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AN APPRAISAL OF MARINE CAPTURE FISHERIES MANAGEMENT IN INDIA

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ABSTRACT

Through technological advancements and increased adoption of innovative fishing methods, Indian marine fisheries has moved from a subsistence oriented traditional one to an industrial sector with annual fish production presently stabilizing at around 2.7 million t. The ever-increasing demand for seafood from export and domestic markets has resulted in intense competition for a maximum share of the resource by the fishers and resulted in inter-sectoral conflicts spurred by diminished catch rates. This has led to a situation where, some kind of management of fisheries has become inevitable. Although the main objective of fisheries management has been conservation and sustainability of fish stocks, in recent years it has been extended to address additional economic, social and environmental objectives as well. The ecosystem based management is increasingly gaining importance as a holistic option. The declaration of Exclusive Economic Zone (EEZ) in 1977, adoption of UN Convention on Law of the Sea (1982) and the FAO Code of Conduct for Responsible Fisheries (FAOCCRF) in 1995 were important milestones in Capture Fisheries Management. The policies and programmes being implemented for responsible fisheries in India date back to the seventies when Marine Fishing Regulation Acts (MFRAs) were enacted in various maritime States. In the rapidly developing fisheries sector, management approaches will now have to evolve from a regulatory to participatory mode.

INTRODUCTION

Fisheries management has been defined as the “integrated process of information gathering, analysis, planning, decision-making, allocation of resources and formulation and enforcement of fishery regulations by which the fisheries management authority controls the present and future behaviours of the interested parties in the fishery, in order to ensure the continued productivity of the living resources” (FAO, 1995b). It aims at optimizing the use of fishery resources as a source of human livelihood, food and recreation, dynamically regulating fishing activity, meeting resource-related objectives or constraints, mainly indirectly. While the main aim of fisheries management is to maximize yield (in weight or in revenue) and maintaining a particular stock level to provide a minimum spawning stock and a buffer against poor recruitment year, economic and social benefits as well as environmental protection aspects are also being included recently.

Over time, and since the extension of national jurisdictions through proclamations of Exclusive Economic Zones (EEZ) in the 70's in particular, fishing capacity has grown significantly as world demand for fish increased and most countries undertook, often with broad government support, to fill the gap between their actual take and their estimated 'national' resource potential. This process not only led many countries to overextend their fishing capacity, but also changed the nature of exploitation in many fisheries, especially in the inshore sector. Community-based and relatively small-scale operations shifted to more business-like ventures based on larger units and more capital-intensive technologies leading to growing competition between small-scale (artisanal) and industrial vessels and between semi-industrial (inshore) vessels and larger deep-

sea vessels or factory ships. In the last 3 decades, fisheries products have also changed from locally traded fresh or simply processed products to internationally traded commodities which has impacted the fishery practices as well as management regimes. In some countries this has motivated the small-scale fishing sector to develop and modernize while in some other cases, they have become marginalized or limited to supplying the less lucrative local market (Greboval, 1999) and resulted in widespread intersectoral conflicts.

The difficulties involved in managing a fisheries resource are related to the number and types of user groups and the distribution and mobility of the fish stocks. Conflicts arise when the same stock is exploited by different user groups either in the same/different fishing grounds. Allocating resources between artisanal and commercial fishers then becomes a difficult task and involves weighing the advantages of employment and food supply from artisanal fisheries against the advantages of export income from commercial fisheries. The situation becomes even more difficult when the resource is distributed over the coastline of several adjacent countries and particularly severe when different parts of the same unit stock eg. juveniles, adults and spawners are unequally distributed in different countries. The UN Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks (1995) brought forth an agreement under which coastal states and distant water fishing nations (DWFNS) exploiting a particular straddling or highly migratory fish stock are to come together to form a regional fisheries management organisation, or arrangement for purpose of managing the resource on a co-operative basis.

