Marine Fisheries of Karnataka State, India

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Abstract

This contribution provides an overview of the marine capture fisheries off the coast of Karnataka State, India. It covers the main fisheries and fishing gears, production trends (by main species/groups and gears), assessment results and fisheries management. Marine fisheries production in the State increased from about 57 000 t/year during the 1950s to a peak of about 250 000 t in 1989, declining to about 150 000 t/year by 1995. Substantive changes have been noted in dominant gears and species/groups contributing to the catch between 1980-84 and 1990-95. Results of assessments indicate that many commercially important stocks are overfished, thus requiring a reduction in fishing effort.

Introduction

Karnataka State along the southwest coast of India (Fig. 1) is at the forefront of marine fisheries development in India. Historically known as the 'mackerel coast', it has a coastline of 300 km and a shelf of about 25 000 km². The State's contribution to total marine fish production in India has varied between 6% and 14% annually. Karnataka State has been a pioneer in the introduction of mechanized fishing technologies, development of fishing ports and improvement of the living standards of fishers. The State has the largest purse seine fleet in India and its trawl fleet is modern and dynamic. The introduction of more efficient gears resulted in a steep increase in marine catches in the 1970s and 1980s. However, catch and catch rates either stabilized or decreased by the mid-1990s for major gears like purse seine and trawl. This has led to lower profits for fishers and less revenue for the State. This paper provides an overview of the marine fisheries of Karnataka State during the period 1990-95. It represents an update of an earlier study covering the period 1980-84 (Kurup et al. 1987).

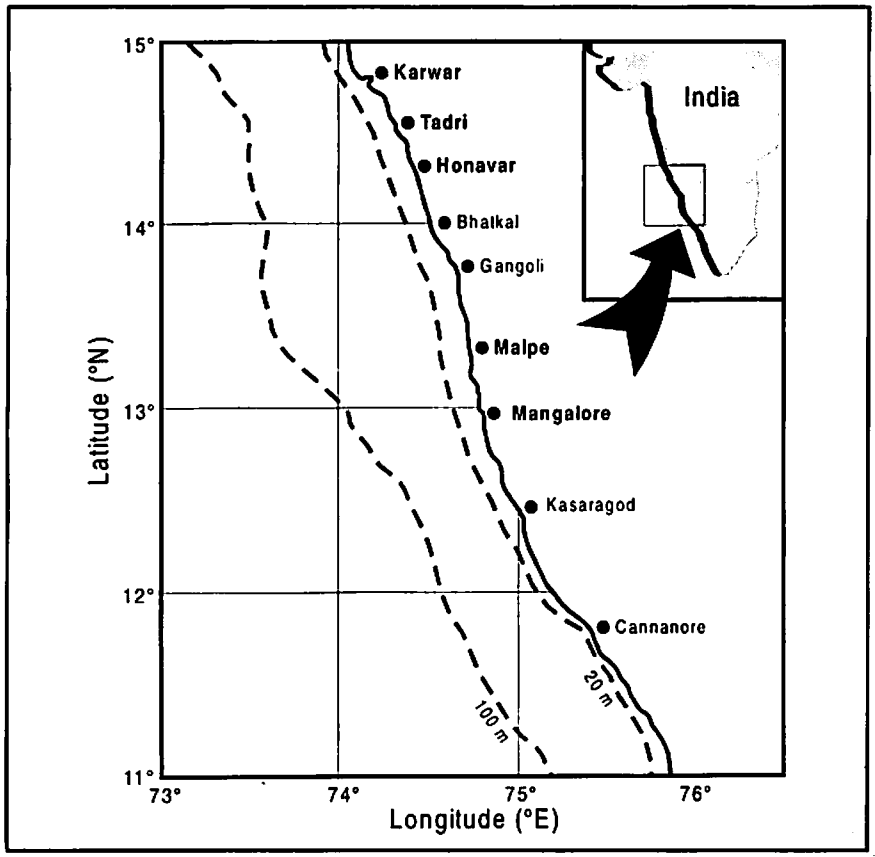

Fig. 1 Coastal area of Karnataka State, India, showing location of major (bold) and minor fishing ports. Over 90% of marine fish production are landed off the five major ports, the rest of the landings are distributed among the four minor ports and 19 other fish landing centers along the coast.

