

# **ISSUES CONCERNING MARINE FISHERIES AND FISHERIES MANAGEMENT IN INDIA**

**V.S. Somvanshi**  
**Director General, Fishery Survey of India, Mumbai**

## **INTRODUCTION**

India's marine fish harvest annually being 2.46 million tonnes contributes about 35% to the production from the entire Indian Ocean. This is expected from a nation with the dimension of a subcontinent, having a strategic geographical position and tropical climatic conditions with seas at the east (Bay of Bengal) as well as the west (Arabian Sea). The Lakshadweep and Andaman & Nicobar waters also add to a considerable extent to the country's marine fish production.

Of the three major oceans, Atlantic, Pacific and Indian, the latter is still showing a steadily increasing trend in fish production (FAO, 1997). The increase in Indian marine fish production in recent years, as in the case of developed fisheries elsewhere in the world, is associated with differential fishing pressure on different species constituting the catches. This could be mainly attributed to (i) increase in number of fishing craft and their combined fishing effort on the stocks being harvested from the same fishing grounds and (ii) the consequent management issue arising from the situation.

The paper presents various issues concerning marine fisheries and fisheries management in India and underlines the requisite management and conservation measures needed for sustainable fisheries, livelihood and socio-economic development. Earlier reports on monitoring, control and surveillance for marine fisheries (Somvanshi *et al.*, 1999a & b) summarize the system of MCS and related constraints in India.

## **PRESENT SCENARIO**

The average annual marine fish production of India during the period 1988-97 stands at 2.46 million tonnes (MOA, 1997). The maritime State-wise fish landings are given in Table 1. This level of fish production is the result of not only the increase in number of fishing crafts but the enhanced fishing capacities of some of them. However, it would be appropriate to have a glance at the present strength of fishing fleet and its composition (Table 2). The impetus of mechanization of fishing crafts and their improved fishing capacity is evident from the fact that the present day fish landings are predominantly (65%) due to the mechanized sector. Thus the contribution by the non-motorised traditional sector in recent years is reduced to around 9% and that of the motorised sector increased to 26%. Though, there has been substantial improvement in the number of fishing crafts and their enhanced catching capacity, their fishing operation barring a few boats fishing for fish stocks in depths up to 250m, remained confined generally to within 100m depth contours along the mainland coast line and around the islands. Thus the development and enhancement in the fish production have brought in the associated issues such as overcrowding of fishing crafts and over-concentration of their fishing effort in the limited area probably directed to some "cash stocks" e.g. shrimps, lobsters, pomfrets, squids, cuttlefish and Indian mackerel.

**Table 1. Maritime average annual marine fish landings in India by State (1988-1997)**

<b>STATE (from NW to NE)</b>	<b>LANDINGS (‘000 tonnes)</b>
Gujarat	529.1
Karnataka	176.3
Kerala	491.7
Maharashtra	367
Goa	70.8
Lakshadweep	9
Daman & Diu	12.5
Andhra Pradesh	130.4
Orissa	98.2
Tamil Nadu	302.9
West Bengal	124.6
A. & N. Islands	20.2
Pondicherry	32.4
<b>Total</b>	<b>2365.1</b>

**Table 2. Fishing craft in maritime States/UT**

<b>STATE/UT</b>	<b>All traditional crafts (Number)</b>	<b>Motorised traditional Crafts (Number)</b>	<b>Mechanised Boats (Number)</b>	<b>Total (Number)</b>
Gujarat	12 653	4 283	8 365	21 018
Maharashtra	9 988	286	7 930	17 918
Karnataka	13 141	1 189	3 655	16 796
Kerala	40 786	12 913	4 206	44 992
Tamilnadu	32 077	5 340	8 230	40 307
<b>Andhra Pradesh</b>	<b>57 269</b>	<b>3 269</b>	<b>8 911</b>	<b>66 180</b>
Orissa	10 249	2 453	1 665	11 914
West Bengal	4 361	270	1 880	6 241
Lakshadweep	1 078	298	443	1 521
A & N Islands	1 340	160	230	1 570
Pondicherry	6 265	365	553	6 818
Goa	2 000	900	850	2 850
<b>TOTAL</b>	<b>191 207</b>	<b>31 726</b>	<b>46 918</b>	<b>238 125</b>

Source : State/UT as in 1994-95

The major fisheries practised in Indian waters can be classified broadly into (i) species specific fisheries and (ii) multi species fisheries.

