CMFRI

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Lecture Notes

Part 1

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STATUS OF MARINE FISHERIES IN INDIA

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Introduction

Marine fisheries sector in India plays a significant role in Indian economy and provides livelihood security to about 3.5 million coastal rural folk living in 3200 marine fishing villages. The substantial growth of the sector is due to innovative and efficient fishing practices, government policies, well developed harvest and post-harvest infrastructure and increased demand for marine fish products in the domestic and international markets. The growing demand resulted in fishing effort intensification, extension of fishing grounds, increase in overall length of fishing boats, holding capacity of the trawlers, fishing effort in terms of fishing hours through multi-day fishing by the mechanized sector and enhanced fishing operations by the motorized sector. Multiday fishing that came into vogue in the 90s. The production, which reached 2.7 million t in 1997, has remained almost invariant. The asymptotic production level in all the regions of exploitation indicates a little scope for further increase. Thus, there is an urgent need to ensure sustainability of resources through appropriate management interventions as envisaged in the FAO Code of Conduct for Responsible Fisheries and also in the context of global warming and climate change.

Status of marine fisheries

Resources

The availability and distribution pattern of marine fishery resources in India follow a pattern typical of tropical waters. The fishery resource is constituted by a large variety of species (nearly 1570 species of finfishes and about 1000 species of shellfishes) coexisting in the same fishing ground. The multispecies fishery comprises of over 200 commercially important finfish and shellfish species. The important varieties belong to the pelagic groups such as the sardines, anchovies, mackerel, carangids, Bombay duck, ribbonfishes, seerfishes, tunas; demersal finfish groups such as the sharks, rays, sciaenids, perches, silverbellies, lizardfishes, catfishes; crustaceans such as the penaeid and non-penaeid shrimps, crabs and lobsters; and cephalopods *viz*., squids and cuttlefishes. The abundance of these stocks varies from region to region and from season to season with large pelagics like tunas being more abundant around island territories and small pelagics like sardines and mackerel supporting a fishery of considerable magnitude along the southwest and southeast coasts. The Bombay duck and non-penaeid shrimps form a good fishery along the northwest coast, while perches are dominant in the southwest and southeast coasts, especially in the Gulf of Mannar, Palk Bay and Wadge Bank. Among this, species/groups contributing to more than one lakh tonnes in a year are oil sardine, mackerel, Bombay duck, ribbonfishes, carangids, perches, sciaenids, shrimps and cephalopods.

The annual catchable potential yield (of as many as 68 species/groups of fishes) in the Indian EEZ is validated by a Committee as 3.93 million t (m t) consisting of 2.02 mt of demersal, 1.67 m t of pelagic and 0.24 m t of oceanic resources of which the present annual average production of about 2.6 m t forms 64.8%.

Fleet size

The growth of the fleet shows that the artisanal fleet (including the motorized) increased by about 110% from the 1960s to the 1990s and the mechanized fleet by about 570% during the same period and has resulted in an over capacity of fleet operating in the inshore waters (see Table 1). The development of harbours and landing jetties, motorization of artisanal crafts and rapid expansion of mechanized fishing have contributed towards a significant increase in fish production, employment generation and revenue earnings.

Table 1. Growth in fleet size during the period 1961-2004

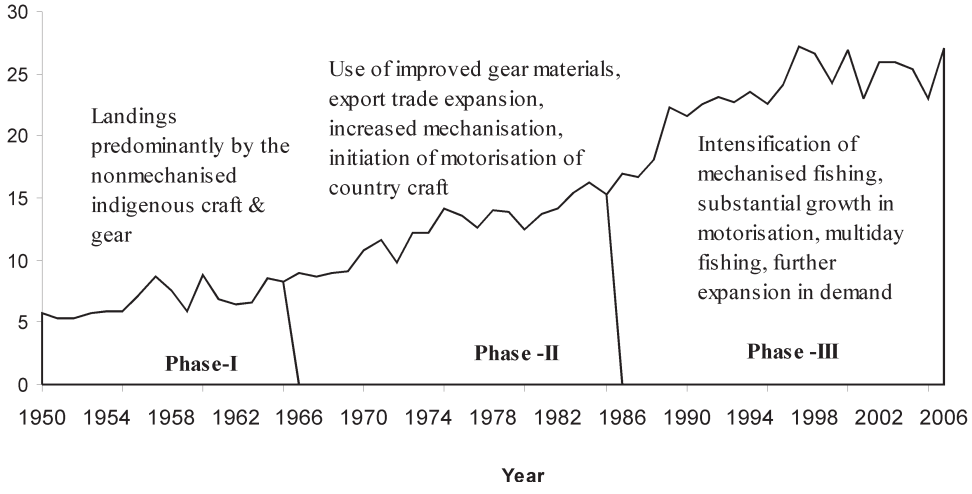
Year	1961-'62**	1973-'77**	1980**	1993*	2005†
Artisanal craft					
Motorised				26171	75591
Non-motorised	90424	106480	140833	155925	104270
Mechanised boats		8086	19013	34571	58911
Trawlers		N.A.	11316	N.A.	NA

