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Policy issues for Marine Fisheries Management in India

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ABSTRACT

Fisheries contribute about 1 per cent of India's GDP, which forms about 4.12 per cent of the agricultural GDP (2003-04). The sector provides employment to about 28 lakh people in its primary, secondary and tertiary segments. Economic evaluation of marine fish landings at 2004 price level is about Rs.13,019 crore at first sales and Rs. 22,653 crore at last sales. Surpassing the domestic marketing pattern, the export market is still wide as crustaceans and cephalapods alone generates 50 per cent of the gross earnings. An overview of the price movements of food products for the last four decades reveals that fish and fishery products displayed the highest increase in price level. The private capital investment in marine fishery sector also recorded phenomenal growth both in harvest and post-harvest sectors primarily oriented towards export market. The overcapitalisation of fishing fleets, excess capacity of export-oriented processing plants, disguised unemployment, inter and intra sectoral marginalisation, inequitable distribution of income, increasing fishing pressure on high resource-rent varieties, economic loss due to discards and juvenile fish catch, divergent trend of production and earnings, harvesting strategies for deep-sea and oceanic resources, integration of inshore fisheries with coastal mariculture, socio-legal problems of open sea mariculture, development and launching of artificial reefs / fish aggregating devices, public funded sea ranching programmes, product development and market diversification, credit requirements and constraints, quality control and promotion of exports complying with WTO regulations, parallel development of internal marketing system, community based conservation strategies including awareness on responsible fisheries, HRD for research and development personnel, crisis and disaster management, development of infrastructure and marine fisheries information system, proper utilisation of information technology and rural network of knowledge centres and comprehensive approach for coastal zone development are some of the aspects, which requires appropriate policy interventions. The escalating pressure on the coastal biodiversity is another major concern, in view of consistent and sustainable deliverables for the future generation.

Keywords : Policy, marine fisheries, artificial reefs, integration

INTRODUCTION

Fisheries play a predominant strategic role in the economic activity of our country by its contribution to national income, food and employment. It supports the deprived coastal community and serves as an important foreign exchange earner contributing sustainably to food and nutritional security. It is also a principal source of livelihood to people in coastal areas. Fisheries contribute about 1 per cent of India's GDP, which forms about 4.12 per cent of the

agricultural GDP (2003-04). The total fish production during the four decades (1950-51 to 1990-91) showed an annual average compound growth rate that varied between 3.35 to 4.62 percent. About 12.2 lakh fisherfolk operate diverse types of craft-gear combinations with regional and seasonal variations all along the Indian coastline.

Increasing fishing pressure has led to over exploitation of inshore resources and depletion of marine fisheries is further aggravated with the increasing catch of juveniles and discards. Decline in catch rates coupled with increasing domestic and international demand of high value species has resulted into more conflicts in sharing of resources, increase in migration of fishing units and labourers, emergence of multiday fishing even extending beyond 15 days and consequent socioeconomic disturbances like increase in burden of women in household management. Fisherfolk all along the Indian coast as well as Inland hamlets are similar in their socio-economic backwardness. About 47 percent of coastal fisherfolk is living Below Poverty Line (BPL) with a monthly per capita income of less than Rs. 1000. Housing is one of the most important indicators- about 35 per cent are living in huts, 40 per cent in *kutcha* houses and 25 per cent in *pucca* houses. More than 50 per cent of total fisher population lives within the CRZ-1 and half of them are devoid of title deeds. Inequitable distribution of income is the greatest challenge by our fisherfolk. With the increasing capital intensity of fishing units, the extent of ownership of means of production (crafts and gears) by fisherfolk declined from 27 in 1970 to 14 percent in 2004, which indicates growth of dispossessed labour class, like landless labourers in agriculture. With the unbridled capital penetration inter and intra sectoral marginalisation is taking place. It is ironical to note that one third of active fishermen (mechanised sector) corners about 70 per cent of the earnings generated at the primary level and the other one third involved in non mechanised sector gets only 7 per cent of the common property resources. Policy interventions in the production, distribution and marketing segments are highly essential for the rational utilisation and sustainable development of open access marine fisheries.

MATERIALS AND METHODS

Comprehensive usage of data, both secondary and primary is attempted in this paper. Primary data gathered by the Socio-Economic Evaluation and Technology Transfer Division (SEETTD) of CMFRI is used for comparative assessment of different aspects of various craft and gear combinations. Exhaustive usage of secondary data from various publications cited herein is also used in the preparation of this paper.

Fisheries Legislation in India

The backdrop of fisheries legislations enacted in India traces back to 1857, when The Indian Fisheries Act was endorsed. It was meant to regulate riverine fisheries and fisheries in inshore waters, to prohibit the use of poisons and dynamite in fishing, and to protect fish resources in selected waters through regulation of, among other things, the erection and use of fixed engines (the reference is to nets, cages, traps, etc.), the construction of weirs, the use of nets of certain types and dimensions, etc.