**(i) Species-specific fisheries**

These fisheries have many similarities with activities in temperate waters in that they are largely based on single species stocks and employ one or more common types of gear for harvesting them. Under this category of fisheries are those that are directed to the stocks of Indian mackerel (*Rastrelliger kanagurta*), oil sardine (*Sardinella longiceps*) and Bombay duck (*Harpodon nehereus*).

These stocks are harvested in the recent years to the extent of 185.7, 223.8 and 179.7 thousand tonnes respectively. The quantum of landings together of these three stocks over the period of past ten years varied from 440.9 to 652.0 thousand tonnes with an annual average of 484.9 thousand tonnes. The oil sardine and mackerel fisheries have expanded their area of operation seawards and there have been also technological inputs such as purse seining and ring seining. In the case of Bombay duck fishery there have been no such impacts either of area expansion or technology. These stocks have tendencies of fluctuating from year to year responding to the changing oceanographic features (Madhupratap *et al.*, 1994) and possess greater capacity of resilience. The Bombay duck fishery has retained its monolithic characteristic of employing only 'dol net' or 'bag net' for harvesting the stock.

On the contrary, the mackerel and oil sardine fisheries have undergone over the past three decades transitions from shore seine to boat seine, boat seine to purse seine and purse seine to ring seine. These technologies and practices compete with each other towards sharing the same fish stock. Thus at any given time, more than one technology is applied/used for harvesting the same stock. However, the modern technologies are so much accepted and absorbed that operation of the traditional gear "Rampani" or 'shore-seine' is reduced to a rare scene.

In view of the fact that when the gear compete their number increases and the fishermen tend to reduce their mesh size in order to retain the level of their catches high, albeit dominated by the smaller fish than the marketable size. Thus, the situation brings forth the issues of excess number of crafts, multiple type of gear and their ever decreasing mesh sizes.

**(ii) Multi-species fisheries**

Trawl fisheries, which were introduced, popularized and established during the previous century in Indian waters for effective catching of multi-species demersal fish stocks have been practiced all along the Indian coast and to limited extent in Andaman waters. A large complex of typical tropical species of different sizes and shapes are caught using this technology, prominent among them being threadfin breems (*Nemipterus* spp), lizard fish (*Saurida tumbil*), trevallies (*Caranx* spp), perches (*Epinephalus* spp, *Lutjanus* spp, *Lethrinus* spp, etc), elasmobranchs, consisting of sharks, rays & skates (*Scoliodon* spp., *Carcharhinus* spp. *Aetobatis* spp., *Rhynchobatus* spp., *Rhinobatus*, spp.) and shrimps (*Penaeus indicus*, *P. monodon*, *Metapenaeus* spp., *Solenocera* spp, *Parapenaeopsis* spp.).

Most of the mechanized boats (<20m OAL) conduct stern trawling directed to harvest fin-fishes as well as shrimps. The larger vessels practice out-rigger trawling for shrimps ("the cash stock"). Of late, these shrimp trawlers are re-deployed from the east coast to the west coast for diversified fishing operation of stern trawling for "other cash stocks" viz. deep-sea shrimps, deep-sea lobsters and squids and cuttlefish. With the increased familiarity with the technology and the fishing grounds, various types of trawling technologies have attracted a large number of crafts in each of the fleets operating in the fishery. Thus, this fishery could well be described as "multi-species, multi-fleet, multi-gear and multi-tech fishery". The

fishery dominated by stern trawling and out-rigger trawling by the larger vessels has witnessed in past few years application of modern electronic technologies such as GPS, echosounders, walky-talkies and mobile telephones even by the small mechanised crafts.

Hence the fishery has been exerting considerable fishing pressure on the demersal stocks in the known fishing grounds. The inter-fleet and intra-fleet competition, in order to maximize their catches of the commonly targeted species, has resulted in the reduction of the mesh size of the trawls employed by them. Thus the situation has brought in a host of issues viz. number of fleets and the constituent crafts in each fleet, the mesh size of trawls used and zone of the operation of these crafts.

