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Marine Fisheries Management in India : Policy Initiatives

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Introduction

Fishing has been considered as a primary livelihood option since time immemorial, for the occupants of the coastal belt in India, stretching along 8129 kms. 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 per cent. About 12.2 lakh fisherfolk operate diverse types of craft-gear combinations with regional and seasonal variations all along the Indian coastline. The secondary sector provides employment to more than 15 lakh people and another one lakh people is employed in the tertiary sector.

Increasing fishing pressure has led to over exploitation of inshore resources - out of 47 commercially important species 30 per cent have been over exploited and 55 per cent have reached an optimum level. 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 per cent of coastal fisherfolk is living Below Poverty Line (BPL) with a monthly per capita income of 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 per cent 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 (that is the 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 of2004 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 as shown in Table 1.

Table 13.1 Growth rate of marine fishing fleets in India
(1961-62 to 2003-04)

Year	Sector							
	Non-mechanised		Motorised		Mechanised		Total	
	Number	Growth Rate (%)	Number	Growth Rate (%)	Number	Growth Rate (%)	Number	Growth Rate (%t)
1961-62	90424	---	---	---	---	---	90424	---
1973-77	106480	18	---	---	8086	---	---	---
1980	1,37,000	29	0	0	19,013	135	1,56,013	73
1998	1,60,000	17	32,000	0	47,000	147	2,39,000	53
2003	76,596	-52	50,922	59	49,070	4	1,76,588	-26
2005	1,04,270	36	75,591	136	58,911	25	2,38,772	35
2010	50,618	-51	71,313	-6.0	72,559	23	1,94,490	-19

There is a definite trend of decline in the number of non-mechanised boats in recent years. As non-mechanised fleets are decreasing, there is a clear increase in motorized and mechanized boats due to their better technical efficiency and comparative economic advantage. In mechanized sector itself, 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. Mechanised crafts displayed a major boom during 1980s and 1990s. The growth rates were 135 and 147 per cents respectively in 1980 and 1997, due to diversification and extended area of operation.

While mechanized trawlers and gillnetters are common all over Indian coast, dolnetters are popular in Gujarat and Maharashtra coasts, purseseines in Goa, Karnataka and Kerala coasts, pair trawling in Tamil Nadu and sona boats in Orissa coasts, depending on the regional and seasonal abundance of resources. When the technical efficiency of a particular gear is better than the other, the lesser efficient gears gradually disappear from the operation (Sathiadhas, 1998).

Sectoral Capital Investment and Fishing Intensity: There are many fishing crafts, which are older up to 20 years, operating along the Indian coasts. The gross investment ranges from about Rs.5, 000 for a small non-mechanised catamaran unit to Rs.35 lakh for a trawler in the small-scale fisheries sector. There is drastic structural change in fishing fleets and capital

investment in mechanised, motorised and non-mechanised sector of marine fisheries in 2003 (Table 2). The fishing fleets as well as capital investment witnessed significant growth rates in mechanised and motorised sectors. 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.

Table 13.2 Estimated capital investment inCrafts and Gears (1997-98 & 2003-04)

Particulars	1997-98	2004-05	2008-09	2009-10
a) Mechanized sector				
Trawlers	1879	8289	9751	4951
Purse-seiners	134	189	222	171
Gillnetters	255	725	853	5694
Dolnetters	49	258	304	2068
Others	72	263	309	746
Sub total	2388	9724	11439	13630
per cent of mechanised sector to total investment	58	85.84	85.41	89.89
b) Motorised sector				
Dugout canoes	31	13	16	18
Catamarans	48	89	112	120
Plank-built boats	188	455	570	618
Others	188	452	567	614
Sub total	456	1009	1265	1370
per cent of motorised sector				
Total investment	11.08	8.91	9.45	9.04
c) Non-mechanised				
Dugout canoes	218	46	53	22
Catamarans	236	141	163	55
Plank Built Boats	420	396	458	39
Others	49	12	14	47
Sub total	923	595	688	163
per cent of Non-mechanised				
sector to total investment	22.42	5.25	5.14	1.08
Deep sea fishing				
vessels	350	N.A.	N.A.	
per cent of to Deep sea fishing				
vessels to total investment	8.5	N.A.	N.A.	
Total	4117	11328	13392	15163