The Fisheries

The State has two coastal districts, Dakshina Kannada (DK) and Uttara Kannada (UK). Over a dozen rivers originating from the western *ghats* drain into the Arabian Sea in these two districts making the inshore waters highly productive. Pelagics (such as mackerel and sardines), demersal finfishes, prawns and cephalopods

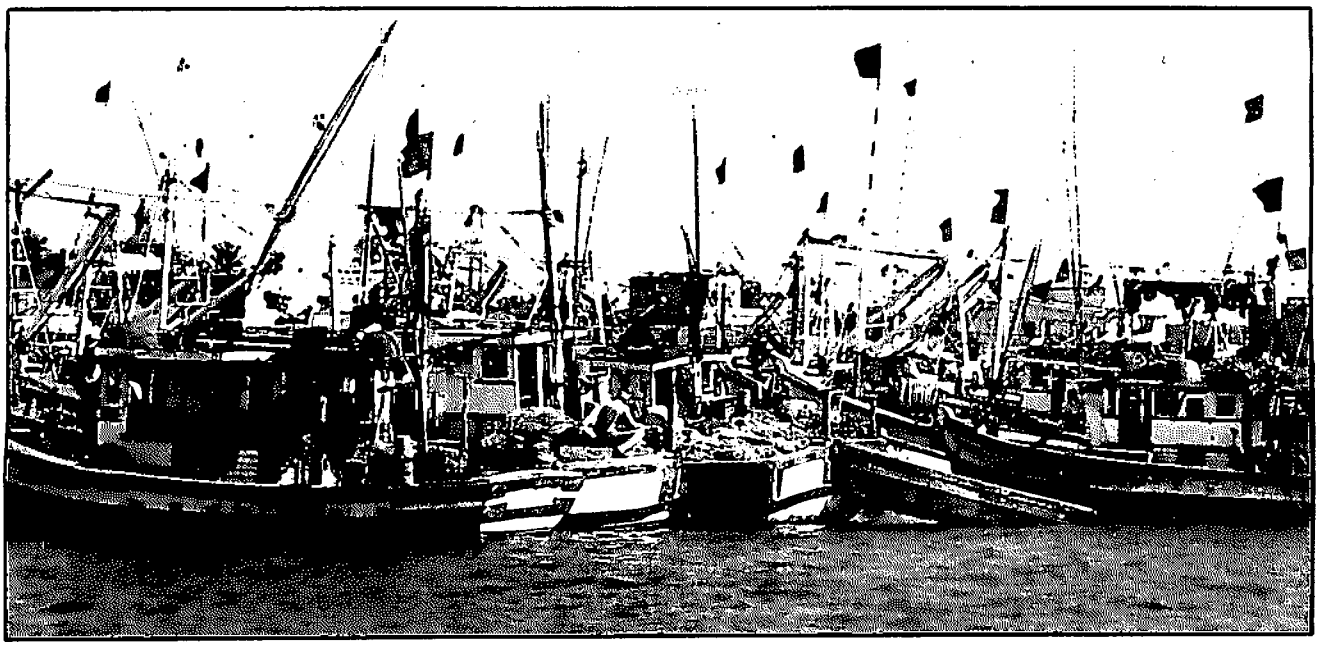

Fig. 2. Purse seine and trawl boats docked at Mangalore fishing port.

are landed at 28 fish landing centers along the coast. Of these landing centers, five are major and four are minor fishing ports. Over 90% of the marine fish production comes from the major ports of Mangalore and Malpe in DK district and Honavar, Tadri and Karwar in UK district (Fig. 1). The major ports cater almost exclusively to the mechanized fishing sector (Figs. 2 and 3), the principal gears being trawl, purse seine and gillnet in addition to a few small longliners. Mechanized trawl fishing is carried out principally by two fleets: the multi-day fleet and single-day fleet (Zacharia et al. 1996). The multi-day fleet, whose number is growing at a fast pace, undertakes voyages lasting up to 7 days and operates in depths up to 100 m. The largest fleet is made up of small coastal trawlers which are 30-32 feet long, operating daily in nearshore areas up to 25 m depth. Their number is decreasing due to dwindling profits. There have been no additions to the fleet in the past few years. The purse seine fleet is mainly concentrated in the major ports and some boats have also been operating as combination vessels (purse seining during the peak season in pelagic catch, and multi-day trawling during the rest of the fishing season). Recently, multi-day longliners have been used primarily for shark fishing.

