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The Indian marine fisheries resources scenario — Past, present and future

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ABSTRACT

In the marine fisheries sector of India, the emphasis until recently was on development and increased exploitation which lead to intense fishing activity in the 0–50 m depth zone resulting in near optimal exploitation of most stocks inhabiting this region. The data on fishery and biology collected over a number of years on a large number of exploited species from the exploited grounds of 0–50 m depth zone show that there is no scope for increasing production from this region and that the emphasis should be given to effectively manage the resources to ensure sustained returns. In the unexploited grounds beyond 50 m depth the potential yield is of considerable magnitude (1.7 million tonnes) and, therefore, the future of marine fisheries depends largely on continuing the present level of exploitation in the inshore waters, exploitation of resources from the relatively deep seas, and researches aimed at stock assessment, particularly assessment of mixed or multispecies fisheries, which will help in formulation of policies for resource management in the entire exclusive economic zone of India.

The exploitation of marine fisheries resources, which used to be only on a sustenance basis using artisanal gear during pre-Independence period, started increasing since Independence. During the past four and a half decades, the marine fisheries has got transformed into a big industry. Marine fishing has been intense in the 0–50 m depth zone in recent years and there is enough evidence to show that several resources have reached or crossed the levels of maximum sustainable yield (MSY). It has been estimated (Anonymous 1991) that the potential yield in the 0–50 m depth zone, which is the area currently fished, is 2.21 million tonnes. The present estimated yield (2.28 million tonnes in 1992) is also close to this indicating that additional yield from these fishing grounds can not be obtained. The declaration of the Exclusive Economic Zone (EEZ) for exploitation of resources in the sea up to 200 miles from the shore, in 1977, has increased opportunities and created challenges to exploit the hitherto unexploited grounds in the EEZ and increase harvests of the hitherto underexploited resources.

The Central Marine Fisheries Research Institute since its inception in 1947, has been carrying out researches on exploited fisheries resources and has collected vast information on the biology of different species contributing to the fisheries along Indian coast. The Institute has developed a scheme of Stratified Multistage Random Sampling for collection of landing and effort statistics and has been making estimates of districtwise, gearwise and specieswise production from all maritime states and union territories (CMFRI 1969, 1980, 1981, 1982, 1983, 1986, 1989). Though, studies on stock assessment of exploited resources have been made earlier, concerted efforts have been made only now to make such studies on a large number of exploited species. Different papers of this series deal with different species stocks. This paper

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attempts to present briefly the overall marine fisheries resources scenario in the country to draw attention to the urgent need for effective management of the fisheries resources in the 0–50 m zone and to put forward options for increasing the marine fish production.

The past

Since Independence, attention has been on increasing fish production from the seas and the different Five-Year Plans took adequate care to develop the marine fisheries by mechanization of indigenous craft, introduction of mechanized vessels, improvement of fishing implements, establishment of infrastructure facilities for processing and storage and to establish a strong R & D facility (James and Rao 1992). All these developments helped in increasing marine fish production considerably which increased from 0.6 million tonnes in 1950 to 2.28 million tonnes in 1992 (Fig. 1). Kerala contributes maximum to the marine fish production in the country (1992 data), forming 24% of total landings followed by Gujarat (20%), Tamil Nadu (16%), Maharashtra (14%), Karnataka (7%), Andhra Pradesh (7%) and others. The yield attained one million tonne mark in 1970 and fluctuated between 1.1 and 1.4 million tonne for nearly a decade from then (Fig. 1), bringing the fish production to a virtual stagnation and fears of overexploitation among the industry. With the introduction of purse seiners along west coast, and large trawlers along both the coasts and intensification of fishing effort by extending the area of fishing to relatively deeper waters up to 50–60 m, by starting exploitation during monsoon period along west coast, by switching over to voyage fishing instead of daily returning to the base, diversification of effort to exploit several resources and by establishing fishing harbours at different places along the coast in the subsequent period, the production started increasing every year (Fig. 1). Several species of pelagic and demersal finfish and shellfish are exploited and oil sardine, Indian mackerel, Bombay duck, perches, croakers, the group of horse mackerels, scads and travellys, and shrimps are the major resources, each one contributing over 100 000 tonnes.