* Source: Ministry of Agriculture, Govt. of India; **CMFRI; N.A. Not available;
† Marine Fisheries Census, 2005

Production trends

The total marine fish production during 1947-48 was only 3.73 lakh tonnes. The production had risen to about 2.7 million tonnes in the year 2000. However, the growth rate since 1981 had been on the decline and during 1991-2000 it was only 1.9%. The trend in the production since 1961, over different phases of development of marine fisheries is depicted in the Fig. 1.

Fig.1. Estimated total marine fish landings (lakh tonnes) in India over different growth phases



The estimated average annual landings of the major exploited resources in the first and last five year periods and 2006 annual landings are given in Table 2.

Table 2. Annual average landings (in 1000 tonnes) in the 5-year periods

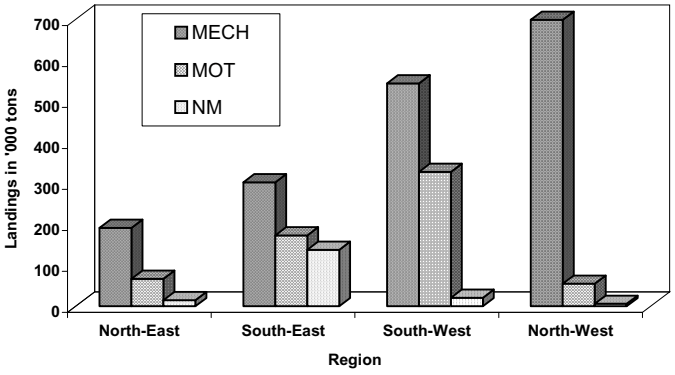
Resource	5- year average		Landings in
	1985-89	2000-04	2006
Elasmobranchs	53.5	60.3	50.7
Catfishes	50.6	53.9	56.5
Oil sardine	141.7	353.0	394.6
Other sardines	75.5	87.4	89.0
Bombayduck	93.2	109.8	118.5
Perches	89.1	197.1	194.5
Croakers	103.3	131.7	119.4
Ribbonfish	79.1	166.7	235.0
Carangids	105.1	122.2	121.9
Silverbellies	60.2	51.3	64.6
Pomfrets	37.1	38.9	44.0
Mackerel	123.0	114.1	141.9
Seerfish	34.8	47.9	49.0
Tunnies	28.6	42.3	64.0
Flatfish	29.7	43.0	39.1
Penaeid prawns	144.2	194.2	172.5
Non-penaeid prawns	58.8	137.6	170.8
Cephalopods	40.3	109.4	136.0
Total (including others)	1769.0	2532.1	2710.1

It is observed, after a rapid growth from 1985, the production levels during the last five years have leveled off.

Sectoral production trends

The mechanised sector accounted for 67.9%, motorised sector 25.0% and artisanal sector 7.1% of the total production. The sector-wise landings in different regions during 2004 are given in Fig. 2. The pattern of marine fish landings in India during the past fifty years clearly reveals that the contribution by the artisanal sector to the total production was significant only up to 1960s while presently, the contribution by the mechanized and motorized sector accounts for 93% of the marine fish landings.

Fig. 2. Sector-wise landings in different regions in 2004



The share of the mechanized sector to the total landings increased from 20% in 1969 to 68% during 2004. More than 80% of the landings by the mechanized sector was by the trawlers. The amount of time expended for actual fishing by this sector has almost doubled during the last 15 years, rising from about 17.4 million hours during 1986 to 34 million hours during the year 2004. This was mainly due to introduction and increase in multiday fishing along the entire coastline. The motorized fishing craft accounted for 25% of the total landings in India. The landings by this sector have increased from about 1.8lakh t in 1986 to 6.2 lakh t in 2004. Kerala accounted for the bulk of the landings by the motorized craft in the country. In other states the contribution by this sector has been gradually increasing. In the motorized sector not only has there been increase in the unit operations but also in the fishing hours from about 3.3 million hours in 1986 to about 25 million hours during the year 2003. Consequent on the growth in these sectors, the artisanal sector has gradually been marginalized over the years. In Gujarat, Maharashtra, Karnataka and to some extent in Kerala, the sector has been totally marginalized.