Profile of Indian Marine Fisheries

The Indian marine fisheries sector is characteristically an open access one with free and common property rights. The multispecies fishery comprise over 200 commercially important finfish and shellfish species. Being a multigear fishery (gillnets, drift nets, hooks and line, pole and line, traps, bag nets, ringseines, purseseines, trawls), fishing practices vary between different regions, depending on the nature of the fishing grounds and the distribution of the fisheries resources (Fig.1) The marine fisheries sector of India has grown over the years to the level of a major industry with a gross capital investment of around Indian Rupees 41,170 million (at 1995 price level). The marine fish landings of 2.7 million tonnes during the year 2000 earned an estimated gross income of Indian Rupees 1,02,000 million at the landing centre price level. The annual production has been oscillating between 2.4 and 2.7 million tonnes since the last one decade, showing signs of leveling off (Pillai *et al.*, 2003) (Fig. 2). Most of the inshore resources are optimally exploited (Table 1) and it has become increasingly clear that there have been tendencies for indiscriminate exploitation of juveniles of many species of commercially important fishes by use of destructive gears with very small mesh size. The increased fishing pressure in the inshore waters has resulted in considerable decrease in fishing area available for operation per fisherman paving the way for conflicts between different categories (artisanal, motorised and mechanised) of fishers and also between the coastal artisanal fishers and coastal aquaculturists (Modayil, 2002).

Table 1. Status of exploitation of different species along the Indian coast in the 0-50 m depth zone

Species	State of exploitation		
	Full	Over	Under
<i>Sardinella longiceps</i>	All along	-	-
<i>S. gibbosa</i>	SW coast	-	West coast
<i>Hilsa ilisha</i>	NE coast	-	-
<i>Encrassicolina devisi</i>	-	-	All along
<i>Stolephorus waitei</i>	-	-	-
<i>Rastrelliger kanagurta</i>	All along	-	-
<i>Scomberomorus commerson</i>	-	SE&SW coast	-
<i>Euthynnus affinis</i>	All along	-	-
<i>Thunnus tonggol</i>	All along	-	-
<i>A. rochei</i>	-	-	All along
<i>Katsuwonus pelamis</i>	-	-	All along
<i>Megalaspis cordyla</i>	-	-	SW coast
<i>Decapterus russelli</i>	-	-	All along
<i>Selaroides lepiolepis</i>	SE coast	-	-
<i>Atropus atropus</i>	NW coast	-	-
<i>Alepes kalla</i>	SW coast	-	-
<i>Atule mate</i>	-	-	SW coast
<i>Caranx carangus</i>	SE coast	-	-
<i>Parastromateus argenteus</i>	-	West coast	-
<i>Formio niger</i>	-	SW coast	-
<i>Trichiurus lepturus</i>	-	East coast	West coast
<i>Harpodon nehereus</i>	NW coast	-	-
<i>Nemipterus japonicus</i>	All along	-	-
<i>Nemipterus mesoprion</i>	All along	-	-
<i>Leiognathus bindus</i>	East coast	-	-
<i>L. dussumieri</i>	Tamil Nadu	-	-
<i>L. jonesi</i>	Tamil Nadu	-	-
<i>Secutor insidiator</i>	East coast	-	-

<i>Tachysurus tenuispinis</i>	-	West coast	-
<i>T. thalassinus</i>	-	W&NE coast	-
<i>Otolithus cuvieri</i>	NW coast	-	-
<i>Johnius macrorhynchus</i>	NW coast	-	-
<i>J. vogleri</i>	NW coast	-	-
<i>J. sina</i>	SW coast	-	-
<i>J. carutta</i>	SE coast	-	-
<i>Penaeus monodon</i>	East coast	-	-
<i>P. indicus</i>	-	East coast	-
<i>P. semisulcatus</i>	-	SE coast	-
<i>Metapenaeus monoceros</i>	All along	-	-
<i>M. dobsoni</i>	All along	-	-
<i>Acetes indicus</i>	NW coast	-	-
<i>Panilurus polyphagus</i>	-	NW coast	-
<i>Loligo duvauceli</i>	All along	-	-
<i>Sepia aculeata</i>	East coast	-	West coast
<i>S. pharaonis</i>	East coast	-	West coast

Source: Murty & Rao (1996)