Thus the past witnessed a phenomenal growth of the marine fisheries sector with emphasis on development and increased exploitation. With the development of a strong export market during the period, for shrimps, the entire development has been biassed towards increasing shrimp production.

On the research front, adequate data have been collected on all the major resources and by eighties, the variations in seasonal abundance and the biological characteristics of majority of the exploited species were well-understood. Stock assessment studies have also been initiated on certain species. The exploratory surveys in depths extending up to 300 m along Indian coast brought to light the distribution of certain stocks in depths beyond 50 m.

The present

The demand for fish to meet the requirements of domestic as well as overseas markets lead to intense fishing in the coastal shelf up to 50–60 m depth and the different agencies and the industry began to suspect that additional effort in the current fishing grounds would not help increase production. Simultaneously the researches on stock assessment were intensified and the results of investigations on particular species along the coast (Krishnamoorthi 1978, 1980; Venkataraman *et al.* 1982; Murty 1983, 1985, 1986a, 1986b, 1987, 1988, 1989, 1990; Narasimham 1983, 1987, 1988; Yohannan 1983; Silas and Pillai 1985; Silas *et al.* 1985a, 1985b; Alagaraja *et al.* 1986; Lalithadevi 1986, 1987; Vivekanandan and James 1986;

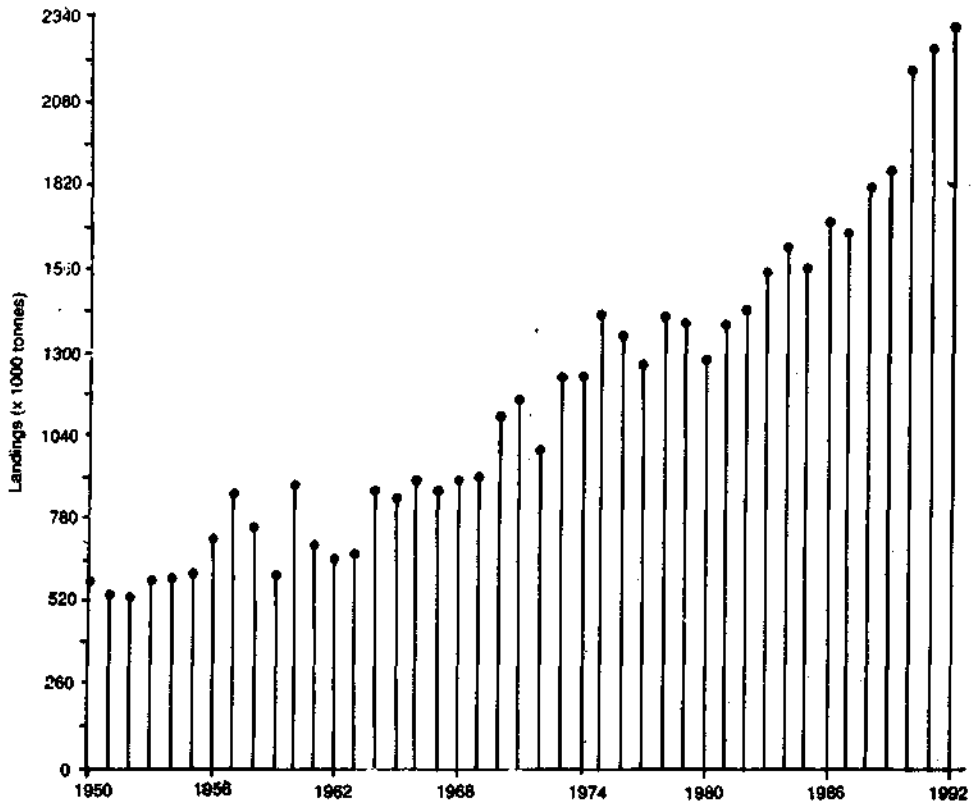

Fig. 1. Marine fish production in India during 1950–92.

