunity cost of fishermen is almost zero and appropriate HRD measures to enhance the capabilities of them should be given prime priority in our coastal zone management.

Structural changes in fishing fleets and production

There is a steady increase of fishing fleets in Indian marine fisheries during the last two decades. The mechanised fishing units increased from about 8086 in 1977 to 47,000 during 1996-'97 and artisanal fishing units including motorised boats from 1.15 lakh to 1.92 lakh during the same period (Table 2). About six-fold increase in mechanised boats and 66 percent increase in artisanal units were observed during this period. Active fishermen involved in capture fisheries were only 3.22 lakh in 1977 which rose to 4.62 lakh in 1980 and 10.25 lakhs during 1996-'97. Increasing fishing effort has enhanced the fish production from 1.3 million tonnes in 1977 to 2.3 million tonnes in 1996-'97 as shown in Table 3 (Anon., 1978). The continuous increase in fishing effort led to the lower percapita production of artisanal fishing units.

There is a drastic change in the contribution of mechanised and artisanal fishing units in the total production for the last 22 years. The intensive mechanisation phase dominated in Indian marine fisheries during the seventies and eighties not only led to the increase in shrimp and fish production, but also marginalised the traditional sector. During 1974, mechanised boats contributed hardly 30

Table 4. Growth of infrastructure and marketing

	1977	1996
I. Infrastructure		
1. Freezing plants	264	372
2. Ice-making plants	131	148
3. Reg. peeling sheds	83	900

II. Export earning of marine products

Year	Forex earnings (Rs. Crores)
1960-'61	4.6
1990-'91	839.7
1994-'95	3270.0
1996-'97	4050.0

percent of the total landings (373,832 tonnes in the total catch of 12,17,797 tonnes) which has risen to 40 percent during 1980 and about 68 per cent during 1996-'97 (Silas *et al.*, 1976, Sathiadhas, 1997). While the annual percapita production per active fisherman in the non-mechanised sector declined from 2590 kg in 1980 to a meagre 420 kg during 1996-'97, it increased from 5260 kg to 8130 kg during the same period in the mechanised sector. It is evident that the traditional sector went for rapid motorisation of artisanal fleets mainly to overcome their marginalisation. The annual average percapita production per active fishermen in the motorised sector is 2390 kg during 1996-'97. Now within the artisanal sector, about 59% of the production is contributed by motorised units. Overall, the non-mechanised units contribute only 13% of the total landings during 1996-'97. The annual

average production of a mechanised unit works out to 33 tonnes, motorised unit 13 tonnes and non-mechanised unit 1.7 tonnes.

Changes and development of diversified fishing gears

Fishing nets till 1955 were all made from cotton and hemp twine and coir ropes (Bapat and Kurien, 1981). With the introduction of nylon twines and monofilament, the major structural change in marine fisheries occurred in late fifties with large scale replacement of cotton twines and coir ropes. The durability and operational efficiency of fishing gears increased manifold due to this technological intervention. Initially synthetic fibers had to be imported and now they are manufactured in India. Further there is continuous improvement in fishing gears over the years based on resource oriented location specific needs. Some of the gears prominent a few years ago were either modified or displaced by new type of gears. The operation of shore seines along the coastline has been drastically reduced in recent years. Similarly the prawn net (ral valai) operation has been mostly replaced by the trammel net (disco net), traditional Rampani operation in Karnataka has been completely replaced by purseseiners. The operation of the boat seines is declining or is being replaced by ringseines.

The mesh size of most of the fishing nets has been reduced in recent years. The mesh size of lobster net which was in the range of 90-110 mm has now been reduced to 40-50 mm. Similarly the cod end mesh size of trawl nets has reduced to less than 10 mm in Kerala and to about 7.5 mm in Gujarat. The drastic

reduction in the mesh size of many of the gears led to the catch of large quantities of juveniles prawns and fishes affecting the very sustainability of marine fisheries.