The estimated gross capital investment on fishing equipments alone works out to Rs.4,117 crore at 1997 price level (Sathiadhas, 1998), in which 58 per cent is in the small scale mechanized sector, 9 per cent in deep-sea vessels, 11 per cent in motorized sector and 22 per cent in non-mechanized sector. It may be noted that out of the total capital investments on fishing equipments, during 2003, 86 per cent is constituted by mechanised sector, 8 and 6 per cents respectively by motorised and non-mechanised sectors.

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 3). 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 13.3 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 the open access marine fisheries, mode of ownership on means of production by fisherfolk greatly influences the occupational pattern and socio-economic status. The type and number of fishing implements owned is the yardstick to measure the economic well being of a fisher household. In India, hardly 13 per cent of the active fishermen in the marine fisheries sector have ownership on craft and gear in 2003 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.

Capital intensive technologies and disguised unemployment: Every 100 kg of fish produced from marine fisheries provide full-time employment for 20 persons in the harvesting sector and another 24 persons in post-harvest sector and one person in the tertiary sector. Earlier studies (Sathiadhas, et.al., 1997) confirmed that altogether 10.2 lakh people are involved in active fishing and 12 lakh people are involved in pre and post-harvest sector of marine fisheries during 1995. 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. Thus 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 4). 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 per cent work in trawl fisheries and the rest 25 per cent in other sectors. In the case of motorized sector, 50 per cent are engaged in ring seine fishery alone. There is a wide disparity in income between those engaged in different sectors. It may be noted that still non-mechanized sector is providing about 30 per cent of the employment in active fishing, yet harvesting hardly 7 per cent of the annual landings. Marginalisation of the indigenous non-motorised sector by the motorized and mechanized sectors frequently creates conflicts among fishers. 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 alternate employment opportunities are very meagre .The poor economic condition coupled with the less availability of finance from the institutional agencies compel them to sustain with less equipped fishing implements which in turn results in diminishing returns. Several studies have highlighted the micro and macro level socio-economic conditions of fishermen in our country (Desai and Baichwal, 1960; Gurtner, 1960; Sen, 1973; Prakasam, 1974; George, 1974; Selvaraj, 1975; Amarasiri Desilva, 1977; Lawson, 1977; Panikkar, 1980; Sathiadhas and Venkitaraman, 1981; Shanbhu Dayal, 1981; Pietersz, 1983; Platteau, 1984; Prasada Rao and Kumar, 1984; Subbarao, 1986; Krishna Srinath, 1987; Sathiadhas and Panikkar, 1988; Korakkandy Ramakrishnan, 1994)

Table13. 4 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 (per cent)	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 (per cent)	17	24	12
Active fishermen	114000	200000	412596
Motorised			
Marine fish production (per cent)	---	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 (per cent)	---	19	12
Active fishermen	---	170000	442581
Non Mechanised			
Marine fish production (per cent)	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 (per cent)	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 (per cent)	34	23	14
Active fishermen	462000	1020000	1220577