#### **FLEETS AND CRAFTS**

The fishing boats are generally categorized into the fleets of (i) traditional crafts of smaller size (<12m OAL) employed for passive fishing in coastal waters, a large number of which are encouraged under the Five Year Plan schemes to install outboard motors and (ii) the larger mechanized boats (12 to 28m OAL) undertaking predominantly active fishing activity, commonly trawling. The number of crafts in these fleets in the maritime States and Union Territories are furnished in Table 2.

#### **THE POTENTIAL OF FISH STOCKS**

The three broadly grouped components of the fish stocks, (a) coastal pelagics, (b) demersals and (c) oceanics, as explored and assessed in the Indian EEZ, have together a maximum sustainable yield of 3.92 million tonnes. The component-wise estimates and their depth-wise distribution (Sudarsan, *et al.*, 1990) are provided in Table 3.

**Table 3 Estimates of potential by area (million tonnes)**

Region	West coast	East coast	Lakshadweep	Andaman& Nicobar	Total Resource
Demersal	1 251	0.656	0.004*	0.022	1 933
Pelagic	1 106	0.434	0.063	0.139	1 742
Oceanic					0.246
Total	2.357	1 090	0.063	0.161	3 921

\* Demersal resources from 300-500 m depth zone (except from west coast Lat.8° – 10° N)

#### **AREAS OF COMPETENCE IN CONTEXT OF FISHERIES**

In India, as per the constitutional provisions, the maritime States, Union Territories and the island groups have jurisdiction over the water spread area within the territorial waters along their coastline, up to 12 nautical miles. Thus the responsibility of fisheries development, monitoring, management and conservation of the fish stocks within the territorial waters rests with the maritime States.

The area of competence for fisheries development, management, monitoring, conservation and surveillance beyond the territorial waters within the Indian EEZ, is that of the Government of India.

## **COLLECTION OF DATA**

The collection of fisheries statistics both from sampling commercial landings and exploratory surveys is carried out by the maritime States and the Government of India. In order to estimate the fish production and fishing effort a stratified random sampling technique with reference to time and space is employed (James and Alagaraja, 1991).

In the case of exploratory surveys which provide " geo-referred " and "time-referred" data on various fish stocks, sampling techniques suitable for the respective stocks are devised viz. two stage stratified random sampling for demersals and systematic and test sampling for the coastal pelagics and oceanic pelagics (FSI, 2000). CMFRI and FSI in their endeavour to collect accurate and precise data respectively on production and abundance indices species-wise continue to refine the sampling techniques used, so as to monitor and estimate the annual fish production and maximum sustainable yields.

## **SATELLITE REMOTE SENSING TECHNOLOGY**

Indian effort in application of satellite remote sensing technology to marine fisheries has yielded significant results. Short term forecasting of coastal fish stock abundance using AVHRR sea surface data (SST) was made operational with positive feedback from the fishermen. The advisories help the fishermen in saving search time at sea and thus fuel. The forecasts, which are generated in the form of potential fishing zone (PFZ) are being further refined to improve reliability by using "chlorophyll a data" in conjunction with SST data. Towards this objective India has launched a devoted ocean satellite IRS-P4 with Ocean Colour Monitor (OCM) on board (NRSA, 1999). Requisite modelling work for composite application of SST and ocean colour information for accurate and reliable forecasting of concentrations of coastal as well as oceanic fish stocks is in progress under the collaboration of SAC, FSI and CMFRI.

The accuracy and reliability of the forecasts using this modern technology could probably be used towards increased, guaranteed fish catch to fishermen, who in turn may cooperate in implementing various management and conservation measures and in following the guidelines given in the FAO Code of Conduct for Responsible Fisheries. Besides, the Indian communication satellites could be effectively be used in the vessel monitoring system (VMS) for monitoring the operation of fishing vessels in the EEZ.

## **LEGISLATIONS**

### ***Global***

Globally fisheries have been attracting increasing concern about the overfishing, excessive fishing effort in certain pockets, changes in composition of fish species, alteration of their habitats, use of multiple fishing gear and variations in the environment/ecology. Though there have been differing scenarios at global, regional and local levels, the world bodies related to the fisheries, have provided guidelines through various laws/conventions/codes for regulating, monitoring, management and conservation of the fish stocks. Some of the important global legal, voluntary and advisory instruments are given below.