Karnataka State has developed the infrastructure to process and market its marine fish production. The State has 98 ice plants, 35 cold storage facilities, 22 freezing plants, 10 canning plants, 21 fish meal plants and 4 fish oil plants. The large number of ice plants (with a production capacity of 1 300 t/day) is primarily because of substantial demand from multi-day trawlers. There are currently 68 primary fisheries' cooperative societies and 2 cooperative fish marketing federations in the two coastal districts.

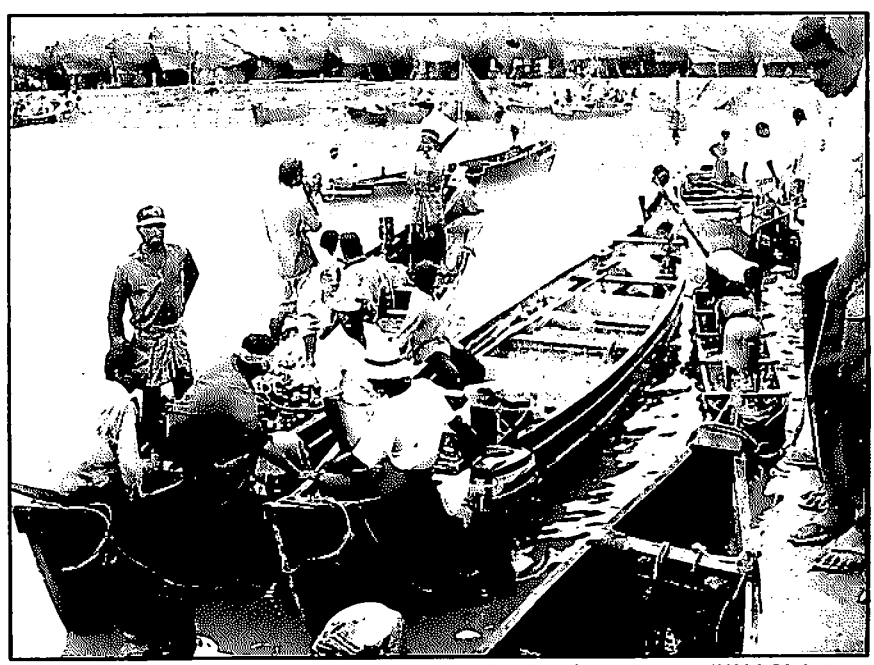

Fig. 3. Mechanized (MAG) and non-mechanized artisanal gear (NMAG) boats landing their catch at Malpe port during monsoon months. Note the beached trawl and purse seine boats in the background.

Trends in Marine Fish Production

From the mid-1950s to the mid-1990s, the average marine fish production in the State was estimated at 112 500 t/year (Table 1). Production peaks were noticed in 1960, 1964, 1970, 1978, 1982 and 1989 (Fig. 4). The production peaks after 1978 were mainly due to the introduction and expansion of purse seiners. Since 1989 there has been a steep decline in production.

The State's average marine fish production per km of coastline has constantly been almost double the national average production since the 1950s. The production increase was steep during the 1970s and 1980s due to heavy exploitation of pelagic resources by the purse seine fleet. However, from the 1980s to the 1990s the State's production has declined while the national average has increased.