Status of exploitation

From the resource monitoring programmes of CMFRI, it is observed that there is a general decline in resource availability as evidenced by decline in catches and catch rates and incidence of a large proportion of juveniles and young fish in the landings and decrease in the average length at capture. It is also reported that there is a considerable volume of discards of non-target resources by the multi-day trawlers. Stock assessment studies have also revealed that most of the stocks are overfished, especially the demersal stocks exploited mainly by the mechanized sector. The stocks of shrimps in regions of exploitation along the entire Indian coast, Bombayduck and pomfrets along Maharashtra and Gujarat, sharks catfishes, mackerel, sciaenids, pomfrets, squids and cuttlefish in the southwest and southeast are heavily exploited and their catches and catch rates are fast declining. Studies have also revealed that there is an increasing tendency to fish down the marine food web, which is threatening the resource balance in the marine food chain. Excessive trawling was also found to adversely affect the biodiversity and ecosystem productivity, which would negatively impact the fish production.

Issues

From the foregoing it is evident that there is an urgent need to reorient the fisheries management regime for long term sustainability of the resources and enhancing the economic efficiency of the fisheries sector. The issues that need consideration for a rational management strategy are:

- Excess fleet size, capacity and over-capitalisation
- Exploitation of juveniles
- Discards utilization/reduction
- Climate change
- Natural and man-made disasters
- Biodiversity decline
- Increasing fishing cost and diminishing returns
- Under exploitation of oceanic stocks
- Inefficient internal marketing system
- Ineffective regulatory measures

Although there is a management control in the form of ban on mechanized fishing, its efficacy, scope and impact on long-term sustainability of the fisheries is still being debated. In the context of globalisation of trade, growing demand for sea food, enormous pressure on the resources and increased awareness of ecosystem based management and eco-labeling, there is an urgent need for developing a management regime based on the principles of responsible fishing for ensuring livelihood security, resource sustainability, economic efficiency and ecosystem integrity.

Management approach

Management of fisheries is not managing the fish stocks alone but it should also take into account of the stakeholders who are directly or indirectly involved such as the fisher folk, traders, those in fishery allied activities and consumers. It is well recognized that fisheries resources must be managed to harvest stocks at sustainable levels for ensuring livelihood security for the benefit of the present and future generations. Fish stocks live in a highly variable habitat, a complex ecosystem and are affected by human intervention and vagaries of nature caused by environmental variations. The management should incorporate this uncertainty factor also in its strategies. Single species management practices prevalent in temperate waters will not be suitable to multi species, multi gear systems of tropical waters such as in India. In such a multi-species system it is impossible to maximize returns from all the constituent stocks. Thus the goal of management should be to promote sustainable fishing practices that do not decrease the stock levels, ensure livelihood security, resource sustainability, economic efficiency and ecosystem integrity.

There are different kinds of management measures that can be taken. They are:

(a) Input control measures

- Access to fisheries (for e.g. licenses)
- The size and power of boats
- The amount of time each month a boat can fish

(b) Output control measures

- Catch quotas
- Total Allowable Catch for a fishery

(c) Technical control measures

- Size limits (capture and marketing)
- Closed areas for fishing
- Closed seasons for fishing
- Size of the nets used

In the Indian context, output control measures are not practical as it involves enormous cost of monitoring and accurately quantifying the catches. Input control measures are relatively easy to implement and they also require an efficient monitoring system. For ensuring a sustainable and responsible fisheries management regime, the following measures are suggested.

Shift from open-access to user rights

The policy measures likely to be most effective for resources management and protection of critical fish habitats in the aquatic environment are those which embrace the abandoning of free and open access system to resources and introduction of appropriate measures to allocate resources and establish user rights. Where it is possible to introduce such measures, they will, *inter alia*, provide greater incentives to reduce excess fishing capacity/pressure, which has been one of the major factors responsible for overfishing and unsustainable development. In addition, in artisanal fisheries, the establishment of user rights is particularly important in protecting the interest of artisanal fishers from unequal competition with industrial vessels. The policy should aim to ensure socio-economic security for the artisanal fishermen whose livelihood depends solely on this avocation. Thus, the measures suggested are:

- Mandatory registration and licensing of all motorized and mechanized boats.
- Review of registration and licensing every five years.
- Upward revision of the registration, licensing fees and berthing charges to discourage new entrants.