1. UN Law of Sea Convention 1982 (came into effect 16-11-1994),
2. Agenda 21 of Rio Earth Summit,

3. Convention on Highly Migratory Fish Stocks and Straddling Fish Stocks,
4. Code of Conduct for Responsible Fisheries.

### ***National***

Early fishery laws in India, starting with the Indian Fisheries Act, 1987 were typically revenue-oriented and aimed at collecting revenue from shell fisheries, pearl fisheries etc. The Government of India has enacted two important national legislations in recent years:

1. The Territorial Waters, The Contiguous Zone, the Continental Shelf, the EEZ and other Maritime Zones Act (1976), besides extending sovereign rights of the country to explore, exploit and manage living and non-living resources of the seas around the country up to the EEZ limits, also marks the beginning of the fisheries legislation aimed at exploration, exploitation, conservation and management of marine resources.
2. The Maritime Zones of India (Regulation of Fishing by Foreign Fishing Vessels) Act, 1981 was the first law to regulate fishing by foreign fishing vessels in India's EEZ, although chartering of foreign fishing vessels was permitted as early as 1976. The Act also aims at preventing poaching of fishery resources by foreign fishing vessels. Under the Act, the detailed Rules were framed in 1982, which forbid fishing by foreign vessels for shrimp and other finfish resources in the coastal areas, where there were already conflicts among different sectors of our own fishing industry for which all maritime States have either enacted or are in the process of enacting legislation. The conventional areas of operation of the Indian owned fishing fleet, including traditional boats, mechanized boats and offshore shrimping vessels, were made out of bounds for foreign fishing vessels.

Subsequently the rules were modified incorporating the following restrictions. The chartered vessels shall fish:

- (A) Beyond 24 nautical miles from the shore on the west coast as a general rule

(1) Off the Maharashtra – Gujarat coast line

No fishing by foreign vessels shall be allowed between the coast line and the line joining the following points:

- (i) 22° 54'N – 67° 33' E
- (ii) 21° 33'N - 68° 56' E
- (iii) 19° 02'N – 72° E
- (iv) 18° 33'N – 72° E
- (v) 18° N – 72° 31' E

(2) Off the Kerala – Tamil Nadu coast line

No fishing by foreign vessels shall be allowed in the areas defined by the following points:

- (i) 7° 45'N – 77° E
- (ii) 7° 45'N – 78° E
- (iii) 7° 30'N – 78° E
- (iv) 7° 30'N - 77° E

(B) Beyond 12 nautical miles from the shore on the east coast as a general rule subject to the following restrictions viz.

(1) Fishing may be done beyond 24 nautical miles between the Nizampatnam (Andhra Pradesh) and the Paradeep Port (Orissa).

(2) No fishing shall be allowed between the area covered by the coast line and the line joining the following points in the north of Chilka (Orissa) and up to Bangladesh boundary:

- (i) 19° 22'N – 85° 30'E
- (ii) 20° N – 86° 56' E
- (iii) 20° 42'N – 88° E
- (iv) 21° 08'N – 89° 07'E
- (v) 21° 16'N – 89° 14'E.

### ***Maritime States***

A country of dimensions like India, having several coastal states and archipelagos, is expected to have legislation at their level for fisheries regulation, management and conservation. The Marine Fisheries Regulation Acts (MFRAs) of each of the coastal states and archipelagos stem from a model bill circulated by the Government of India. These MFRAs and rules were adopted by the respective Legislative Assemblies of the States and Parliament in the case of Union Territories including the Archipelagos of Lakshadweep and Andaman & Nicobar during the period 1980 to 1995. Through the model bill the Government of India had been specifically guiding the maritime States in the following major issues.

1. Fishing in any specified area by the fishing vessels.
2. The number of fishing vessels used for fishing in any specified area may be specified.
3. Catching in any specified area of certain species of fish and period may be specified.
4. The need to protect the interest of persons engaged in fishing, using traditional fishing crafts.
5. The need to conserve fish and to regulate fishing on a scientific basis and
6. The need to maintain law and order at sea.

According to the above guidelines, the maritime States, except Gujarat, have made the necessary provisions in the Marine Fisheries Regulation Act detailing the registration procedures for the mechanized boats, restrictions in depth and area for operation of various

types of vessels, boats and fishing gear, mesh sizes for specific gear, closed seasons for fishing etc. However, these Acts do not indicate any restrictions in terms of type and number of boats to be deployed along the coasts.