The present day scenario is governed by various sets of enactments essentially having bearing on the marine fisheries sector. These legislations include Maritime Zones Act (1976)

which recognizes the sovereign rights to conservation and management of living resources in the Indian EEZ, in addition to their exploration and exploitation. Another important regulation governing the marine fisheries is Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act (1981) and Rules (1982). Fisheries within the 12-mile territorial limits are managed under the Marine Fishing Regulation Acts (MFRAS) of the maritime States of India. The main emphasis of MFRAS is on regulating fishing vessels in the12-nautical mile territorial sea, mainly to protect the interests of fishermen on board traditional fishing vessels. Thus, the Act has been mainly used for the purpose of maintaining law and order at sea. The MFRAS were first implemented in the States of Kerala and Goa in 1980. They were subsequently enacted in other states, the latest being in 2003, in Gujarat. While the earliest MFRAS were enacted only for regulation of fishing vessels along the coastline of the state, the Gujarat MFRA provides for protection, conservation and development of fisheries in inland and territorial waters of the state of Gujarat and for regulation of fishing in the inland and territorial waters along the coastline of the State. The Coastal Regulation Zone Protection Act, (1986) outlines a zoning scheme to regulate development in a defined coastal strip. The Notification defines the coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action in the landward side, up to 500 m from the high-tide line (HTL) and the land between the low-tide line (LTL) and the HTL, as the CRZ. The Environment Protection Act, (2002) authorizes the Central government to protect and improve environmental quality, control and reduce pollution from all sources, and prohibit or restrict the setting and/or operation of any industrial facility on environmental grounds. The Biological Diversity Act (2002) provides for the conservation of biological diversity, the sustainable use of its components and, significantly, the fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and related matters.

Marine Fishing policy enables sustainable and responsible fisheries in addition to tapping the opportunities in domestic and export market. The Marine Fishing Policy of 2004 delineates 'Territorial Waters' as the subject of maritime states. Fisheries beyond this limit falls under the purview of the central Government and is termed as the 'Exclusive Economic Zone'. The Central Government provides financial assistance under the central sector schemes and sponsored schemes for fisheries sector.

Overcapitalisation of fishing fleets

At present (2003-04) there are 2251 traditional landing centres, 33 minor and 6 major fishing harbours in the marine fisheries sector of India. About 1.77 lakh of fishing crafts are in operation comprising 76596 traditional non-mechanised fishing crafts, 50922 motorized crafts and 49070 mechanized crafts operating different gears. Mechanised crafts displayed a major boom during 1980s and 1990s. When the technical efficiency of a particular gear is better than the other, the lesser efficient gears gradually disappear from the operation (Sathiadhas, 1998). In mechanized sector, growth rate of trawlers is increasing at a faster rate, especially boats with 15 m and more OAL, which are capable for multi-day fishing. Many of our existing mechanized boats have now started operating even beyond 100 m depth

resorting to multi-day fishing and the current trend is to go for higher OAL fitted with engines of higher horsepower. The trends in the growth rate of fishing units indicate the possible phasing out of non-mechanised canoes at least in certain regions, which ultimately reflected a negative growth of 52 per cent by them during 1997-98 to 2003-04. This downtrend is compensated in the motorised sector implying large-scale motorisation of existing traditional crafts.

The capital investment has increased more than proportionate to the increase in fleet size not only due to increase in price level and consequent increase in capital requirements but also diversification of fishing units opting for bigger OAL boats with high HP and other accessories. The gross capital investment on fishing units in Indian marine fisheries sector during 2003-04 works out at Rs.10,532crore in which mechanised sector constitutes about Rs.9,049 crore, more than a three-fold increase from 1997-98. The increase in investment on mechanised trawlers and gill-netters are comparatively higher than other sectors. The capital investment on motorised sector also almost doubled from Rs.456 crore during 1996-97 to Rs.861 crore during 2003-04. However, as expected, the non-motorised sector has shown a decline in investment from Rs.923 crore during 1996-97 to Rs.622 crore during 2003-04 in tune with their decline in production and diminishing returns. Further, substantial numbers of these units were converted into motorised units.

The overall per capita investments of an active fisherman in 2003-04 was Rs.86,290 ranging from Rs.17,024 in the non-mechanised sector to Rs. 2,19,319 in the mechanised sector. During 1997, the overall per capita investment was Rs.40,363, where the investment per head in mechanised sector was Rs.1,25,689, motorised and non-mechanised sectors invested Rs.26,835 and Rs.13,979 respectively per active fisherman in India (**Table 1**). Further, fishing intensity is directly related with capital investment *vis-à-vis* number and type of nets they are possessing. A catamaran owner having different types of nets can have more number of fishing days. If he is having only one type of net, he will be having only lesser number of fishing days. In India, most of the non-mechanised fishermen are having one or two fishing nets, which are not sufficient for efficient operation for the whole year.

Table 1 : Per capita investment on fishing equipments per active fishermen in India – 1997-98 & 2003-04 (Rs.)

Sector	1997-98*	2003-04
Mechanised	1,25,689	2,19,319
Motorised	26,835	19,454
Non-mechanised	13,979	17,024
Overall	**40,363**	**86,290**

**Sathiadhas,* et.al., *(1998)*

In India, hardly 14 per cent of the active fishermen in the marine fisheries sector have ownership on craft and gear in 2004 and another 3 per cent possess only gears. The proportion of owner operators in marine fisheries declined over the years with the increasing capital requirement for possessing motorized and mechanized fishing units. In the mechanised sector, 12 per cent, motorised sector 9 per cent and traditional sector 21 per cent have ownership on crafts and gears. Most of the non-

motorised units are operating as family enterprises, not even realizing the operating cost of the labourers. Lack of finance and credit facilities does not allow these fishermen to go for modernization and come out of the vicious circle of poverty and low-income trap.