Alagaraja and Srinath 1987; Annigeri 1987; Kasim 1987; Devaraj and Gulati 1988; Chakraborthy 1989; Karthikeyan *et al.* 1989; Kasim and Hamsa 1989; Kasim *et al.* 1989) have shown that the effort in each case is close to or crossed the level that gives maximum sustainable yield (MSY) and further increase in the effort in the 0–50 m depths is likely to further reduce the catch rates, which in quite some cases are already showing declining trends. The working group on revalidation of potential yield (Anonymous 1991) has also clearly shown that the yield in the 0–50 m depth range is close to the potential yield.

The stock assessments made on over 45 species now show that in case of major exploited pelagic finfish stocks like those of oil sardine, Indian mackerel, tunas, seerfishes, pomfrets and Bombay duck the exploitation has reached or crossed MSY levels. The stocks of lesser sardines, white baits, oceanic tunas, carangids and ribbon fish offer marginal scope of increased yield in the 0–50 m depth.

The studies on dynamics of croakers, threadfin breams and silverbellies, among the demersal finfish, show that these resources are exploited to their optimal level in the fishing grounds of 0–50 m depth. The catfishes

which are exploited on a large scale by purse seiners along Karnataka coast suffered over-exploitation because of large scale fishing on brooders; it has been estimated that, on an average, eight million eggs of *Tachysurus tenuispinis* are destroyed by exploitation of brooders (Bensam, in this issue) every year.

In case of cephalopods (molluscan shellfish) the stock assessment studies show that the level of exploitation is optimum along both the coasts for *Loligo duvauceli*. In case of *Sepia aculeata* and *S. pharaonis* the effort is optimum along east coast whereas along west coast there is scope for increasing production by increasing the effort in the existing trawling grounds.

Several species of bivalves (edible oyster, windowpane oyster, mussels and clams) and gastropods (chank, top shell, turban shell and a variety of ornamental gastropods) are exploited for human consumption or for ornamental purposes from seas, estuaries and backwaters along the Indian coasts. Though the technology of hatchery production of seed and sea ranching has been developed, not much is known on the resource characteristics and population parameters of bivalves and gastropods in the country excepting a few cases (Narasimham 1987, 1988; Devaraj and Ravichandran 1988; Pota and Patel 1988).

Most of the species of crustacean shellfish are exploited beyond optimum levels. *Penaeus semisulcatus* and *P. indicus*, as revealed by stock assessment studies, are heavily exploited along east coast and there is need to reduce the fishing effort. In *P. monodon*, also from the east coast, though there is scope to increase effort to harvest the MSY, it has been recommended that the present effort may be maintained because further increase in the effort from the same area is likely to result in reduced returns per unit effort. In *Metapenaeus monoceros* there is not much scope to increase yield by increasing effort; there is need to reduce effort to ensure optimum exploitation of *M. dobsoni*. Similar is the case with the lobster *Panulirus polyphagus* along Maharashtra coast. In *Acetes indicus* along Maharashtra coast, the stock assessment study shows that increased yield can be obtained by increasing the dol net effort.

In case of many trawl-caught species, it has also been observed that the present cod end mesh sizes are smaller than those which yield MSY in the long run. Therefore, increase in cod end mesh size has been recommended in several instances.

The future

It is clear from the above that it is only a matter of sound management of the resources and there is no scope for any increase in production from the 0–50 m depth grounds by increasing the effort. Moreover, the stock assessment studies show different management options for different species in the same fishery. For example, in a particular trawl fishery, the present effort may be greater than the one that yields MSY of some species, less than that yielding MSY in some other species, and may be the same which gives MSY in still other species; similar situation may be seen with regard to cod end mesh size of trawl net also. In such situations, it becomes difficult to recommend measures of effort or mesh regulations. Though some attempts of mixed fisheries assessments are made in India (Murty 1985, 1989), considerable research effort into the assessment of multi-species or mixed fisheries is essential to be able to formulate effective management policies. This area of research needs encouragement and priority consideration by adequately funding the programmes and by arranging training to the scientists involved in the programme.