<b>Table 4 Enactment of MFRAs</b>			
<b>State/UT</b>	<b>MFRA implemented</b>	<b>Area exclusively for traditional craft*</b>	<b>Area for mechanised vessels</b>
Gujarat	Under consideration		
Maharashtra	1981	5-10 fathom depth (9-18 m depth)	
Goa	1980	5 km	Beyond 5 km
Karnataka	1980	6 km	Beyond 6 km
Kerala	1980	10 km	Beyond 10 km
Tamil Nadu	1983	3 nautical miles (5.4 km)	Beyond 3 nautical miles
Andhra Pradesh	1993	10 km	Beyond 10 km
Orissa	1982	5 km	(i) up to 15 m OAL beyond 5 km (ii) above 15 m OAL beyond 10 km
West Bengal	1993		
Lakshadweep	2000		

\*Traditional craft can fish any where in the sea. The reservation mentioned implies only that other categories of vessels may not fish in the area reserved for traditional craft.

Table 4 provides an overview of the enactment of MFRAs. The Union Ministry of Agriculture, being the nodal authority for fisheries, had held meetings with the State Fisheries authorities separately on the west and east coasts during 1996-97, where it was agreed unanimously that there will be a uniform closed season for fishing from 10<sup>th</sup> June to 15<sup>th</sup> August (65 days) along the west coast and from 15<sup>th</sup> April to 31<sup>st</sup> May (45 days) along the east coast. These decisions have to be adhered to by the respective State Governments for their strict implementation as they are expected to reduce excess fishing effort on the stocks being harvested, as well as provide a quiet period for the spawning fish populations. It could also help in avoiding the conflicts arising due to differential observances of closed seasons by neighbouring States. The innocent fishermen from various States need to be guided by undertaking awareness drives and emphasizing the importance and benefits of these measures.

The lack of legislation on regulation of fishing by Indian owned fishing vessels has been one of the difficulties in strict compliance in the EEZ beyond the territorial waters. The Government of India imposes concurrent closed periods of fishing by foreign fishing vessels operating under deep-sea fishing schemes. Proposed legislation in respect of Indian vessels will go a long way to remove this lacuna in fisheries management.

## **VESSEL MARKING**

The fishing boats/vessels are registered with the authority identified by the State Governments, as per their requirement under the State's Marine Fisheries Regulation Act. The registration is done at the fishing ports listed in the MFRA and rules there under. Instances of



multiple registrations by authorities such as Marine Products Export Development Authority (MPEDA) besides the port authorities are also known from some States. Some of the MFRAs specify the place of writing the name of the boat and registration number, as well as the size of letters and numbers to be written. However, it is also observed that many boats registered at various ports and States differ in the placement of name and registration number as well as the size of letters and numbers to be written. The abbreviations used along with the registration number of boats have to be also adopted commonly. This inconsistency and variability from boat to boat, port to port of registration and from State to State they belong to, do not conform to FAO guidelines for marking the fishing boats. In order to have effective visibility needed for identification of the violating fishing boats by the monitoring, control and surveillance authorities, it is essential that the FAO (1996) guidelines on marking of vessels are followed and uniformly established among all the vessels irrespective of their port of registration and their home port.

## **MANAGEMENT OF MARINE FISHERIES**

In marine fisheries the size of boats, type of boats do not have uniformity in defining the area in which they are envisaged to operate under the rules and notifications stemming from the MFRAs. There is no colour code with reference to the port, State, type of fishing or area of fishing. Therefore, it is often difficult to discern the fishing activity of these boats either in context of the State that they belong to or the area in which they should fish. Moreover, there is no uniformity in the size or type of boats with reference to the fishery to which they belong and the zone in which they are expected to carry out fishing by the stipulated regulations. In these prevailing circumstances, it is rather difficult to implement effectively the management and regulatory measures and restrict the activities of each of the fishing crafts.

It has been agreed in the Committee of Officers, as per the recommendation of the National level Review Committee that the number of traditional craft should be maintained at the present strength. Even though patrol boats are deployed and the designated officers are undertaking monitoring and regulatory activities out at sea, it is often left to the fishermen as to what gear to use and in which area to fish. This occasionally results into law and order problems out at sea. There could be only a few acceptable examples, such as in Mumbai, where traditionally the fishermen from Gujarat berth their boats and land their fish catches at the new Ferry Wharf and the fishermen from Maharashtra berth their boats and land their fish catches in the Sassoon Dock fishing harbours.