Disguised unemployment and diminishing returns: During 2003-04, 12.20 lakh people are employed in active fishing in the primary sector and another 15 lakh in the pre and post-harvest sector in the secondary sector and one lakh people employed in the tertiary sector.

It is estimated that about 18 to 20 million people in India are depending on marine fisheries sector for their livelihood. The proportion of catch by mechanised sector as a whole increased from 40 per cent during 1980 to 68 per cent in 1997 and again declined to 66 per cent in 2003. At the same time, the number of active fishermen depending on mechanised fisheries increased from 1.14 lakh to 2 lakh and again increased to 4.1 lakh respectively during the same period. It should be noted that the annual per capita production of active fisherman during the period has increased from 5260kg in 1980 to 8130 kg in 1997 and drastically declined to 4175 kg in 2003 (**Table 2**). This clearly indicates the high prevalence of disguised unemployment in the mechanised fisheries sector. The pressure for employment in active fishing is increasing more than proportionate to the harvestable yield in the open access marine fisheries. The fishermen involved in active fishing is more than the absorbing capacity of the fisheries sector and has led to lower per capita production, increased pressure on fishing which results in juvenile fishing, large level discards and thus ultimately causing serious threats to resource sustainability and environmental stability.

Employment in fisheries sector has undergone rapid structural changes during the last few decades. Among those engaged in the mechanized sector, 75% work in trawl fisheries and the rest 25% in other sectors. In the case of motorized sector, 50% are engaged in ring seine fishery alone. There is a wide disparity in income between those engaged in different sectors. The number of annual fishing days per worker reveals that the level of employment for hired labourers as well as those not having sufficient equipment is low and they are very much underemployed. The seasonal nature of fishery and the risk and uncertainties associated with marine fishing entangled the fishermen in the low-income trap. The current scenario of marine fisheries in terms of fishing fleets clearly indicates a situation of "too many boats chasing too few fishes". Overcapitalisation in the mechanized sector and under employment in non-mechanised sector is rampant issues, which creates regulatory, and conservatory problems for sustainable production on one hand and socio-economic problems on the other. The continuous changes and up gradation of existing fishing technologies not only increase the efficiency of craft and gears but also marginalize the fisherfolk who are not able to cope up with the changes. Similarly in motorized sector technological upgradation in the form of size of the net and boat has increased over the years. Boats fitted with 2-3 OB engines are very common which enhanced their mobility and fishing capabilities. In the mechanized sector expanded fishing activities with extended fishing days of even more than five days per trip is very common. With this acute competition, both inter and intra sectoral level has marginalized a number of fishermen who are depending on labour intensive technologies for their livelihood.

Table 2: Structural changes in socio-economic parameters in non-mechanised motorised and mechanised sector (1980-81 to 2003-04)

Item	1980-81	1997-98	2003-04
Mechanised			
Marine fish production (%)	40	68	66
Average annual production (in tonnes)	32	33	35
Annual per capita production / active fishermen (in Kg)	5260	8130	4175
Ownership of means of production by active fishermen (%)	17	24	12
Active fishermen	114000	200000	412596
Motorised			
Marine fish production (%)	—	19	27
Average annual production (in tonnes)	—	13	14
Annual per capita production / active fishermen (in Kg)	—	2390	1592
Ownership of means of production by active fishermen (%)	—	19	12
Active fishermen	—	170000	442581
Non Mechanised			
Marine fish production (%)	60	13	7
Average annual production (in tonnes)	6.57	1.7	2.4
Annual per capita production / active fishermen (Kg)	2590	420	500
Ownership of means of production by active fishermen (%)	39	25	21
Active fishermen	348000	650000	365360
Total			
Average annual production (in tonnes)	9.6	9.6	14.8
Annual per capita production / active fishermen (in Kg)	3247	2254	2138
Ownership of means of production by active fishermen (%)	34	23	14
Active fishermen	462000	1020000	1220577

Economics of different types of Fishing Units

Estimated costs and earnings of different craft-gear combinations are given in Abstract. Among the mechanised category, purse seines with 15mt OAL engaged in multi-day fishing (2-5 days) had the highest net operating income per trip (Rs.42,382), gross earnings (Rs.1,15,025) and operating costs (Rs.72,643). Similarly, the trawlers with single-day operation had the lowest operating income (Rs.537) among mechanised sector. Within the motorised sector, canoes with ring seines had the highest and plank-built boats with gill net had the lowest net operating income per trip. Catamarans with hooks and lines that operate with minimum costs (Rs.420) had a lower net income (Rs.150) in the non-mechanised sector. Dugout canoes/shore seines had the highest income (Rs.1,250) among non-motorised category. As shown in **Table 3** on an average almost all types of fishing units have a surplus net operating income. But in each category there is number of less efficient units running on losses. Further for non mechanised units, the major component of the operating cost is wages to labourers which is usually shared depending on gross revenue.The overcapitalisation of fishing fleets and the consequent issues of regulatory, conservatory and socio- economic problems can be solved by formulating adequate mechanisms to complement the gradual phasing out of traditionally functioning boats with motorisation on collective basis. Promotion of "co-operative fishing" instead of "competitive fishing" is advisable for optimum exploitation and introducing regulations. Specific coastal zone development strategies may be worked out towards the ultimate welfare of the coastal community and alternative avocations other than capture fisheries for the fisherfolk, especially in agri-horticulture and livestock management should be promoted. Integration of coconut development in the coastal region with fisheries is another strategy for development of this sector. Alternative avocations should plan in such a way as to utilise the idle (disguised) labour in capture fisheries.