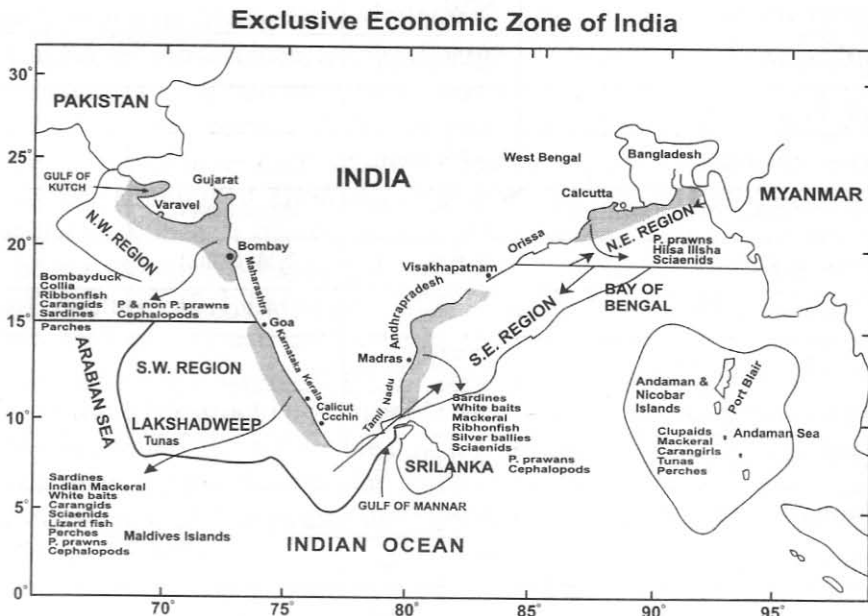


Fig.1 Exclusive Economic Zone of India

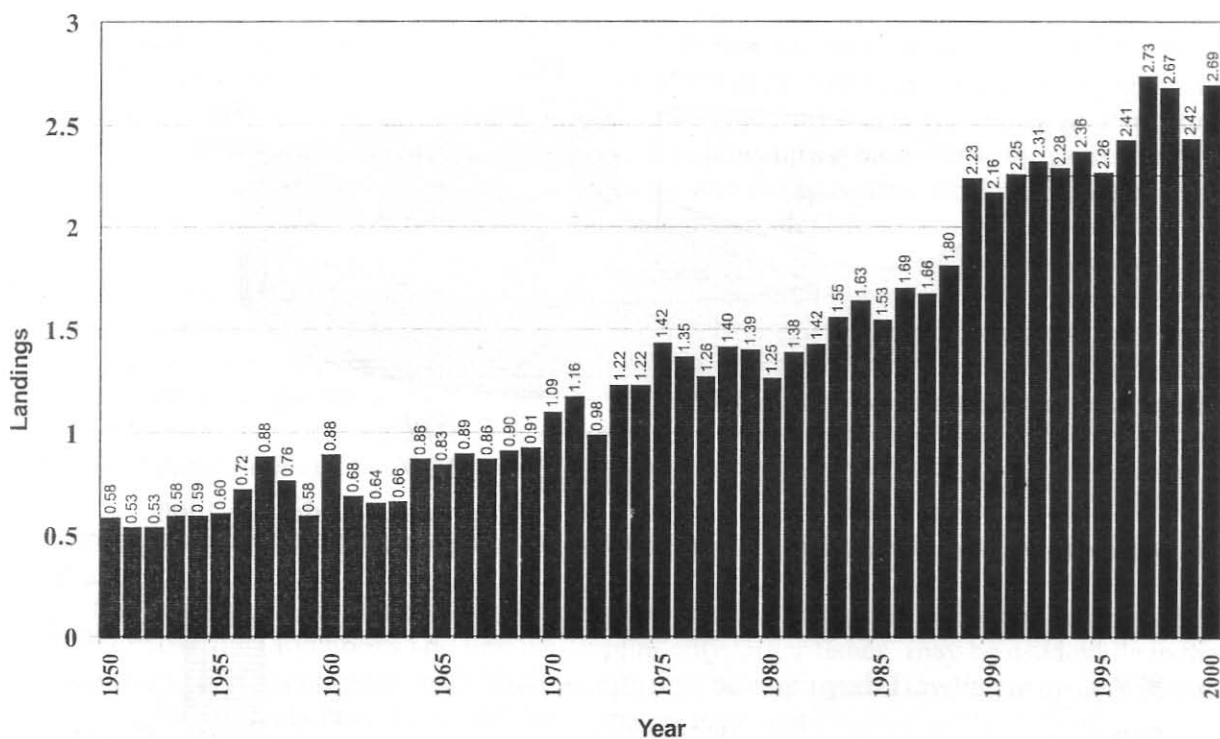


Fig. 2 Total Marine Fish Landings (in mt.) In India 1950-2000

The Maritime Zones Act of India, 1976, provides the country sovereign rights of managing the living and non-living resources in area of 2.02 million sq.km. within the EEZ. The management of the fishery resources of Indian EEZ is a complex subject considering the vastness of area, participation of different sectors in the exploitation of the resources and their tendencies to operate in more or less in the same area (Figs. 3 & 4). The policies and programmes being carried out for responsible fisheries in India date back to 1979 when a Model Bill was circulated in all its maritime States and Union Territories to be the basis for fishing regulation in their territorial waters. The Marine Fishing Regulation Acts (MFRAs) enacted by all the maritime states except the state of Gujarat, in general contain provisions to regulate / restrict or prohibit fishing activities within specified areas, licensing of fishing vessels, cancellations / suspension and amendment of licenses, regulation of fishing etc. The MFRAs also contain provisions earmarking the fishing areas for different sectors of traditional and mechanized fishing.

The success of the capture fisheries sector depends upon employing an effective system of fisheries management. Overfishing and degradation of aquatic environment along the Indian coastal sector has already placed enormous strains upon the fisheries capacity to sustain its present contribution due to lack of proper scientific management relevant to the resource as well as environment. Some of the possible management tools to safeguard the ecosystem/resources at national level are given as under.