Main Fishing Gears

Analysis covering the period 1980-84 (Kurup et al. 1987) showed that in the early 1980s, purse seine was the dominant gear contributing the majority of the catch (Fig. 5), followed by trawl and non-mechanized artisanal gears such as *rampani* or *yendi*. Gillnetting only became popular after 1983 in Karnataka. There were few mechanized artisanal gear operations during the 1980s. The 1990s catch data showed considerable changes. The production of non-mechanized gear and purse seine fell, while the trawl, mechanized gear and gillnet showed increasing usage. The increase in trawl production has been particularly steep, mainly because of the adoption of high opening trawls, larger boats (which can operate away from port up to 7 days) and rapid expansion in fishing grounds to cover depths of up to 100 m. During the 1980s, multi-day fleets accounted for only 35% of the trawl catch, while in the 1990s they contributed nearly 70% (Zacharia et al. 1996).

More than 95% of the annual average catch in Karnataka during 1990-95 was obtained by mechanized gears, of which the purse seine (44.8%) and trawl (43.5%) together accounted for over 88% of the annual average catch. This is similar to the period of 1980-84 when mechanized craft accounted for 84% of total landings in the State (Kurup et al. 1987). However, during the 1980s, purse seine accounted for 59% and trawl for 25% of the average catch. Clearly, there has been a shift in dominant gears brought about by changes in abundance of resources.

Comparison of standard fishing effort of purse seine and trawl in the State during the periods 1980-84 and 1990-95 show that purse seine effort peaked in 1982, 1990 and 1991 after which there has been a progressive decline. The purse seine catch rate showed a steep decline from the 1980 level of 4 t to 1.5 t per standard effort in 1995, while there has been a steady increase in trawl effort from 1980 to 1983, after which it stabilized to between 150 and 200 000 standard effort units per year. The trawl catch rate showed fluctuations between a very narrow range (0.2-0.4 t/standard effort) between 1980 and 1995. Detailed analysis of the trawl fishery from Mangalore-Malpe showed that catch rates were decreasing for multi-day fleets while there was marginal improvement in the catch rate for single-day fleets (Mohamed and Zacharia 1997, in press). Results of this study show that the single-day fleet is recovering from overcapitalization, whereas the multi-day fleet catch rates are decreasing indicating decreased profits per boat.

Peak abundance of target species for gillnets is observed during the first, third and fourth quarters of the year, while for purse seine it is during the third and fourth quarters. In trawl, highest abundance is during the first and fourth quarters. The number of species/groups exploited is comparatively high in trawl and low in gillnet and purse seine. Mackerel, a species exploited by all gears, is caught year-round.

Table 1. Average marine fish production and production per km of coastline in Karnataka State compared to the national average.

Period	Karnataka State		All India	
	Ave. production (t)	Ave. production per km of coastline (t/km)	Ave. production (t)	Ave. production per km of coastline (t/km)
1950s	57 400	191.2	634 200	84.4
1960s	63 100	210.4	812 600	108.1
1970s	104 000	346.8	1 249 200	166.2
1980s	165 400	551.3	1 607 300	213.8
1990s	157 500	525.0	2 252 300	299.6

Key Resources

A comparison of the important marine fish groups comprising the catch during 1980-84 and 1990-95 is given in Fig. 6. The figure shows remarkable changes in catch composition. During the 1980s, pelagic resources like oil sardine, mackerel and anchovies made up nearly 50% of the catch. In the 1990s, oil sardine dropped from 33% to 7% and other new resources exploited by trawl like nemipterids, cephalopods, flatfishes, ribbonfishes and carangids have increased in relative terms. The percentage of prawns remained more or less the same during both periods.

Mackerel, a pelagic resource exploited by all gears (mechanized and non-mechanized), in-

creased from 9% to 20% thus becoming the single largest component of the catch. By sheer volume, oil sardine and mackerel have traditionally been the mainstay of the State's marine fisheries. Their catches are characterized by wide fluctuations (Fig. 7). Since 1988, there has been a steady decrease in the catch of oil sardine along the Karnataka coast. The reasons for this are currently being investigated. Large fluctuations in abundance are quite common among small coastal pelagics all over the world. The reasons for the flunctuations are not fully understood but they have been attributed to a number of biotic and abiotic factors.