Table 3 Comparative Economics of Marine Fishing Units, 2003-04

Fishing Units	Operating Cost	Net Operating Income
Non-Mechanised Boats		
Catamarans with Gillnet	525	210
Fibre Glass with Gillnet	575	325
Dugout Canoes / Shoreseiner	6250	1250
Catamarans with Hooks & Line	420	150
Motorised Units		
Plank built Boats with Gillnet	1470	480
Fibre Glass Boats with Gillnet	940	550
Canoes with Ringseines	20000	4000
Canoes with Minitrawl	1100	620
Mechanised Purseseiner		
Single Day Units	13548	21134
Multi-Day Units (2-5 days)	72643	42382
Mechanised Gillnetter		
Single Day Units	1072	1492
Multi-Day Units (2-5 days)	14716	6338
Multi-Day Units (6 & above)	40150	21720
Trawlers		
Single Day Units	1937	537
Multi-Day Units (2-5 days)	17648	5703
Multi-Day Units (6 & above)	27934	16641

Need for reducing juvenile catch

Juvenile fishing is the greatest curse of multi-species, multi-gear open access marine fisheries. They are the worst victims of over fishing. Juvenile is any fish that is not yet reached the reproductive stage. Juvenile fish is captured even during the spawning periods of specific species. The catch composition of some selected gears of Kerala was assessed. About 50 per cent of the flat fish landed by mini trawlers are juveniles and 30 per cent each of *penaeid* prawns and anchovies landed by mini trawlers are juveniles. Within the total landings of anchovies by ring seiners and shore seiners, about 40 per cent are juveniles.

The gross economic loss occurred due to the capture of juveniles of different species is recorded for each fishing craft. The total economic loss due to juvenile fishing is worked out for each fishing vessel. It is found that while the annual revenue generated by mechanised trawl units is Rs.31.2 lakh, it caused an economic loss of Rs.28.26 lakh due to juvenile fishing alone in the study region. For purse seine, the economic loss is Rs.39.57 lakh against its gross revenue generation of Rs.20.7 lakh. Ring seine units create a gross revenue of Rs.12.4lakh, at the same time, they are responsible for an annual economic loss of Rs.19.1 lakh by way of juvenile fish catch. The gross revenue generated by mini trawl and ring seine are Rs.4.47lakh and Rs.4.31 lakh respectively, but the gross economic loss created by these units are Rs.6.89 lakh and Rs.5 lakh respectively. The gross estimate shows that the economic loss due to juvenile fishing made by trawlers, purse seiners, ring seiners and mini trawlers together along Kerala coast during 2001-02 is around Rs.1850 crore where as the annual revenue generated by these fishing units comes to only Rs.705 crore. Mechanised trawlers made almost 70 per cent of the economic loss. There are altogether 4,484 number of mechanised trawlers in Kerala which creates a gross economic loss of around Rs.1264.40 crore due to juvenile fishing, where as, these crafts generate an annual revenue of Rs.508.88 crore, thus causing a deficit of Rs.758.52. The next largest contributor of the economic loss is the 2351 ring seiners causing Rs. 286.54 crore to the economy. A total of 1500 mini trawlers debits an amount of Rs. 85.20 crore where as the 76 purse seiners debits Rs.15 crore from the economy.

Economic loss due to discards and juvenile fish catch can cause serious environmental threats that could be reduced by implementing strategies like mesh-size regulations to avoid juvenile catch, developing appropriate utilisation strategies of discards, multi-day fishing operations should be regulated or innovative measures may be adopted to land the catches on frequent intervals. A collective number of traditionally functioning boats may be engaged as carrier boats to land the fish which would otherwise turned as discards. Awareness among fisherfolk regarding the consequences of juvenile catches and confiscation measures may be adopted to discourage mechanised boats from such catches.

Harvesting strategies for deep-sea and oceanic resources

There is no scope of increasing fishing pressure in our inshore waters as there is excess capacity in traditional and small scale mechanised sectors. Further many of the existing mechanised boats are extending their

fishing up to 100 meters of depth resorting to multi-day fishing operations. Hence our fishing policies should be oriented towards exploiting the fishery resources beyond 100 metres depth giving thrust to indigenous technology and more employment generation for coastal fisherfolk to avoid social conflicts.