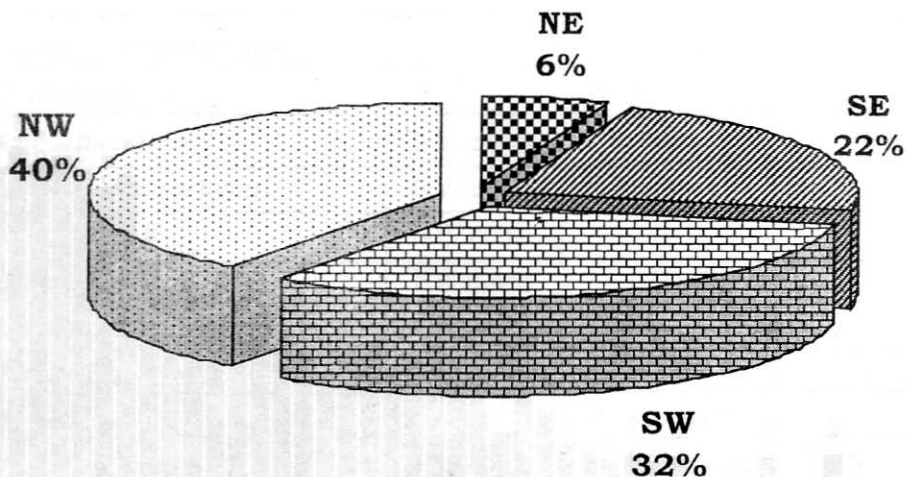


Fig. 3 Region-wise contribution to all India production during 2000

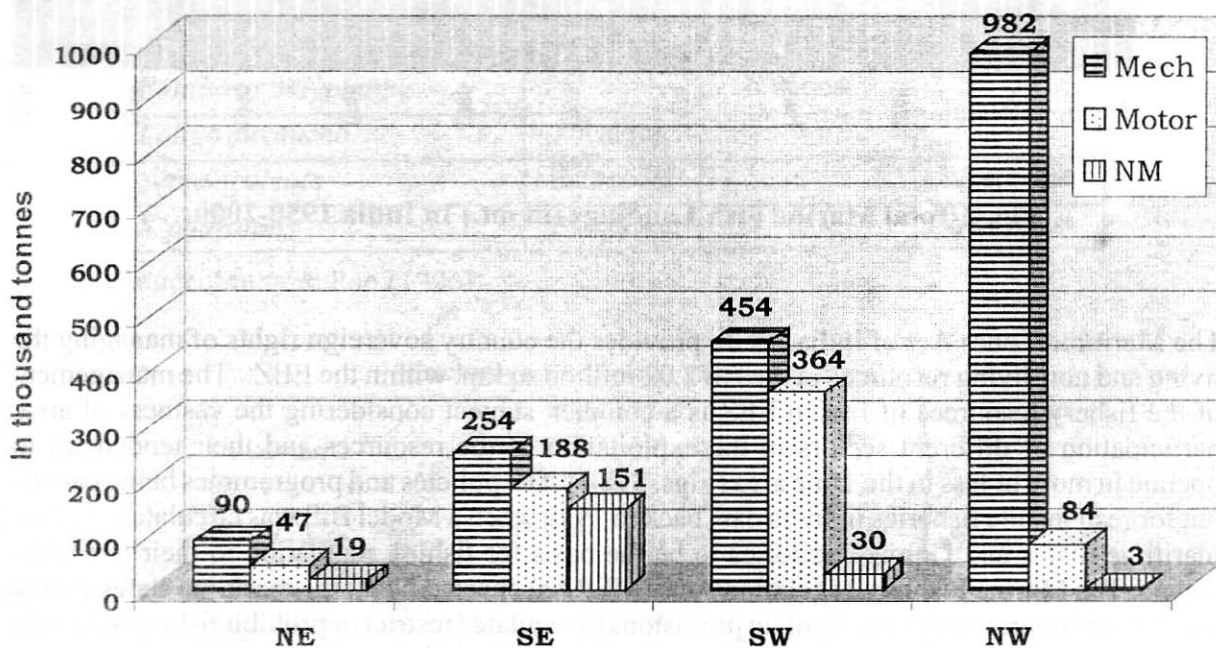


Fig. 4 Sector-wise landings in different regions

Reduction of fishing effort: Fishing effort is a composite of many parameters particularly fishing duration and fishing efficiency. The restriction of fishing effort could be in various ways such as restriction on number of vessels, number of days at sea, fishing days/hours, engine power, fish hold capacity or length of nets etc. Precise estimates of the actual fishing effort exerted on the fishery resources is an important input in taking management decisions. It is generally felt that the fishing effort in the Indian marine fisheries is on the higher side and there is need to reduce some effort in the mechanized sector (Modayil, 2002). A diminution of overall fishing effort reduces pressure on the target stock(s) with a consequent reduction of effort on non-target

species and discards. In certain tropical demersal fisheries, the level of fishing effort may be so intense that long term changes in the composition of the catch will occur, resulting in high value finfish and crustacean species being replaced by low value finfish and invertebrates (Pauly and Murphy, 1981). Restriction of the number of days of fishing during monsoon is the most common method followed in India the objective being to protect the spawning stocks from capture by mechanised fishing vessels and allow natural and efficient replenishment to the fish stocks.

Alternative harvesting methods : The use of more selective fishing methods can reduce by-catches and often limit mechanical damage to the catch. A good example would be preferring squid jigging to trawling for squids. The jigging operation leads to reduced by-catch and better quality squid although the yield per unit fishing effort may not be as high as in trawling. In Indonesia a number of the regional fisheries authorities have banned trawling in favour of more selective fishing methods.