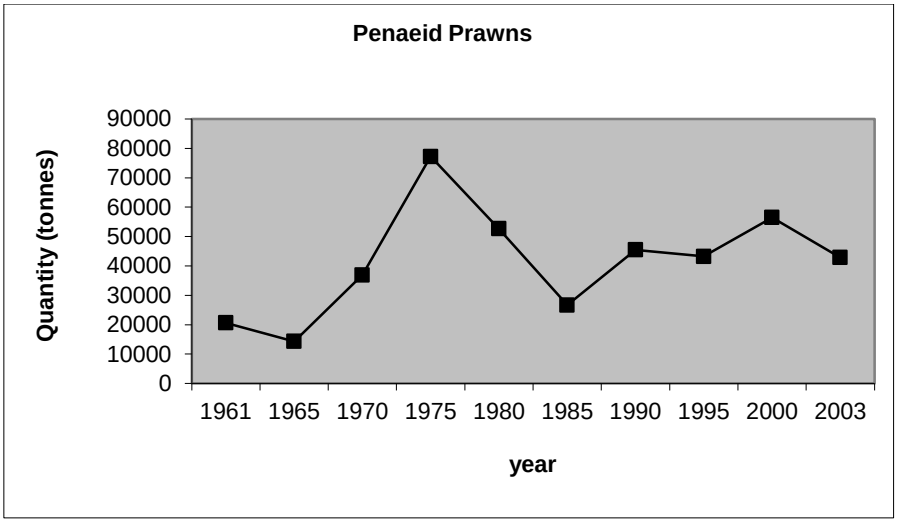
The current scenario of marine fisheries in terms of fishing fleets clearly indicates a situation "too many boats chasing too few fishes". Overcapitalisation in the mechanized sector and under employment in non-mechanised sector is rampant issues, which creates regulatory, and conservatory problems for sustainable production on one hand and socio-economic problems on the other. There are lots of variations among the fishing units in mechanized, motorized, and non-mechanised fishing units. 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. The craft-gear combinations in the non-mechanised sector have undergone rapid changes. Many of the fishing technologies prominent in past years are even not visible in our coastal villages. Shore seine and low cost cotton nets are almost vanished. Bigger catamarans/canoes/plank-built boats with variety of fishing gears alone are capable to withstand the mounting competition from the motorized and mechanized sector. The non-mechanised sector, as a

whole, is sustaining only as a family enterprise. 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 13.5 - Annual Landings of Selected Resources *(tonnes)*

	Ribbon fish	Mackerel	Seer fish	Penaeid prawn	Oil-Sardine	ancho-vies	Lizard-fish	Perches	Carangids		Barra-cuda	Flat fish	Cephal-opods	Elasmo-branchs	Cat Fishes	Goat fishes
1961	4047	20044	2885	20627	166005	6742	5	1316	5311	4503	234	5882	28	8515	3114	226
1965	13826	18048	1513	14327	219170	3567	199	1057	4083	1831	902	7312	174	5969	3565	305
1970	4922	54659	1731	36940	191683	12558	1066	4336	2797	1226	79	10212	86	7490	16380	279
1975	15175	14930	4065	77207	97183	13070	11294	14741	7539	5845	396	6932	3342	10292	32603	23
1980	12937	18474	3763	52633	69667	10013	7080	17814	4760	10611	330	4394	4244	6803	13936	1
1985	25146	18115	8459	26685	79237	38045	5695	30710	12899	10009	921	11332	8308	6013	5184	100
1990	9751	78335	5372	45483	179276	29219	11469	67356	69068	32860	3842	15427	24206	6968	2739	6919
1995	4641	78515	5910	43224	13328	41406	12581	47620	102762	11088	4677	12385	43472	4109	308	174
2000	19264	33854	4998	56462	241411	25643	7779	50819	29368	16763	2996	16769	30627	2832	103	63
2003	15107	35026	8554	42862	264372	24644	10609	34215	37423	23325	4413	21692	27277	4856	261	1

Source: Central Marine Fisheries Research Institute, Cochin-18


Penaeid Prawns
Quantity (tonnes)
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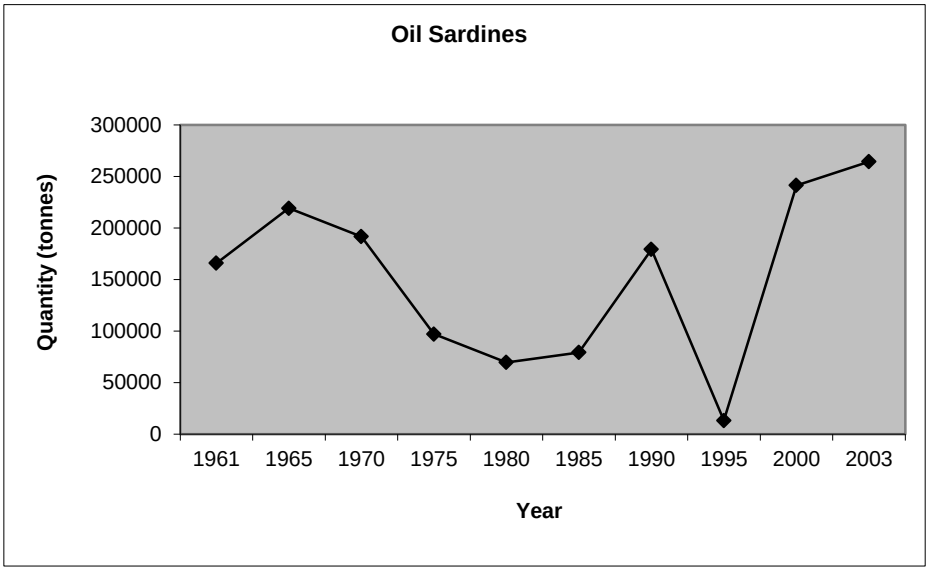
80000
70000
60000
50000
40000
30000
20000
10000
0
1961 1965 1970 1975 1980 1985 1990 1995 2000 2003
year