Harvesting of marine fish resources is categorised into three levels viz., (I) subsistence fishing, (II) small-scale fishing and (III) industrial fishing. It is worth noticeable that the Marine Fishing Policy of India 2004 envisages schemes to motorise the traditional craft and also providing better material and technology for traditional craft. The country has a very large fleet of traditional craft (181284 nos.). Motorisation of the entire fleet may make fishing unsustainable. The motorised craft with their operational limit would end up in overcrowding whereby exerting too much fishing pressure in a limited area. Accordingly, the policy visualises motorisation of about 50 per cent of traditional craft allowing the remaining to carry on subsistence fishing in the near shore waters. On the other side, providing incentives for acquisition of multi-day fishing units would encourage the small-mechanised sector. The suggestions for providing infrastructure support in terms of landing and berthing facilities for the growth of deep-sea vessel category is noteworthy. Other ingredients of the support package include, provisions for special incentives for wholly Indian owned vessels for venturing into international waters and for concluding fishing arrangements with other countries under licence etc, promoting fishing in by Indian owned vessels or with equity participation or under licence by working out sustainable strategies, screening and approval of proposals for import of resource-specific fishing vessels by wholly Indian owned enterprises by designated authority in accordance with well laid out norms. The pressure of fishing in the inshore waters is exceeding the limits resulting in overexploitation of the fishing stocks and consequential threat of depletion. The current situation of virtual absence of Deep-sea Fishing Policy is detrimental to the growth of marine fisheries and a clear-cut policy should be evolved.

Integration of inshore fisheries with coastal mariculture

A report of the consultative group on international agricultural research states that within the next 15 years, fish farming and sea ranching could provide nearly 40 per cent of all fish for the human diet and more than half of the value of the global fish catches. According to a report of the FAO, the world aquaculture production is projected to increase by 2.69 times by 2025 AD. India as a leading country in Asia in aquaculture production should be able to achieve at least a production of 2mt (0.1mt finfish, 1.0mt crustaceans, 0.3mt molluscs and 0.6mt seaweeds) through mariculture by the year 2025 AD, i.e., 3.9 per cent of projected global aquaculture production of 51.8mt. With improvements in the domestic market, diversification of marine products exports, availability of a vast range of cultivable candidate species, several culture technologies and hydro climatic (or agro climatic) zones for coastal mariculture and seafarming, India is poised to become one of the world's leading producers of mariculture products.

Issues related to Coastal Regulation Zone (CRZ), Integrated Coastal Zone Management (ICZM) and the unfounded apprehensions that coastal mariculture would adversely affect the environment are leading to unnecessary or avoidable litigations retarding the growth of the mariculture sector. It is worth to note that the present shrimp oriented, land-based coastal mariculture has resulted in the under-utilisation 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 farms.

Issues related to apprehensions that coastal mariculture would adversely affect the environment are leading retarded growth of the mariculture sector. The present shrimp oriented, land-based coastal mariculture requires being reoriented to take maximum advantage from the high production potential of tropical aquaculture farms. Promotion of enclosure fisheries should be done wherever possible with appropriate legal support. Fishery estates and public sea ranching programmes with sufficient legal framework may also be made into practice for sustaining the fishery resources. Inshore artificial reefs needs to be established throughout the country as was done in South Korea as an industry in itself and duly integrated with inshore seafarming to promote productivity and production in the artisanal sector. Open sea mariculture of mussels, pearl oysters, edible oysters and other candidate species in the calm bays and coastal waters should also be given due importance.

Product development and market diversification

Seafood products form a considerable segment of the post-harvest utility of marine fish resources. There has been considerable structural change in the seafood processing and export industry for the last few years. There is a growing demand for "ready -to -cook" or "ready to serve" type of seafood, hygienically prepared and attractively packed convenience foods to match the changing needs of urban population.

Table 4: Export growth of marine products from India (1995-96 to 2000-2001)

Year	Quantity (Tonnes)	Value (Rs.Crores)	Unit Value (Rs/kg)
1995-96	296277	3501.11	118.17
1996-97	378199	4121.36	108.97
1997-98	385818	4697.48	121.75
1998-99	302934	4626.87	152.74
1999-00	343031	5116.67	149.16
2000-01	440473	6443.89	146.29
2001-02	424470	5957.05	140.36
2002-03	467297	6881.31	147.26
2003-04	412017	6091.95	147.86
2004-05	461329	6646.69	144.08

The seafood processing and marketing has become competitive all over the world and exporters are switching over to value addition to increase profit. Seafood exports alone constitute about 3.14 per cent of the gross export earnings of our country. During 2004-05, India's seafood exports earnings have crossed Rs.6647 crores (**Table 4**). Though there has been an increase in terms of total quantity of seafood exported and value realized, there was an overall decline in unit value realized per kg during the last few years. This is mainly due to the change in product composition with an increasing trend in finfish component, which fetch comparatively lesser prices.

Product diversification always promotes price discrimination and enables us to realise maximum forex earnings. It further helps us to enhance the employment opportunities of coastal rural women. The emergence of value added products are accelerated by the current demand pattern of the major seafood markets in exporting. Today the affluent society is gradually shifting towards value added products. An additional export of almost one-lakh tonnes of value added products in our marine products could easily corner about Rs.1500 crores of forex earnings and generates regular employment opportunity of about 35000 fisherfolk. The shift in demand towards value added products mainly in the export markets have opened an excellent opportunity for the seafood sector that requires to be tapped. Promotion of diversified value added products accelerates our forex earnings in exports and provides a multiplier effect on employment front especially for weaker sections and womenfolk. Continuing support and adequate training to women self help groups engaged in the preparation of value added products and marketing. The most viable alternative to maximise our forex earnings from marine shrimp landings is to focus on export of value added ready to eat products.