Growth of Infrastructure and improvements in marketing

The post-harvest sector of marine fisheries also shown substantial growth in infrastructure development, expansion of internal marketing and boost in export earnings. The increase in number of freezing plants was from 264 to 372, ice making plants from 131 to 148 and registered peeling sheds from 83 to 900 from 1977 to 1996 (Anon., 1978; Anon., 1997). The increase in cold storage facilities and thrust for preservation and quick transportation of fish improved our distribution and marketing system. Earlier marine fish consumption was mostly confined

Table 5. Ownership of means of production by active fishermen and capital investment.

	1980	1997
I. Mode of ownership		
Non-mechanised sector	39%	24%
Motorised sector	-	19%
Mechanised sector	17%	24%
Overall	34%	23%
II. Estimated capital investment		
	Total (million Rs.)	Per capita of fishing labour (Rs.)
Non-mechanised sector	9226	13,979
Motorised sector	4562	26,835
Smallscale sector	23881	1,25,689

to the coastal and adjoining regions. Now it is observed that about 50% of the fish is consumed fresh in and around producing centres, 43% in demand centres located upto a distance of 200 km from the coast and 7% goes to the centres located beyond 200 km in our internal marketing system (Sathiadhas *et al.*, 1995). The iced fish which faced consumer resistance in the initial years have now gained almost total consumer acceptance. The extent of spoilage of fish at landing centres as well as various points of distribution channel has been considerably reduced due to wide spread use of ice, technological improvements in processing and transportation facilities.

The export earnings of fishery sector have increased from Rs. 4.6 crores in 1960-'61 to Rs. 839.37 crores during 1990-'91, Rs. 3,270 crores in 1994-'95 and Rs 4050 crores in 1996-'97 (Table 4). The marine products of India have attracted many new customers in foreign markets and brought about a new era of hope and optimism to the fishing community (Sathiadhas, 1997). The fisherfolk got better prices for their catches and gained respect and recognition in society as primary producers of raw materials for marine products export industry

Ownership of means of production and gross capital investment

Ownership of means of production is one of the most important indicators of assessing the socio-economic status of fishermen communities. During 1997, overall only 23 percent of the active fishermen of marine fisheries sector have ownership on fishing implements (Table 5). The active fishermen

owning non-mechanised units declined from 39% in 1980 to 25% in 1997. One of the factors for decline in ownership of non-mechanised units is its conversion in to motorised units in recent years. Among the fishermen operating motorised units, 19 percent had their own units at present (1997). The owners among active fishermen in the mechanised sector increased from 17% during 1980 to 23% in 1997.

Capital investment on fishing equipments has been worked out on the basis of data collected from sample units operating at selected centres in each region. Most of the boats were old ones and their resale value at the time of observation were considered to compute the gross investment. The capital investment in fishing implements in the marine fisheries sector at current price level (1996-'97) works out at Rs 41,170 million comprising Rs. 9,226 million in non-mechanised artisanal sector, Rs. 4,562 million in motorised sector, Rs. 23,881 million in small scale mechanised sector and the rest in deep sea vessels (Table 5). The overall percapita investment per fishing labour works out to Rs. 13,979 in the artisanal sector, Rs. 26,835 in the motorised sector and Rs. 1,25,689 in the small scale mechanised sector.

Socio-economic status of fishermen

One of the major objectives of fisheries development programme is to improve the socioeconomic status of the fisherfolk. Socio-economic indicators such as age structure, educational status, type of ownership of fishing tools and implements, indebtedness and credit facilities and income and expenditure pattern influence the response of fishermen towards innovations and their participation in

development activities. Studies on these variables attempt not only to explain the socioeconomic conditions of the fisherfolk, but also to identify the factors constraining the realisation of the full potential of the fishery and the appropriate area for government intervention. Fishing villages all along the coastal waters in India are almost similar in their backwardness and underdevelopment. The CMFRI conducted a number of microlevel socioeconomic studies in selected fishing villages in different maritime States of India. General conclusions were drawn on the basis of these studies and comparison given for some parameters between traditional fishing villages and predominantly mechanised villages.