Oil Sardines
Quantity (tonnes)
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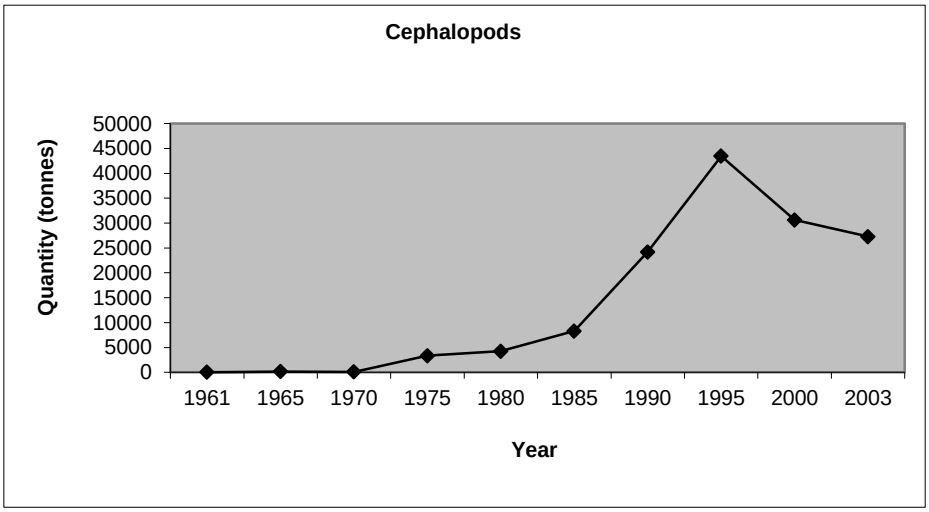
250000
200000
150000
100000
50000
0
1961 1965 1970 1975 1980 1985 1990 1995 2000 2003
Year