Quality control and promotion of exports complying with WTO regulations

Quality assurance in the domestic marketing channel will enable the parallel development of the internal marketing system, which is highly essential to withstand any market collapse and price crash in the export market at any point of time (Sathiadhas and Narayanakumar, 2002). The marketing and distribution system in the fishery sector of the country is not well equipped with quality maintenance mechanism comprising essential marketing infrastructure and proper administrative procedures. In the light of HACCP regulations, the government as well as industrialists has been increasingly complying with the quality standards of the export products. However, quality maintenance in the internal distribution system of fresh and processed fish is also essential. Quality concern attracts atmost priority in the present day markets. On the basis of real field level observations, adequate care for the post-harvest quality assurance of marine resources should be emphasised. In addition, proper and cost-effective preservation facilities should be provided at all retail outlets. Preservation or cold storage units can be established on cooperative basis or by the local bodies extending the facilities by nominal charges.

Eco-labelling

Ecolabelling is a voluntary method of environmental performance certification and labelling that is precise around the world. An "eco-label" is a label which identifies overall environmental preference of a product or service within a specific product / service category based on life cycle considerations. The idea that eco-labelling would lead to improved management of marine capture fisheries is recent origin. Unilever PLC/NV and the World Wide Fund for Nature (WWF) first publicly promoted it at their Marine Stewardship Council (MSC) initiative in early 1996. Despite the international community's general acceptance of product eco-labelling, the approach has caused controversy in several international arenas, including WTO Sub-Committee on Trade and Environment. General concerns about eco-labelling are its potential to act as a barrier to trade and its coherence, or lack of it, with international trade rules. More specific concerns arise when applying ecolabelling to products from marine capture fisheries because these have special characteristics. At any point of time, eco-labelling is market-based economic instrument that seeks to direct consumer's purchasing behaviour so that they take account of product attributes other than price. Consumer's preference are expected to result in price and/or market share differentials between products with eco-labels and those that either do not qualify for them or whose producers have not sought to obtain them. The large and progressive global fisheries trade, especially from developing to industrialised countries, indicate the potential of ecolabelling as both an incentive to improved fisheries management and a barrier to trade. There is increasing acceptance on the part of those who are familiar with eco-labelling that such labels should not be used to discriminate against those who cannot afford to develop and implement the management practices needed for sustainable fisheries management. Governments, industry and consumers should promote international collaboration in order to agree on basic principles for the introduction and use of eco-labels in fisheries and aquaculture.

Subsidies

Subsidies have long been part and parcel of the fishing industry, partly because of the public good nature of fisheries management and associated research, but also because of the precarious livelihood experienced by most fishing communities. The WTO definition of subsidies is chiefly concerned with the trade effects of subsidies in general, rather than effects on conservation or fisheries management. In WTO terminology, subsidies in general are identified by "boxes" which are given the colours of traffic lights: green (permitted), amber (slow down or be reduced), red (forbidden). The Agriculture Agreement has no red box, although domestic support exceeding the reduction commitment levels in the amber box is prohibited; and there is a blue box for subsidies that are tied to programmes that limit production. There are also exemptions for developing countries (sometimes called an "S&D box", including provisions in Article 6.2 of the agreement).

"Green box" subsidies are allowed without limits, provided they comply with the policy-specific criteria set out in the Agriculture Agreement. Amber box include measures to support prices, or subsidies directly related to production quantities. These supports are subject to limits minimal supports are allowed (5% of agricultural production for developed countries, 10% for developing countries).

The reduction commitments are expressed in terms of a "Total Aggregate Measurement of Support" (Total AMS), which includes all supports for specified products together with supports, that are not for specific products, in one single figure. In the current negotiations, various proposals deal with how much further these subsidies should be reduced, and whether limits should be set for specific products rather than continuing with the single overall "aggregate" limits. Blue box is the amber box with conditions designed to reduce distortion. Any support that would normally be in the amber box is placed in the blue box if the support also requires farmers to limit production.

Subsidies that distort trade are not promoted in the WTO regime and consequent measures to reduce the same are highly debated. The pros and cons of its implementation on fisheries sector require to be examined with reference to its far-reaching implications. Hence there is increasing pressure from Indian scientist community to club all the subsidies together, instead of being placed in separate boxes. India would not be adversely affected if these were clubbed together, as the aggregate measure of support (AMS) to Indian agriculture is still well below the *de minimus* of 10 per cent. AMS were calculated as the sum of product-specific and non-product specific support, as the former is significantly negative in the Indian case. If India avails of the input subsidies to the resource poor farmers who are exempt from reduction commitments even now under WTO provisions, the non-product-specific support may come down to less than half of the present condition. Anti-dumping and anti-subsidy duties or safeguard measures must be invoked in time. Imports should comply with standards and the TRIPs system needs to be strengthened (Rao, 2004).

Parallel development of internal marketing system

Post-harvest fisheries activities including processing, product development, transport and marketing provide greater employment to labour than the harvesting sector. As the demand and price of fish keep continuously increasing in the domestic and export markets, the opportunities for the above activities also keep growing. Fresh fish, once inaccessible to distant locations still a few years ago are now easily available due to the vast improvements in handling technologies coupled with advanced transportation facilities and consequent market penetration. However, the infrastructure for fish marketing in India is still principally oriented towards the export market.