Yohannan *et al.* (1999) suggested a method of successional fishing whereby varieties of gear are used in space and time according to the biological characteristics of the fishes with an aim of protecting their spawning stock and early juveniles. During the spawning period large meshed nets (above 80 mm) and hooks and line that exploit only larger fishes may be used while in the post spawning period nets with mesh above 40 mm may be employed. Trawling in inshore waters during May to September may be controlled to protect spawners.

Mesh-size regulations : The fine meshes of gears like trawls and bag nets cause large-scale destruction of juveniles of many important commercial fishes. The codend mesh size (CEMS) of the trawls prevalent in India is uniformly very small (about 10 mm stretched knot to knot) while the recommended minimum stretched mesh size is 30 mm. Kalawar *et al.* (1985) advocated a compulsory mesh regulation by legally imposing a minimum stretched CEMS of 35 mm, that would help protect significant number of juvenile fishes as well as shrimps. However there is widespread noncompliance of these regulations by fishermen who use several ways to get around these regulations like by lining the codend outside or inside with a finer mesh or by superimposing two layers of the legal mesh size so that the apertures are about half the original mesh size or by attaching a weight to the end of the codend so as to obtain maximum stretching of the net, thus decreasing the opening (Vivekanandan, 2004). If this is not stopped forthwith the major marine fisheries will certainly be adversely affected and the fish production in the coming years will decline drastically. Some workers have expressed doubts about the utility of mesh size regulation in shrimp fisheries as it is felt that too large CEMS regulations will lead to underexploitation of the smaller shrimp species (Gulland, 1972; Daan, 1981). It may be recommended that a codend mesh size of 25-30 mm may be enforced in Indian waters to ensure sustainable exploitation of the fish and shrimp stocks. As regards lobster resource, Central Marine Fisheries Research Institute (CMFRI) has recommended the Minimum Legal Size (MLS) for capture of four species of lobsters which is a step to ensure sustainable exploitation of the resource. Based on the recommendations of CMFRI, the Ministry of Commerce, Govt. of India has issued orders specifying the Minimum Legal Weight fixed for *Panulirus homarus* - 200 g, *P. polyphagus* - 300 g, *P. ornatus* - 500 g and *Thenus orientalis* - 150 g.