Cephalopods
Quantity (tonnes)
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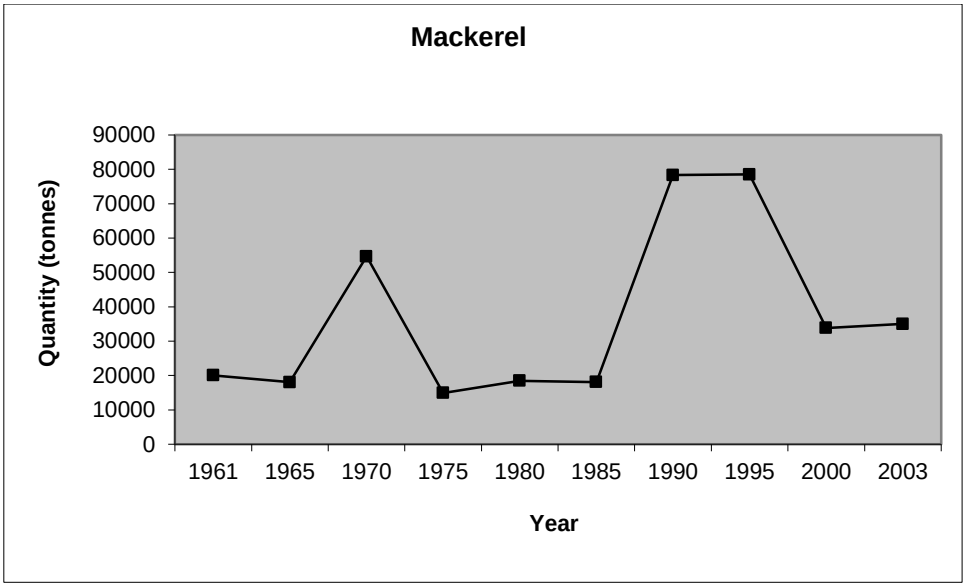
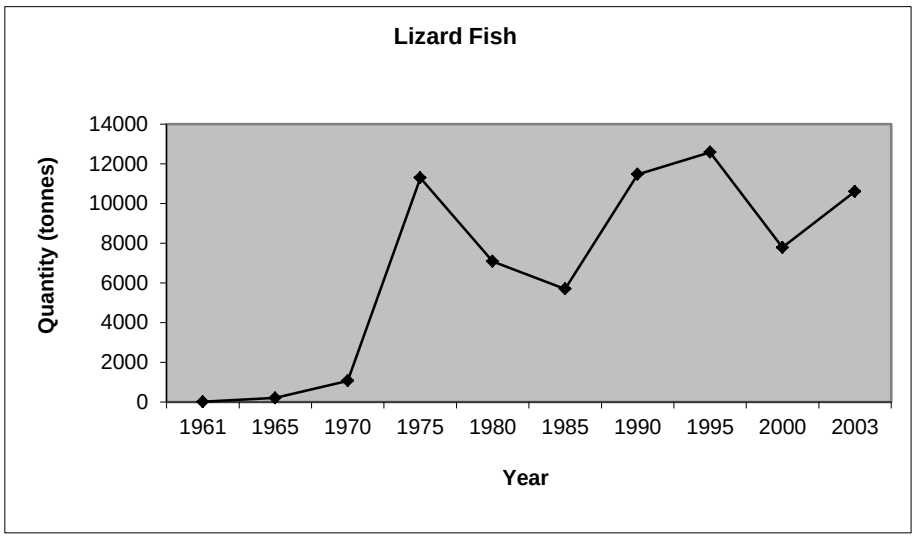
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1961 1965 1970 1975 1980 1985 1990 1995 2000 2003
Year