Traditional fishing villages mean the centres where nonmechanised and motorised fishing units are operating (category I) while the mechanised villages refer to the centres located close to the major fisheries harbours where mechanised fishing is predominant (category II). The general socioeconomic profile of the category I&II villages has been analysed in some detail. Housing is one of the most important yardsticks to measure the socioeconomic status of any community. About 80 percent of the fisherfolk in traditional villages and 50 percent in mechanised fishing villages are living in huts and kutcha houses only. The overall literacy rate works out to 29 percent in category I and 33 percent in category II villages. With regard to the occupational pattern, owner operators are more (45%) in category I villages and wage earners more (50%) in category II villages. People engaged in fishery related activities are comparatively more in category I villages and 70% households in category II

villages are in debt and the average outstanding debt per indebted households works out to Rs. 60,000 for category II villages as against Rs. 12,000 for category I villages. About 55% of the credit requirements of fishermen in category I villages are supplied by money lenders. In category II villages, banks advance a maximum of about 57% of the credit requirements. With regard to the annual household expenditure pattern, 80% household expenditure of fisherfolk families, in category I village and 67% in category II villages are on account of purchase of food items. In all fishing villages fishermen spent very meagre amount towards health care and education. Analysis of the ownership pattern of the means of production reveal that about 40% of fisherfolk households in traditional fishing villages do not possess any fishing equipments.

Fishing units like catamarans and canoes have been found to be economically sustainable and sufficiently efficient enough only with 3 or more resource specific nets suitable for operating in one or the other season so that the craft could be engaged round the year. About 11% of the fisherfolk households in traditional fishing villages possess 3 or more type of nets. The capital investment on fishing equipments by the fisherfolk households of traditional fishing villages also indicates that only about 30 % of the owners invested Rs 15,000 or more for fishing implements. Differences in the utilisation of loan amounts have been noticed between these two category of fishing villages. Fishermen in category I villages utilise 32% of the loan amount for the purchase of craft and gears as against 66% for the same in category II villages. Altogether,

54% of the fisheries credit in category I villages and 87% in category II villages are utilised for investment purposes. The proportion of utilisation of credit for consumption purposes is higher among the lower income groups. The basic amenities such as schools, banks, post office, primary health centres, private dispensaries, housing societies, drinking water taps and other infrastructure facilities are comparatively less in all the fishing villages. In spite of the introduction of several development schemes and stimulated economic activities in marine fisheries, traditional fishermen in general still continue to be one of the most backward sections of our society.

Aquaculture & Coastal Zone Management

India is endowed with 1.2 million hectares of potential area suitable for aquaculture. Until 1977 only about 10,000 ha of this area were utilized for aquaculture mainly for prawn farming by traditional methods (Muthu, 1978). Added thrust on aquaculture in recent years brought more area under different types of mariculture practices. The techno-economic viability coupled with high income earning potential of growing shrimps, edible oysters, pearl oysters, crab, and lobsters fattening and various finfish culture has induced more and more entrepreneurial fishermen to enter into commercial ventures and as a result vast areas of coastal lands have been brought under mariculture specifically for shrimp culture in most of the maritime States. India produced about 82,910 tonnes of prawns by culture from an area of 1,07,700 ha in 1994-'95 which valued at Rs 1,658 crores (Sudhakara Rao, 1997). The haphazard growth and development of prawn farming led to serious disease crisis in 1994

and several socio-economic conflicts subsequently along our coastal zone. The marginal and small farmers could not take advantage of this flourishing business as it is mainly undertaken by large scale farmers. However, the following apprehensions of coastal villagers should be taken into consideration before drafting the location specific coastal zone management plans (Paulraj et al, 1997). (1) most of the agricultural lands are converted to shrimp farms and there is a possibility that agriculture may not be feasible in future in the shrimp farming areas, (2) the stagnant brackishwater in the shrimp ponds would seep through the soil and convert the potable well water brackish, (3) the untreated effluent water from the shrimp farms which is allowed to stagnate around the farms and the dwellings, would be a health hazard, (4) many agriculture labourers are displaced due to depleted agricultural activity and (5) the water intake pipes of the farms which pass through the beach project into the sea, causing hindrance to the fishing activity of the coastal fishermen.