The most remarkable change has been that of marine catfishes. They formed about 5% of the catch during the 1980s but in the 1990s their catches are almost negligible (Fig. 6). Catfish exploitation by purse seine peaked in 1979, 1982, 1986 and 1988 (Fig. 7). After 1988, there has been a steady fall, something which scientists had predicted (Silas et al. 1980) because of the large-scale exploitation of male brooders. Penaeid prawns have also shown moderate fluctuations in the landings, but their catches have remained below maximum sustainable yield (MSY) levels. Cephalopods also show a dramatic increase (mainly squids, but lately also cuttlefish). Until 1985, their catches were meager but they rose steadily until 1994. This is principally because of the increased operation of multi-day fleets in deeper areas using high opening trawls. Exportable and commanding good prices, squids and cuttlefishes are increasingly targeted by the multi-day fleets operators, forming about 26% of their total revenue (Zacharia et al. 1996).

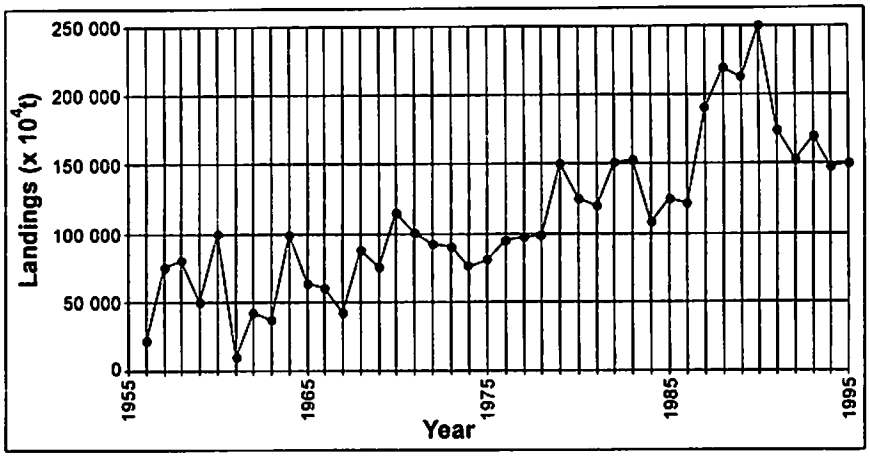

Fig. 4. Estimate of marine landings in Karnataka State, India, from 1956 to 1995.

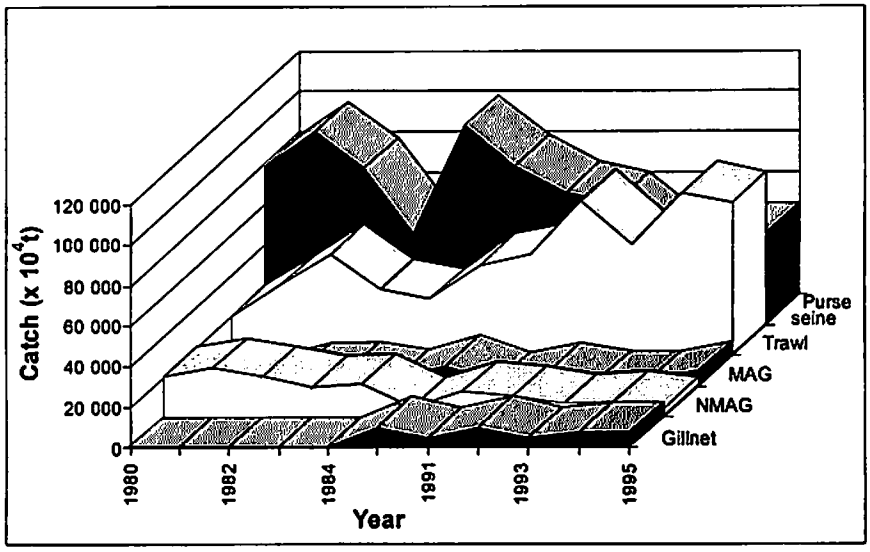

Fig. 5. Catch by fishing gear/group in Karnataka State during the periods 1980-1984 and 1990-1995 (MAG: mechanized artisanal gears; NMAG: non-mechanized artisanal gears).