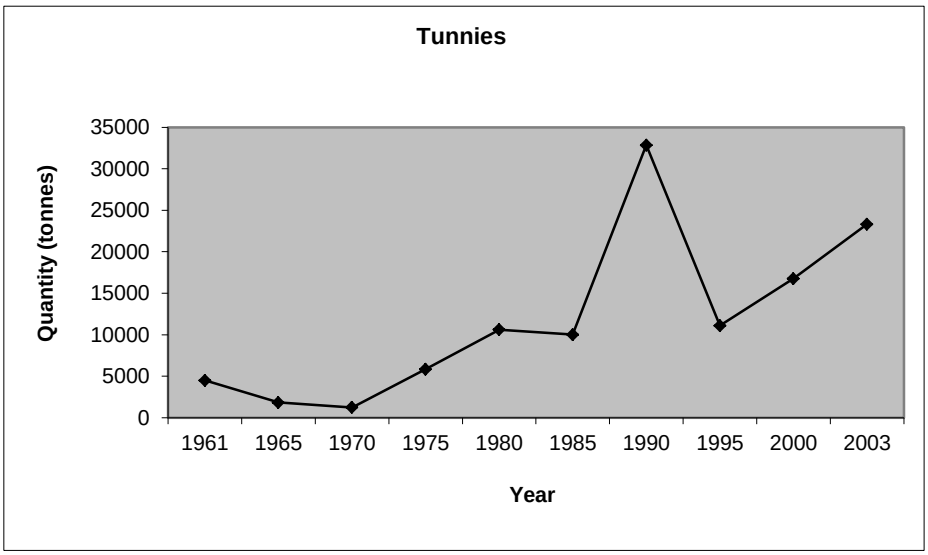


Figure 13.1 Catch trends of selected varieties of fish

The analysis of species-wise catch composition during the last four decades clearly indicates that these technological changes had affected some of the marine resources leading to their depletion. The catfish fishery along the Kerala coast is the best example for the indiscriminate fishing by the mechanised sector. The average annual catch of catfishes in 1961 was 3114 t, which rose to 32603 t in 1975 owing to the large-scale exploitation by the mechanised trawlers and purse seiners during the intensive mechanization period. The annual catch recorded in 2003 was only 261 t. One of the obvious reasons for the decline of this particular species was the overfishing of brooders. The harvest of catfishes was at its peak mostly during September-October period when the species congregated the coastal waters for breeding. During the period 1979-86, more than 50 per cent of the catch consisted of gestating males, each fish carrying about 50 eggs/embryos. This large-scale destruction took place over a period of two months, September and October. The landings of elasmobranch resources were the highest in 1970s (10292 tonnes). This might be proportionate to the intensive operation of mechanised trawlers, which resulted in the reduction of its landings in subsequent years. In the case of goatfishes, the maximum exploitation took place in 1990 (6919 tonnes), but later the species has almost disappeared from the landings by 2003, as was experienced during 1970s. If we assume a cyclic production pattern for catfish, the next turn up would happen after 30 years.

Harvesting strategies for deep-sea and oceanic resources

The 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 their 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.

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 sea farming, 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.

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. 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 2000-2001, India's seafood exports earnings have crossed Rs.6400 crores. 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.

Table 13.6 Export growth of marine products from India (1995-96 to 2010-2011)

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
2010-11	812456	12541.25	154.36

The Marine Products Export Development Authority has listed about 65 value added products, suitable both for export and domestic markets. 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 countries. In India too the market for value added fish products is expanding. The introduction of microwave oven also helped to pick up markets for value added products (Garthwaite, 1997). Today the affluent society is gradually shifting towards value added products. Such a change is due to the attitudinal change towards fast-food concepts, due to the increasing preference for ovenable packets over deep fry 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.

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 *et.al.,* 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.

Ecolabelling

Ecolabelling is a voluntary method of environmental performance certification and labelling that is precise around the world. An "ecolabel" is a label which identifies overall environmental preference of a product or service within a specific product / service category based on life cycle considerations. There are many different voluntary (and mandatory) environmental performance labels and declarations. The International Organization for Standardization (ISO) has identified three broad categories of Voluntary

Environmental Performance Labels, with Ecolabelling fitting under the Type-I designation. Type-I clarified environmental labels as a voluntary, multiple criteria based, third party programme that awards a license that authorises the use of environmental labels on products indicating overall environmental preferability of a product within a particular product category based on life cycle considerations. Type II is informative environmental self-declaration claims and Type III is voluntary programmes that provide quantified environmental data of a product, under pre-set categories of parameters set by a qualified third party and based on life cycle assessment, and verified by that or another qualified third party.

The idea that Ecolabelling 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. The usefulness of Ecolabelling in creating a market-based incentive for environment-friendly production was recognised about two decades ago when the first ecolabel products were put on sale in Germany in the late 1970s. Since then, and especially during the 1990s, Ecolabelling schemes have been developed in most industrialised countries for a wide range of products and sectors. In recent years, they have been gaining importance in a number of developing countries, including India, Brazil, Indonesia and Thailand. The concept was globally endorsed in 1992 at UNCED, where governments agreed to "encourage expansion of environmental labelling and other environmentally related product information programmes designed to assist consumers to make informed choices".

Despite the international community's general acceptance of product ecolabelling, the approach has caused controversy in several international arenas, including WTO Sub-Committee on Trade and Environment. General concerns about Ecolabelling 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, ecolabelling 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 ecolabels 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 ecolabelling 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 ecolabels in fisheries and aquaculture.

Subsidies

Fisheries subsidies are defined as "government actions or inactions that are specific to the fisheries industry and that modify – by increasing or decreasing – the potential profits by the industry in the short-, medium- or long-term". 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. The SCM defines subsidies as, *inter alia*:

- Specific financial transfers from state to the industry (including implied transfers such as loan guarantees)
- Conversely, the state foregoing normally collectable revenue (e.g. tax free fuel)
- Provision of services or investments to industry that would not "normally" be state provided. E.g. indirect subsidies such as state cold storage facilities or specifically targeted research programmes
- State purchases of industry outputs other than on commercial terms
- All forms of state income or price support (e.g. production subsidies designed to maintain prices, reference prices etc.).