Though the situation in the currently fished regions is not encouraging in the sense that there is no scope for increasing production, the regions beyond 50 m depth in the EEZ offer considerable scope for the same. The potential yield from this region has been estimated as 1.7 million tonnes (Sudarsan *et al.* 1990, Anonymous 1991). As this region is virtually unexploited the much needed increase in fish production can be obtained from this area. Of the total estimated potential in this zone, 70% is constituted by pelagic resources (including oceanic tuna), 19% by demersal resources and the rest by others including a variety of low-value fishes, crabs, etc.

Among the pelagic resources, carangids (horse mackerels, scads, travellys), coastal and oceanic tunas, ribbon fish, mackerel and pelagic sharks constitute the bulk of the resource available for exploitation, forming 97% of total estimated potential of pelagic resources.

For carangids, the northwest coast has the highest potential constituting 46% of the total, followed by southwest coast (28%), southeast coast (14%) and northeast coast (12%). Along northwest coast, about 73 000 tonnes can be exploited by trawlers and the remaining (67 000) by other gears. In the other regions, major harvest of this resource can be made by other gears only. For the coastal tuna, of the total potential of 242 000 tonnes, 28% can be harvested from off southwest coast and almost the entire remaining quantity from around Andaman and Lakshadweep islands. Out of a total of 216 000 tonnes of ribbon fish, estimated to be available for exploitation beyond 50 m depth zone in the EEZ, 52% can be harvested from off northwest coast followed by 35% from southwest coast and the remaining from the east coast. Of the 62 000 tonnes potential yield of mackerel, about 80% can be taken from off the northeast coast and the entire quantity is available for exploitation by trawlers. West coast contributes to the bulk of pelagic sharks.

Among demersal finfish resources, the threadfin breams, groupers, snappers, catfish and bull's eye offer immense scope for exploitation beyond 50 m depth followed by croakers, lizard fish and others (Sudarsan *et al.* 1990). Of the estimated potential of 110 000 tonnes of threadfin breams, 65% is from northwest coast, 23% from southwest coast, 10% from southeast coast and the rest from the northeast coast. Similarly, the bulk of catfish and bull's eye potential is available off northwest coast followed by southwest coast. Same is the case with croakers and lizard fish. The groupers and snappers are known to be abundant in the rocky and coralline areas along west coast beyond 75 m depth (Silas 1969, Bapat *et al.* 1982, Oomen 1989), in the 36–64 m depth zone of the Wadge bank (Joseph *et al.* 1987) and in the Gulf of Mannar (Somavanshi and Bhar 1984). As most of these grounds are rough and are not fit for trawling, fishing by traps has to be done on a commercial scale to effectively exploit these resources. Menon *et al.* (1977) have already shown the possibility of this approach.

Among the deep-sea prawns and lobsters, over 85% of estimated potential yield (9 000 tonnes) is available along southwest coast in depths beyond 50 m. In case of squid and cuttlefish, of the total estimated potential yield of 20 600 tonnes (Sudarsan *et al.* 1990), 72% is available off northwest coast of India, 23% off southwest coast and the rest from the east coast.

It is thus clear that the region beyond 50 m depth in the EEZ offers immense scope to harvest several resources. It is also clear that this region off Indian west coast, particularly off northwest coast, is most productive for most resources and emphasis on deploying effort in this depth zone should be maximum

in this area. In case of tunas, however, the oceanic areas around Lakshadweep and Andamans offer immense scope for increasing production. For mackerel the northeast coast offers immense scope for exploitation by trawls.

It has been recently estimated (GLOBEC, 1993) that a potential of 100 million tonnes of myctophids (particularly of *Benthosema pterotum*) is available in the Arabian Sea. While further researches on the distribution pattern in space and time and biological characteristics of species contributing to such a large potential (which is almost the same as world fish production) are needed, this resource seems to offer immense scope for exploitation and utilization for fish meal production or for making fish protein concentrate.

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