Reduction of fishing effort

The fishery regulation through effort reduction that is in vogue in different maritime states is chiefly aimed at the trawl fishery. In recent years, there has been significant increase of the motorized sector, especially the ringseine fishery and the mini-trawl fishery along the Kerala coast, causing concern for

sustenance of some of the exploited stocks. There have also been dimensional changes in the gear giving wider coverage and efficient catchability. Similarly, the increase in the time spent for fishing in the mechanized sector by undertaking multiday voyage and use of sophisticated electronic devices for fish finding and communications has resulted in increased fishing efficiency. Action points suggested are:

- Fixing and capping the size and power of the boats in each sector by imposing upper limits for the length and horsepower, especially the large ringseiners operating in Kerala.
- Restriction of multi-day fishing by fixing upper limit for absence from the shore in all the states.
- Discourage further entry into the fishery through refusal of licensing to new boats.

Closed season/closed area /Marine Protected Areas (MPAs)

Recognizing the necessity for ensuring sustainable yields from the exploited stocks, some maritime states have enacted fishery regulation acts enabling effort reduction, rebuilding of the stocks and ecosystem rejuvenation by closure of fishery for a specified period of time. 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 replenishment of the fish stocks. The effect, extent and scope of the ban across different fisheries continue to be a debatable issue without conclusive evidence on the merits. However, there is consensus about the fact that the intensive exploitation of the coastal waters does adversely affect the ecosystem resulting in low productivity from different trophic levels. Recently, based on discussions with coastal states/UT and CMFRI and FSI, the Ministry of Agriculture, Govt. of India has initiated a move to impose a uniform ban on trawl fishing during the monsoon months along the entire Indian coast.

Areas of fish spawning and feeding as Marine Protected Areas (MPAs) in which fishing is prohibited, allow rapid build-up of fish spawning stock biomass. 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. Marine reserves in the Gulf of Mannar, Gulf of Kutch and Andamans are a right step in this direction.

The suggested measures are:

- Mandatory closed fishing season
- Prevent/control operations of certain types of gears that adversely affect sustainability.

Mesh-size regulations and curbs on destruction of fish juveniles

The small 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 (10-15 mm stretched knot to knot) while the recommended minimum stretched mesh size is 35 mm. As regards to lobster resource, Central Marine Fisheries Research Institute (CMFRI) has recommended the Minimum Legal Size (MLS) for capture of four species of lobsters 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 interventions required are:

- Complete ban on landing and marketing of juvenile fish.
- Minimum export size of high value resources should be fixed.

Diversification of vessels and targeting specific resources

To ease out fishing pressure in the inshore waters, the existing vessels may be suitably upgraded/ modified as multipurpose/combination vessels to harvest the under tapped resources like tunas, bill fishes, pelagic sharks and oceanic squids available in the oceanic and deeper waters. The suggested options are:

- Diversification of fishing to passive fishing by gill nets, squid jigging and hooks&lines
- Promote deep-sea fishing by resource specific craft and gear to tap the tuna resources.

Participatory management

Management of fisheries can be made more effective if the principal stakeholders are involved in the decision-making and its implementation. Fishermen cooperatives can be formed which can be vested with the responsibility of protecting the fisheries resources they harvest. They should be made aware of the biological and environmental basis for sustainability of fish stocks by constant interactions with the scientific community. 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.

Strengthening of Management Information System

It has been now recognized that the basic requirement for knowledge based fisheries management is availability of reliable and adequate data on the resources and their dynamics including economics of fishing. For this, an effective data acquisition mechanism is needed. The maritime states must develop mechanisms to generate reliable data on marine fish landings and fishing effort, which could be used for understanding dynamics of the fisheries as well as for regulating their exploitation.

Conclusion

Marine fisheries in India, beset with problems of over capitalization, over capacity, increased operational expenses and reduced catch rates, is at cross roads. In the context of globalization and challenges of global competition in trade and economics, there is urgent need for policy interventions at the state and national levels to meet the increasing domestic and export demand of seafood for the millions and to ensure better livelihood for the fisherfolk. A comprehensive national fishing policy namely, *Marine Fishing Policy - 2004* has been released by the Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Govt. of India. The policy objectives are: (1) to augment marine fish production of the country up to the sustainable level in a responsible manner so as to boost export of sea food from the country and also to increase per capita fish protein intake of the masses, (2) to ensure socio-economic security of the artisanal fishermen whose livelihood solely depends on this vocation, (3) to ensure sustainable development of marine fisheries with due concern for ecological integrity and biodiversity. In the policy, the need for a shift from the open access to the limited entry concept in the territorial waters besides enforcing stringent management measures for sustained production is stressed. Climate change is another emerging issue that the fisheries managers need to address in the context of its impact on the marine fishery resources, their adaptability and vulnerability. Fisheries management is a continuous and interactive process, where, economic, social and ecological costs and benefits are to be understood and interventions designed. There is, thus, an urgent need for a paradigm shift in the fisheries management to ensure sustainability and livelihood security for the coastal rural folk.