In addition subsidies are categorised in relation to the rights of members to make complaint and take action (countervailing measures) with respect to alleged trade-distorting subsidies undertaken by other members. 3 In this respect there are two categories of subsidy:

- Prohibited: including export enhancing subsidies or subsidies giving preference to domestic producers or grants tied to the use of domestically produced goods.
- Actionable: a subsidy that may be challenged on the basis of causing 'adverse effects' to the interests of other WTO members and if the subsidy is specific to an enterprise or group of enterprises or industries (generally available subsidies are permitted).

Boxes

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). In agriculture, things are, as usual, more complicated. 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).

In order to qualify, green box subsidies must not distort trade, or at most cause minimal distortion. They have to be government-funded (not by charging consumers higher prices) and must not involve price support. They tend to be programmes that are not targeted at particular products, and include direct income supports for farmers that are not related to (are "decoupled" from) current production levels or prices. They also include environmental protection and regional development programmes. "Green box" subsidies are therefore 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 per cent of agricultural production for developed countries, 10 per cent 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.
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 12) 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.

Table 13.7 – Percentage share of fishermen in consumers' rupee for different varieties of fish (1989-90 to 2003)

Name of Fish	1989-90 (per cent)	1996-97 (per cent)	2003 (per cent)
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 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 enforceable property rights regime or unanimously agreeable regulatory mechanisms (Ramchandran, 2004). There are many activities, which adversely affects the sustainability of marine resources including shallow water mining, use of improper crafts, ghost fishing, destruction of mangrove forests, etc. Development processes such as urbanisation, industrial pollution and eutrophication of estuaries have also jeopardised the fragile ecological dynamics of the coastal area(Clark, 1990.,Weitzman, 1992., Johnson, 1993.,

Munasinghe, 1994., F. di. Castri and Younes,1996., McNeely, 1996., Dominic and Pearce, 1998., Escobar, 1998.,Gopal, 2001.

The concept of Responsible Fisheries advocated by FAO through its Code of Conduct for Responsible Fisheries is an epitome among global efforts for realising the coveted goal of sustainable utilization of our marine resources. The Code is a landmark in marine development thinking as it represents the consensus achieved by more than 150 nations across the world on the directions we should follow in order to avoid resource depletion due to irrational utilisation behaviour pattern shown by various stakeholders.

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.

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 destructive earthquake (8.9 on Richter scale) occurred under the sea off Sumatra Island near Indonesia and the consequent killer waves that emerged in Indian Ocean affected most of the bordering coastal States and Islands of South East Asia. 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. A few minutes of killer waves with this magnitude and the wreckages it made has far reaching implications on the socio-economics and livelihoods of coastal population along the affected regions of India. The ecosystems that supported their livelihood particularly coral reefs, mangroves, coastal fish ponds, inshore fishing regions and landing centres have been substantially affected through the force of the waves and the subsequent run-off of mud, sediments and debris. This has awakened mankind towards the need for generating sustainable alternatives of environmental, ecological, social and economic and communication models to cope up with such oceanic repulsions and natural disasters in the future.

In India, due to tsunami tidal waves, Andaman and Nicobar Islands and coastal States of Tamil Nadu, Kerala and Andhra Pradesh has witnessed loss of life of 15,545

(official toll of dead or missing) as reported during the first week after the tsunami and complete displacement of thousands of people, making them refugees in their own land without having anything of their own. Among the States, Tamil Nadu has accounted for most of the human casualties with the loss of 7814 people and serious socio-economic crisis and catastrophic situation in several villages of Chennai, Cuddalore, Nagapattinam and Kanyakumari districts. Fishing crafts, gears and household belongings were washed off or damaged beyond recovery.

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. 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 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.

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).

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 has centres have the 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.

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. 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 spring tide.

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. 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.