Research and Management

Fisheries and biological research has been principally carried out by the Central Marine Fisheries Research Institute (CMFRI) since the late 1950s. Biological studies have

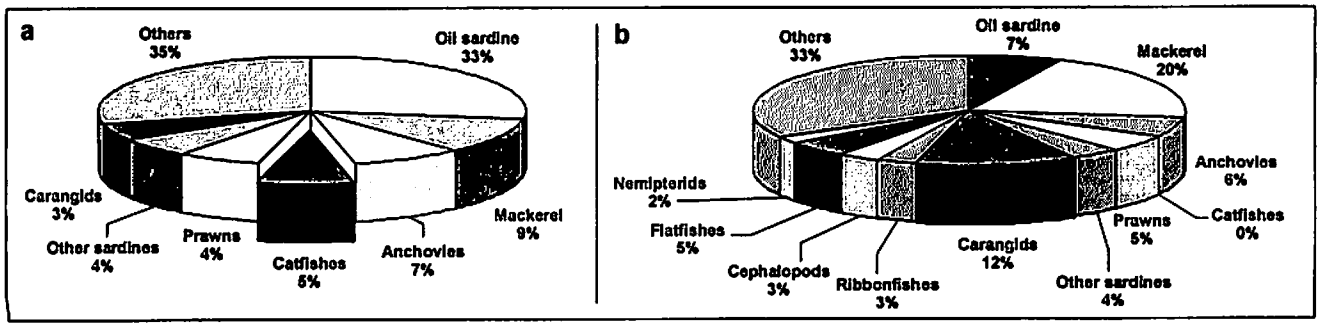

Fig. 6. Main species/groups comprising the catch in Karnataka State during the periods (a) 1980-1984 and (b) 1990-1995.

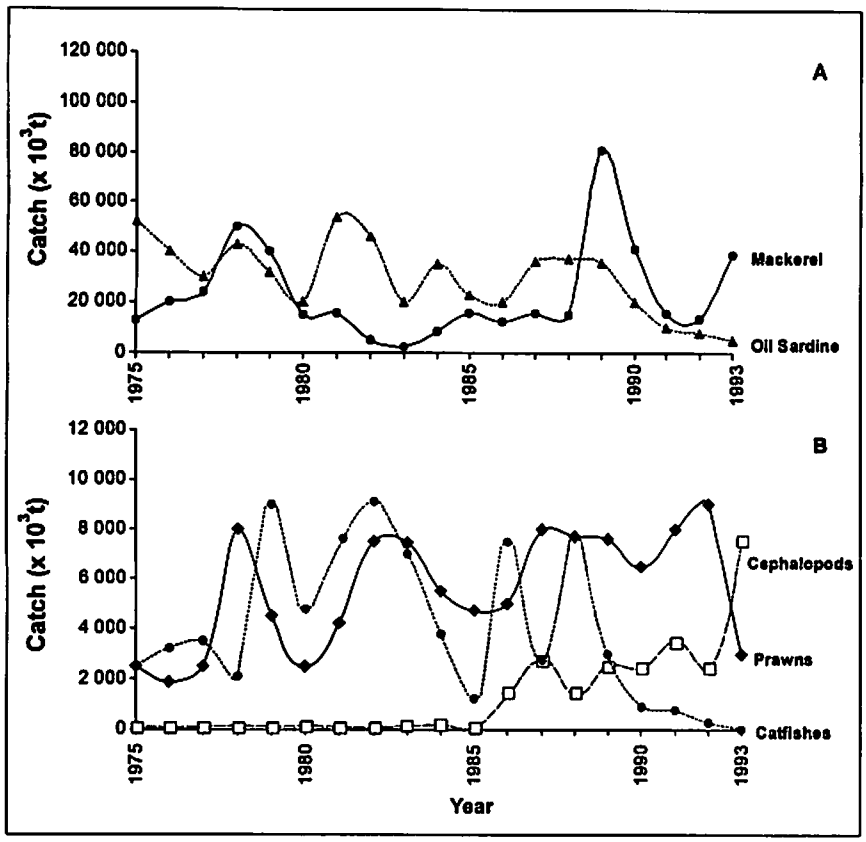

Fig. 7. Catch of selected (A) pelagic and (B) demersal groups in Karnataka State (1975-1993).