In accordance with the 8th and 9th Five Year Plans, the Union Ministry of Agriculture has extended one time funding assistance to the coastal States in acquiring patrol boats to meet their requirements of fisheries management within the territorial waters. Some of the States have already acquired the patrol boats and they have been able to successfully implement the marine fisheries regulations and the conflicts among the fishermen out at sea are curtailed.

In view of the above facts it is obvious that implementation of various provisions under the MFRAs is difficult and serious efforts need to be put in to improve the situation, besides creating awareness among the fishermen and the operatives.

## **NEED FOR EFFECTIVE IMPLEMENTATION OF MANAGEMENT AND REGULATORY MEASURES**

Having provided information on the status of fisheries management and conservation measures, their implementation and the current level of harvest, it is appropriate to pin-point some of the issues concerning marine fisheries management in territorial waters as well as beyond, within the Indian EEZ, for sustainable fisheries, the livelihood of fishermen and the conservation of fish stocks.

The issue of prime concern in formulating various management and conservation measures should be the distributional boundaries (limits) of the species rather than the State boundaries. The second issue that should govern the management and conservation measures is the minimum size of fish to be caught of a particular species. The latter mentioned criteria should be linked with awareness to be created among consumers for acceptance of fish if it is smaller than the prescribed size. Thirdly, in a given fishery there is a need to determine annual harvestable yields for each stock, a year in advance so as to know as to what extent fishing effort should be expended and how many boats should be deployed with reference to the fishing gear used. On considering this important criteria the next step should be to resolve various issues concerning to effective implementation of the management and regulatory measures.

These issues could be as furnished below.

### ***Zonation***

The maritime States as per their MFRA have specified fishing zones for each category of fishing craft within the territorial waters. However, these fishing zones mainly indicate that the non-mechanised boats should be fishing in inshore waters and the mechanized boats beyond that limit seawards in the territorial waters. However, these zones of operation of the boats differ from State to State which adds to the confusion of fishermen fishing either in the territorial waters of their State or their adjoining States. It is therefore, essential that these zones are made uniform, so that there will not be any ambiguity in understanding the zones of operation and conflicts among fishermen can be avoided. Similarly, the larger vessels should have their zones of operation specified in the EEZ with reference to the resources they harvest and the technology they employ.

### ***Colour Code***

Each prescribed zone should have boats with a specific colour code, so that can be used to identify the fishing zone in which they are envisaged to conduct their fishing activities. Both for the fishermen and the patrolling authorities it would be an easy guide to monitor and regulate fishing out at sea, if such a colour code would be implemented. Such a scheme of colour code is practiced in Malaysia and could be adopted in India as well. Uniform location of markings on boats helps in easy identification. It is essential that the name of the boat and registration number are written in readable, prescribed sizes of letters and numbers on the hull as well as the superstructure of the boat. There is also a need to have single registration and single authority uniformly prescribed in each of the States for registering fishing boats. The code letters, the abbreviations used in conjunction with registration numbers, should also uniformly be indicating the home State and port of the boats.

### ***Boats and fishing practices***

It is observed that along the coast of each maritime State the size of boats and type of fishing and their combination differ irrespective of the fishery in which they are engaged. In order to facilitate management of fishing effort, it is essential that we follow “one technology – one size of boats – one specified species catch”. In such an approach, it would be easier to allocate fishing effort with reference to total allowable catch and the particular fishery.

### ***Uniformly closed season***

It already has been decided by the Ministry of Agriculture to follow a uniformly closed season for the specified period, 65 days (from 10<sup>th</sup> June to 15<sup>th</sup> August) along the west coast and 45 days (15<sup>th</sup> April to 31<sup>st</sup> May) along east coast. Such a closed season with stringent implementation should benefit the fishermen as well as the fish stocks, the former with the catch dominated by larger specimens and latter by having opportunity to breed, spawn and recruit their progeny to the ecosystem and eventually to the fishery. In the case of intensively fished stocks, in addition to implementing the closed season, it would be essential to locate their precise spawning grounds and put the necessary restrictions as closed areas of fishing. Resources enhancement programmes such as protected areas, artificial reefs and sea ranching would go a long way in enriching the fish stocks and restoring their habitats.