Fishermen's share in consumer's rupee is the best index to measure the efficiency of fish marketing system. Judging from the trend of fishermen's share on consumers' rupee at all India level during 1989-90, 1996-97 and 2003, the fish marketing efficiency has increased over the years (**Table 4)** for most of the varieties. During 2003, fishermen's share in consumers' rupee ranged from 45 per cent for silver bellies to 75 per cent for seerfish. Although the share of producers increased over the years for quality fishes like seerfish and pomfrets, there is enormous scope to enhance the marketing efficiency of low quality fishes such as silver bellies and lizardfishes in the internal markets. Marketing costs including transportation range from 6 per cent to 13 per cent of the consumer's rupee.

Not only the export markets but also the internal marketing system should be supported by appropriate policies reoriented from time to time depending upon the market conditions. Not much thrust have been given on the development of the markets and towards improving marketing efficiency per se. The need of the hour is to develop wider perspective from marketing angle in terms of product, price, promotion and physical distribution with supportive factors such as market research and communication. Policies should follow market rather than markets follow policies. The observation that 85 per cent of catch is channelled to the internal marketing system and the rest exports should be restructured to give balanced importance. Cooperative marketing should be strengthened since hardly 5 per cent of the fish in the internal marketing system is currently marketed by cooperatives and the rest is through private marketing agencies and traders. Thrust should be given for promoting value added products and support price for commercially important varieties. Identifying and cataloguing of pharmaceutically important marine products and utilisation of idle capacity of processing plants for internal marketing are viable options.

Community based conservation strategies including awareness on responsible fisheries

The information from various segments reveals that the marine fisheries in India is currently undergoing through a phase of socio-economic cum ecological turbulence. A versatile study on responsible fisheries observes that the major factor that endangers its sustainable utilization is the open access nature of marine resources and the veritable lack of an

Table 5: Percentage share of fishermen in consumers' rupee for different varieties of fish (1989-90 to 2003)

Name of Fish	1989-90 (%)	1996-97 (%)	2003 (%)
Seer Fishes	63	68	75
Pomfrets	62	60	65
Mackerel	54	50	72
Ribbon fishes	41	48	53
Tunnies	55	45	63
Catfishes	49	56	59
Barracudas	53	40	66
Silverbellies	41	30	45
Lizard fishes	42	35	56
Goat fishes	37	57	59
Rays	39	47	58
Whitebait	41	40	61
Threadfins	46	42	57

Source: SEETTD, CMFRI

community essentially entails the following points. It is essential to inculcate awareness on the need to undertake all fisheries-related activities on a responsible manner. Since the code is voluntary in nature, it is only through concerted and continuous communication or extension interventions that we can bring about desirable cognitive changes among the varied and multiple resource users in the fisheries sector so that they would follow responsible practices as a moral obligation (Modayil, 2004).

HRD for research and development personnel

Several organisations are engaged in marine fisheries R&D, but for various reasons, data exchange and use for a common national cause is not effective enough. The National Marine Living Resource Data Centre (NMLRDC) functioning in the CMFRI is consolidating data of the last more than five decades on various aspects of marine fisheries from various central and state agencies. The quality of this database needs to be constantly upgraded and the results of analyses brought out regularly. It is highly commendable that CMFRI has taken the effort to bring out comprehensive Census Report of marine fisheries sector, which is now in the concluding stage of compilation. The complexities of tropical marine fish stocks and fisheries necessitate specially trained manpower to carry out the various R&D and commercial tasks of the capture fisheries and mariculture. Some Fisheries research institutes under the ICAR, Fisheries colleges and many academic universities are conducting masters and doctoral programmes in various disciplines of fisheries science including mariculture since the late seventies.

The Human Resource employed in research and development in fisheries sector needs to be updated with the latest information and new technologies in the field, which essentially requires better information network and training programmes designed for the purpose. A balanced curriculum strategy giving emphasis to both applied and basic research is highly required in this dynamic world. Training of Indian scientists in the sophisticated laboratories in USA, Japan, UK and other countries in relevant disciplines requires priority considerations.

Crisis and disaster management

Though natural disasters and its mitigation is a presumed agenda of development planners in India, it was only recently that it got such an importance especially in the coastal regions, with the havoc showered by tsunami. The tsunami, which hit on December 26, 2004, swept the coasts of South East Asian countries, seriously affecting Indonesia, Sri Lanka and India. The surge of the ocean along the coastal belt ravaged many villages creating huge casualties, damages, distress and despair for millions of people. Coastal fishing communities living on the edge of the sea have largely borne the brunt of this catastrophe. The livelihoods of these people are at stake as they have lost everything and hence needs to be re-launched from a virtual zero-base. They lack capital resources, assets and capabilities to quickly rebuild their lives. Though tsunami has not came under the purview of the unique disaster management system in India (as it has never been envisaged and earmarked in our map of areas prone to various calamities), the crisis and disaster management mechanism from the highest level to the grassroots level is fully

geared up to face the critical situation. The short-run measures of restoration include, provisions for drinking water, temporary shelter, sanitation, health, counselling for remedying depression and fear psychosis, revival of livelihoods, supply and repair of fishing implements and ecological restoration and economic rehabilitation within the framework of CRZ, development and dissemination of knowledge on natural calamities, its mitigation and management. Funds and other resources, which had flown from public and private sectors for rebuilding the ravaged coastal sector, had been utilised to create an alternative development paradigm, promoting responsible fishing and aquaculture, aiming at comprehensive and sustainable coastal zone management with maximum equity. However, there are lot of conflicts in redistribution pattern of tsunami relief funds, especially in states like Kerala.