indicated the breeding season of all important fish stocks. The stock biomass and dynamics of mackerel (Devaraj et al. 1994), squid (Mohamed and Rao, in press) and threadfin bream (Zacharia 1997) has been studied. Assessment studies of all important stocks in the State have been carried out and some of the more recent results are summarized in Table 2. The results indicate that many commercially important resources (like prawns, squid and demersal finfishes such as whitefish, lizardfish and catfish) are overexploited and that effort levels need to be reduced. Marine fisheries along the Karnataka coast are very dynamic with the fishing grounds expanding every year and a gradual decrease in the mesh size being used. Nonetheless, a reduction in fishing effort for purse seine and trawl fleets is warranted as past studies have shown such a necessity for most species groups. Given the multispecies/multigear nature of the fisheries, however, it is difficult to make re-

Table.2. Summary of assessment results on selected marine fishery resources in Karnataka State.

	Species/group	Region	Exploitation status	Source
Prawns	*Metapenaeus dobsoni*	Karnataka	Overexploited	Sukumaran et al. (1993a)
	Metapenaeus monoceros	Karnataka	At optimum level	Sukumaran et al. (1993b)
Crabs	*Portunus sanguinolentus*	Karnataka	Overexploited	Sukumaran and
	Portunus pelagicus	Karnataka	Overexploited	Neelkantan (1996)
Lizardfishes	*Saurida* spp.	Mangalore	Overexploited	Zacharia (1995)
Threadfin bream	*Nemipterus japonicus*	Karnataka	At optimum level	Zacharia (1997)
Whitefish	*Lactarius lactarius*	Mangalore	Overexploited	Zacharia (1997)
Flatfish	*C. macrostomus*	Mangalore	Near MSY level	Zacharia (1997)
Squids	*Loligo duvauceli*	Mangalore	Overexploited	Mohamed (1996)
	Loligo duvauceli	Karnataka	Overexploited	Mohamed and Rao (in press)
Trawl resources	Single-day fleet	Mangalore-	Optimum level	Mohamed and Zacharia
	Multi-day fleet	Malpe	Above optimum level	(in press)
Purse seine resources	All species	Karnataka	Optimum level	Devaraj et al. (1994)
	Mackerel	Karnataka	Overexploited	
Seerfishes	*Scomberomorus commerson*	Karnataka	Overexploited	Zacharia (1997 ms)

source management decisions based on studies of single species. Attempts are being made to direct research toward management of the resources using the ecosystem concept.

Management of marine fishery resources has received the attention of the State Government and the State Fisheries Department. The government of Karnataka (GOK) passed the Marine Fisheries Regulation Act in July 1986 and the implementing rules were issued in August 1987. Although this act was promulgated as early as 1986, it has not been implemented in full. In 1995, the GOK initiated steps to implement the first part of the act, i.e., registration of all fishing vessels and the licensing of fishing vessels. By consensus, mechanized fleet fishers' associations in the State observe a closed fishing season during the monsoon months (June to August), primarily due to the rough seas prevailing during the period and lack of insurance cover for the fishing boats. Lately, the GOK has issued orders prohibiting operation of mechanized fishing boats from 1 June to 31 August. During this period, the mechanized and non-mechanized gears operate only for exploitation of pelagic resources.

Several self-imposed local regulations exist which are more or less adhered to by all fleets. Local fisheries associations (for example the Karnataka Purse Seine Association) have regulations on rights to a fish shoal at sea and night purse seining (Kemparaju et al. 1992).

So far, the GOK has not implemented management measures for conserving marine fishery resources. According to the FAO framework (Caddy and Mahon 1995), specific actions are incumbent on the State to ensure the flow of scientific advice so that limits to exploitation, with precaution as the key word, are properly set.

Acknowledgments

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