### ***Vessel Monitoring System (VMS)***

A VMS is essential for the country like India having over 2 million km<sup>2</sup> of the sea space. In the initial stage a VMS can bring in its ambit the larger deep-sea fishing vessels (>20 m OAL) and all the foreign fishing vessels permitted under the deep-sea fishing schemes to fish within its EEZ. The Ministry of Agriculture has seized the issue and is expected to implement a VMS, which could help in knowing the fishing activities and their operational details on regular basis.

### ***Monitoring, Control and Surveillance (MCS)***

The State Fisheries Departments, Coast Guard and Ministry of Agriculture (Government of India) together form the MCS mechanism for marine fisheries in India. Under this mechanism the Ministry of Agriculture is the nodal authority for fisheries in the country. The maritime States have the jurisdiction over territorial waters. Within the EEZ the Coast Guard has been responsible for the fisheries monitoring, control and surveillance function under the various maritime legislations. This mechanism needs to be further refined and strengthened so as to bring the effectiveness in implementation of various measures under the Code of Conduct for Responsible Fisheries including the matters related to the MCS.

## **CONCLUSION**

In the marine fishery scenario in India presented above the sustainable fisheries of the new millennium should be ensured by addressing the issues outlined and taking measures for management and conservation of the fish stocks. The measures should also include initiation of necessary mechanisms for rehabilitation of already over-exploited stocks and monitoring, controlling of the fishing effort and the responses of the fish stock to them on a continuous basis.

Uniformity in zonation, vessel marking, colour code and closed season would go a long way in an effective implementation of regulatory and management measures. Considering the MCS including VMS as essential tools for implementation of management plans and legal provisions, strengthening/acquiring these systems is but inevitable. A participatory-cum-

partnership approach in implementation of these measures could come to a great help in this endeavour. These approaches alone will enable the present generation to harvest the fish stocks at sustainable level and help handover the natural bounties to the future generation for their use in healthy state.

## REFERENCES

- FAO, 1997.** Fishery Statistics (1997). Capture Production Vol. 84, FAO, Rome
- FAO Fishing Technology Service, 1996.** Fishing Operations. *FAO Technical Guidelines for Responsible Fisheries*, No.1, Rome, FAO: 26 p. 6 annexes.
- FSI, 2000** Fishery Resources Survey Programme 2000-2001 Fishery Survey of India. Mumbai : 58 pp.
- James, P.S.B.R. and K. Alagaraja, 1991.** Assessment of marine fishery resources of India. Proc. Nat. Workshop Fish. Resour. Data Fish. Indus. : 1-7.
- NRSA, 1999** Interface, A Bulletin from the National Remote Sensing Agency, Data Centre, Hyderabad
- Madhupratap, M, R.R. Shetye, K.N.V. Nair and S.R. Sreekumar Nair, 1994.** Oil sardine and Indian mackerel; their problems and coastal oceanography. *Curr.Sci.* 66 (5): 340-348
- MOA, 1997** Hand Book of Fisheries Statistics, New Delhi, Ministry of Agriculture, Govt. of India: 217 p.
- Somvanshi V.S., S.V. Joshi, P. Paleri and C. Haridas, 1999a.** Fisheries Monitoring Control and Surveillance in India, FAO Regional Workshop on Fisheries Monitoring Control and surveillance in South Southeast Asia, Kuala Lumpur and Kuala Terengganu Malaysia, June 29, July 3, 1998 FAO Rome, FISHCODE GCP/INT/648/NOR, Field Report C-1 (En): 19-21.
- Somvanshi, V.S., G.D. Chandrapal, P. Paleri and M.I. Patel, 1999b.** The Fisheries Monitoring Control and Surveillance with special reference to Gujarat State. Regional Workshop on Fisheries Monitoring Control and Surveillance, Muscat, Oman, October 24-28, 1999. FAO Rome FISHCODE GCP/INT/648/NOR Field Report C-3 (En): 57-62.
- Sudarsan D, M.E. John and V.S. Somvanshi, 1990** Marine Fishery Resources Potential in the Indian Exclusive Economic Zone - An update; *Bull. Fish Surv. India*, 20: 27 p.