The fishing for shrimp seed along the coastal waters of the east coast is yet another example of the destruction of valuable ichthyoplankton. For every shrimp seed collected, hundreds of other larvae and juveniles of commercially important species of finfishes and shellfishes are destroyed. The juvenile fishing should be stopped forthwith and immediate attention and drastic intervention is urgently required (Modayil, 2002).

Licensing or quota regulation : The FAO Technical Guidelines for Responsible Fisheries No.4 Fisheries Management guideline 1.4 (11) states that “ It is in the interest of the users and the resource to maintain potential fishing capacity at a level commensurate with the long term stock productivity” (FAO,1997). The issue of over-capitalization is normally associated with the open-access fisheries as in India. Concepts such as Total Allowable Catch (TAC) and Individual Transferable Quotas (ITQ) have been used in certain countries like Canada and Australia but the system may not be amenable to India as there is no practice of reporting the catch to any authority by any fishing vessel, mechanized or artisanal. In this context introduction of licensing scheme to help monitor fishing effort and optimisation of inputs could be desirable.

Marine Protected Areas (MPAs) : By-catch and discard levels can be reduced by declaring known zones of fish spawning and feeding areas as Marine Protected Areas (MPAs) in which fishing is prohibited and which allows the rapid build-up of fish spawning stock biomass (Roberts and Polunin, 1991; Dugan and Davis, 1993). An analysis based on 300 studies of 60 small marine reserves globe over, showed clear evidence that reserves will rebuild decimated populations. The idea behind reserves is that if the fish are protected from fishing, they live longer, grow larger and produce an exponentially increasing number of eggs. It is observed that adult fishes tend to remain in the protected areas while their larvae help replenish adjacent fisheries. Overall (multispecies) levels of biomass per unit area can double in two years and quadruple in ten years of closure (Vivekanandan, 2004). Marine reserves in the Gulf of Mannar, Gulf of Kutch and Andamans are a right step in this direction.

Closure of a fishery : This severe management measure could be used when the fish stock is deemed to have collapsed. However, this can have rather negative effects upon the socio-economic status of the fisherfolk in the rear future. But in the long run it is a positive step for the replenishment of stocks and better income to fisherfolk.

Diversification of vessels and targeting specific resources : To ease out fishing pressure put on the inshore water the existing vessels may be suitably modified as multipurpose vessels to harvest the under tapped resources like goat fish, carangids, ribbon fish, lizard fish, bill fishes, tunas and sharks available in the oceanic and deeper waters.

Gear impact assessment : While introducing innovative fishing gears, concurrent action should be taken for gear impact assessment in space and time and advise the fishers and policy makers accordingly before its massive introduction for the sake of environment/resource protection and conservation.

Fish ranching : As coastal waters of Indian EEZ are already under severe fishing pressure, further increase in fishing effort would become unsustainable in the long run. The CMFRI has

ranching penaeid prawns, pearl oysters and clams on several occasions in the recent past leading to replenishment of the depleted stocks such as that of pearl oyster beds along Tuticorin coast and clam stocks of Ashtamudi backwaters. This system which at present practised on a modest scale in India is widely adopted in Japan as part of its fishery management programmes. The activity which is subsidised by the Japanese government is implemented by sea ranching associations in collaboration with fisheries co-operatives associations and combines private property management during the hatchery and rearing phases and common property management in capture fisheries at the time of recapture (Vivekanandan, 2004). In India also such programmes may be implemented by identifying hatcheries sponsored by State Government agencies for seed production and sea ranching done with involvement of local fishermen groups/co-operatives.