Further the totally shrimp oriented, land based coastal mariculture has resulted in the under utilization of the technologies developed for the culture of bivalves, seaweeds and pearls, and hence requires to be diversified and broad-based to take maximum advantage from the high production potential of tropical aquaculture farmers (Devaraj et al., 1997). Hence, there is urgent need to bring the entire potential area suitable for mariculture into effective use not only for culture of shrimps, but also for marine finfish, bivalves and seaweeds through diversification under the policy framework of coastal zone management.

POLICY IMPLICATIONS

Though the income generated from the capture fisheries has substantially increased over the last few years, the percapita contribution to output by various factors of production in the harvesting sector is continuously declining inspite of the increase in the total catch. It is evident that over capitalisation and under-employment of human resources are rampant in the inshore fisheries. The decline in the marginal productivity of labour is comparatively, higher in the artisanal sector than in the mechanised sector widening the gap between the rich and the poor affecting the harmonious socio-economic fabric of the coastal rural community. It is explicitly seen that the coastal rural people could not get much of the benefits of the economic development taken place in our country since independence. In this context, generation of alternate employment opportunities through the development of proper infrastructure for mariculture and fishery related industries in the coastal region is very essential.

The balanced development of the coastal agro-climatic zone with the integration of capture and culture fisheries combined with agriculture, horticulture, forestry and animal husbandary is essential for providing productive employment and improving the socio-economic conditions of the coastal rural communities. The geographical classification of CRZ and adjoining regions indicating the human, material and natural resource potential is vital for planning. Hence region-wise Geographical Information System of the coastal agro-climatic zone should be prepared on priority basis. Since fisheries form the major source of income to

vast majority of coastal population, experts from capture and culture fisheries including socio-economists should be associated in the preparation of coastal zone management and development plans and adequately represented in the state and national level Coastal Zone Developmental Authorities.

There is, at present, considerable confusion in the land and water use policies of Government in our coastal regions. There are conflicts on issues pertaining to developmental strategies and conservation of resources. Development without endangering the environment and resources degradation is the prime requirement for sustainable socio-economic improvement of coastal fishermen. Hence, appropriate policy measures should be framed and enforced on the land and water use pattern of the coastal and adjoining regions. With regard to the development of coastal aquaculture and sea farming including the launching of artificial reefs, community participation through cooperatives to share the benefits should be ensured to avoid conflict with the current resource users who hold traditional fishing rights. Location specific regulatory measures on indiscriminate coral collection, rare earth mining, soil erosion and salt pan development should be also included in the proposed policy framework.

A pre-requisite for planning coastal zone developmental programmes in the capture fisheries sector is the information base on the potentialities of human resource involvement, the magnitude of facilities such as fishing crafts, gears and other infrastructure available and the extent of current resource exploitation. The comprehensive all India census on marine

fishermen, craft and gear was conducted by CMFRI during 1980, which forms the basic data of craft, gear and fishermen population for the country till now. The socio-economic parameters later published by various States either through census or periodic updating bring out a number of discrepancies. For instance the fishing crafts both in non-mechanised sector and mechanised sector appears to be on the higher side. The fact that the capacity utilization of fishing fleets are hardly 20% for non-mechanised boats and 50% for mechanised boats clearly indicate that the real operational units are very less than the figures furnished by various State Governments. Since fisheries being seasonal and interstate migration of fleets are very common, there are immense possibilities of their double entry. Further it appears that the defunct and non-operating units are also included in recent years in the number of fishing crafts. Hence the periodic all India census of marine fishermen, craft, gear and other socio-economic parameters should be conducted by a central agency like CMFRI regularly as recommended by National Commission on Agriculture for providing the much needed information base for planning of fisheries development and coastal zone management.

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