Conclusion and Recommendations

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.

Suitable strategies to overcome the problems in marine fisheries sector need to be developed on the basis of the following broad perspectives. The overcapitalisation of fishing fleets and the consequent issues of regulatory, conservatory and socio economic problems can be solved by formulating adequate mechanisms in the following direction.

- Complement the gradual phasing out of traditionally functioning boats with motorisation on collective basis
- Promotion of "co-operative fishing" instead of "competitive fishing" if advisable for optimum exploitation and introducing regulations
- Specific coastal zone development strategies may be worked out towards the ultimate welfare of the coastal community
- Alternative avocations other than capture fisheries for the fisherfolk, especially in agri-horticulture and livestock management
- Integration of coconut development in the coastal region with fisheries
- Alternative avocations should plan in such a way as to utilise the idle (disguised) labour in capture fisheries

Economic loss due to discards and juvenile fish catch can cause serious environmental threats that could be reduced by implementing the following strategies

- Mesh-size regulations to avoid juvenile catch
- Appropriate utilisation strategies should be developed with respect to 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

The disturbing trends in fish production pattern of Kerala resulting in the depletion of certain fishery resources warrants the adoption of following strategies

- The present scenario of disturbing production trends is attributed to intensified targeted fishing and this may be regulated
- Quota fixing in terms of number of fishing days according to the catch composition and volume of catch of fishing fleets
- Marine fishes like sharks, sea horses and sponges have immense pharmaceutical value, alike species should be catalogued and patent the pharmaceutically important products development from them under the IPR regime.

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.

Issues related to apprehensions that coastal mariculture would adversely affect the environment are leading retarding 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. The following strategies would serve as milestones in this respect.

- 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.

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. The following steps will be beneficial in this respect

- Promotion of diversified value added products and 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 concern attracts atmost priority in the present day markets. On the basis of real field level observations, the following aspects could be taken care of for the post-harvest quality assurance of marine resources.

- Fish and shellfish should be preserved properly immediately after catch
- Ice should be prepared from good quality good quality water and used in appropriate proportion
- Handling area and containers should be properly disinfected
- Proper drainage should be provided in markets and landing centres
- Fish should be protected from flies, rodents, insects, birds and animals
- Species-wise sorting should be practiced immediately after the catch. Shrimps should be graded, beheaded, peeled and de-veined as soon as possible
- The quality standards like fixing limits for heavy metals and microbial limits etc should be imposed
- The bivalves as far as possible should be depurated before shucking
- Sun drying of fish in sandy beach should be strictly stopped and moreover good quality salt should be used
- 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

In October 1998, FAO convened a Technical Consultation on the Feasibility of Developing Non-discriminatory Technical Guidelines for Ecolabelling of Products from Marine Capture Fisheries, where a number of principles were identified, which should be observed by ecolabelling schemes. They should:

- Be consistent with Code of Conduct for Responsible Fisheries
- Be voluntary and market-driven

- Be transparent
- Be non-discriminatory, by not creating obstacles to trade and allowing for fair competition
- Establish clear accountability for the promoters of schemes and for the certifying bodies, in conformity with international standards
- Include a reliable auditing and verification process
- Recognise the sovereign rights of states and comply with all relevant laws and regulations
- Ensure equivalence of standards among countries
- Be based on the best scientific evidence
- Be practical, viable and verifiable
- Ensure that labels communicate truthful information
- Provide for clarity

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 the following points are highly relevant in this context

- 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).

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. The following guidelines will be helpful in developing fish marketing system in India

- 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 marketed by cooperatives and the rest is through private marketing agencies and traders.
- Thrust for value added products
- Support price for commercially important varieties
- Identifying and cataloguing of pharmaceutically important marine products

- Utilisation of idle capacity of processing plans for internal marketing

Conservation of marine fisheries resources to achieve the goal of sustainable production with active participation of the 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 concerned 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).

Crisis and disaster management, the 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. That it requires wide ranging strategies in terms of preventive, preparedness, relief and rehabilitation etc., some points which require to be mentioned are

- 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.

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.

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. This needs to be implemented with high priority essentially incorporating the following suggestions

- 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.

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