The long-run measures are the construction of sea walls and dykes, provision of housing sites beyond the coastal zone, community participation for the management of marine bio-sphere, raising artificial coral reefs, planting mangroves and other saline resistant tree species for the location specific development of coastal bio-villages and fishery estates. The super cyclone of Orissa and the present tsunami has raised the awareness level of people regarding the need for alternative disaster management practices. It has been proved that the impact of this tsunami (2004) was very less pronounced in those coastal areas where there were adequate green belts comprising mangroves (Pitchavaram and Muthupet) and casurina trees (in Naluvedhapathi coastal village near Vedaranyam). Crisis and disaster management assumed priority agenda of the policy makers, were not that relevant to the coastal regions until the occurrence of tsunami of 2004. The disastrous havoc has thrown light into the need for developing a comprehensive strategy for the coastal area to face disasters in future. Adequate extension programmes utilizing the network of rural information centres through private-public partnership would equip the people to face such type of unforeseen natural calamities in the future. A comprehensive analysis of all the possible impacts of such a great disaster on different spheres of life (social, economical, occupational, environmental and related) needs to be done to formulate suitable disaster management preparedness programmes.

Development of infrastructure and marine fisheries information system

Infrastructure development contributes substantially to the growth of marine fishing and growth of its ancillary sectors. The physical infrastructure in fisheries comprises 2244 landing centres (otherwise termed as primary markets) six major fishery harbours and 28 minor harbours. Among these landing centres only a few have well-developed landing and berthing facilities. This acts as an impediment since a lot of wastage occurs in handling the catches at the landing centres. The fishery infrastructure for handling and processing includes freezing plants, canning plants, ice plants, fishmeal plants, pre-processing centres (peeling sheds) and cold storage. The development of fishery infrastructure is vital for improving the quality of fish sold at domestic and export markets. The number of freezing plants increased from 264 to 372, number of

ice-making plants increased from 131 to 148 and that of registered peeling sheds from 83 to 900 during 1977-1996 periods. The increase in cold storage facilities and thrust for preservation and quick transportation of fish improved our distribution and marketing system.

Earlier marine fishing was closely confined to the coastal and adjoining regions. By the mid of 1990s, it has been observed that about 50 per cent of the fish is consumed fresh in and around producing centres, 43 per cent in demand centres located up to a distance of 200 km from the coast and 7 per cent goes to the centres located beyond 200 km in our internal marketing system (Sathiadhas, et.al., 1997). The reluctance of the consumers towards iced-fish has also changed. The extent of spoilage of fish at landing centres as well as various points of distribution channel has been considerably reduced due to the intensive use of ice, technological improvements in processing, improved transportation facilities, targeted awareness campaign measures by state and central government agencies etc. The marine products of India have attracted many new customers in foreign markets, which ultimately become advantageous for the fishing community. 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.

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. Growth of fishery sector essentially coupled with development of infrastructure facilities. The growth of marketing communication also has enunciated development of the sector fetching better prices to the producers. Also coastal zone management is also based on information gathering and dissemination, which forms the basis of the strategies developed. Region-wise Geographical Information System of the coastal agro-climatic zones for coastal zone management and development should be prepared in consultation with experts from capture and culture fisheries. Periodic dissemination of information on prevailing prices of commercially important varieties of fish in different markets will be much useful to fishermen, traders and consumers. Adequate fishery infrastructure like freezing/ice plants, cold storage units may be established in the marketing centres which will help to store excess catch during the glut and sell it for a good price later.

Comprehensive approach for coastal zone development

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 18.04.1996. The CRZ forms only part of the agro-climatic zone of India in the geographical classification. 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. Both public and private investment strategies may be worked out by integrating development aspects with 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.

Adherence and compliance of CRZ notification will ensure the protection of the degrading environment and depleting bio diversity, which falls under the auspicious of the concerned maritime states. In addition to motorisation, withdrawal of substantial labour force from the inshore fisheries is highly advisable for optimising production without affecting sustainable development. Formulate suitable programmes for their redeployment and rehabilitation under the overall framework of the integrated coastal zone management within the coastal agro ecosystem. Delineation of environmentally rich regions and preserve them through declaration of protected areas, establishment of marine parks, biosphere reserves and national sanctuaries.

Conclusion

The strategies or development programmes to face various difficult situations ultimately for the general welfare of multiple stakeholders in fisheries sector should bear a participatory co-management approach. Since the sector thrives significantly on the natural ecosystem is very dynamic and hence policies and strategies requires flexibility. Alterations and evolutions of policies depend upon the developments in the national and international scenario. In terms of production and marketing, uncertainty is comparatively high in marine fisheries production. Hence continuous monitoring of production, supply and demand is a pre-requisite for evolving appropriate policy decisions and suitable strategies to overcome the problems in marine fisheries sector.

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