Monitoring, Control and Surveillance (MCS) system : To date, considerable progress has been achieved in harvesting the inshore resources to their optimum level through emergence of a multiple fleet- multiple gear fishery but alongwith a host of problems like excessive capitalization, inter-sectoral conflicts and destructive fishing practices has sprung up raising questions of sustainability and necessitating the need for a strong Monitoring, Control and Surveillance (MCS) system in India. In certain developed countries with a highly capitalintensive fishing industry with fisheries management measures like quotas, restrictive licences, seasonal closure and gear limitations surveillance is a high-tech job done on shore and at sea using ships and aircraft. Although expensive the system sustains itself through licensing and fees paid as fine. Somvanshi (2001) observed that in India, where fish stocks and fisheries within 12 nautical miles (nm) territorial waters is the state subject and the national responsibility extends beyond 200 nm for the purpose, the MCS machinery and requisite legislative instruments have to be improvised, strengthened and made compatible to meet the present and future challenges of management and conservation of fish stocks.

Participatory management : Management of the fisheries can be made more effective if the principal stakeholders are involved in the decision making and its implementation. Fishermen cooperative can be formed which can be vested with the responsibility of protecting the fisheries resources they harvest. They can be made aware of the biological and environmental basis for sustainability of fish stocks by constant interactions with the scientific community. Such interactions will be mutually beneficial to the fishermen, the fishery scientists and the policy makers and make the implementation of the management measures/options smooth and effective. Awareness on benefits of conservation of fish stocks has to be created through extension services of Central and State Fisheries institutions/agencies with a participatory management approach.

Adoption of FAO Code of Conduct for Responsible Fisheries (CCRF) : Its main objective is to establish principles and standards applicable for responsible fishing and fisheries practices after taking into account relevant biological, technological, economic, social, environmental and commercial aspects. The Code of Conduct for Responsible Fisheries as a voluntary guide for all concerned with the fisheries was adopted by the FAO in 1995. The code provides necessary framework for national and international efforts to ensure sustainable exploitation of aquatic living resources in harmony with the environment. It includes all aspects of fisheries from the fishing ground to the final consumer. The developed countries like the United States, Canada

and Australia have already taken steps to implement the code. Developing countries are yet to take steps to apply the code to their marine fisheries.

Meanwhile, Southeast Asian Fisheries Development Centre (SEAFDEC) expressed concern about the code being “more relevant to the developed countries” and they are in the process of producing an Asian Code for Coastal Fisheries. The two day National Workshop on the CCRF organised by the BOBP in association with the Govt. of India at Chennai during 29-30 September 2000 also highlighted several problems concerning the implementation of the Code in a large country like India (BOBP, 2000). The workshop formulated various action plans for the implementation of the Code in Indian fisheries.

Ecosystem-based Fisheries Management (EBFM): The term has been defined (US National Research Council, 1998) as “an approach that takes major ecosystem components and services both structural and functional - into account in managing fisheries. It values habitat, embraces a multispecies perspective, and is committed to understanding ecosystem process. Its goal is to rebuild and sustain populations, species, biological communities and marine ecosystems and high levels of productivity and biological diversity so as not to jeopardize a wide range of goods and services from marine ecosystems while providing food revenues and recreation for human”. The Ecosystem Approach to Fisheries Management was adopted by the FAO Technical Consultation on Ecosystem based Fisheries Management held at Reykjavik from 16 to 19 September 2002 (FAO, 2003). Since then some of the developed countries initiated the process of adopting the ecosystem based fisheries management in their waters.

SUMMARY

Silvestre and Pauly (1997) reported that fisheries management is a dynamic resource allocation process where ecological, economic and institutional resources of a fisheries exploitation system are distributed with value to the society as the overall goal. If measures affecting people are to get results, participation of the affected people in the decision making is a must and it is essential that the aspirations, fears and dreams of the people are sympathetically considered and least painful decisions taken (Modayil, 2002). Fisheries management in India, if it has to work needs to shift its emphasis from a regulatory mode to a participatory one. Also fishery management policies are seldom final as we are dealing with a highly dynamic biosphere. Hence, any management strategy should be reviewed and corrected from time to time.

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