Our fisheries resources and the role of upwelling in their fluctuations

Part I*

MARINE FISH PRODUCTION OF INDIA

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The fisheries of the Indian region, are supported by a large number of pelagic and demersal fishes which are exploited by varied types of craft and gear. The fishing industry in India is passing through a phase of changing over from the traditional to the modern methods of exploitation, from the use of indigenous sailing craft and rather less effective gear to fishing with the help of mechanised craft and the larger powered vessels operating the more efficient types of fishing gear and other ancilliary equipments as the radars, fish finders etc. Exploration and harvesting of the fisheries resources of the ocean depths and high seas and a more intensive applied fisheries research especially in the field of processing is of considerable importance to the country. The object of this series is to present a brief account of the recent findings on the regional and seasonal distribution of the major exploited marine fishery resources, potential fisheries resources available for exploitation and on the influence of upwelling on the wide fluctuations in the availability of fisheries resources.

The ecological relationship between fishes and their environment is of great practical application in fisheries. For any large scale development of our fishery resources a better understanding of the environmental factors influencing the resources is essential. Marine biological and oceanographical investigations in recent years have provided very interesting information on biological and non-biological factors of the environment.

* This is the first of a series of 3 papers by the author.

Non-biological factors influencing fisheries include winds, monsoons, currents, tides, nature of bottom, light, temprature, salinity, pH, nutrient salts etc. Influence of the south-west monsoon on the sea surface is manifested in upwelling along the west coast of India. It has been found that monsoon intensities of certain higher range and associated vertical circulation off the coast is favourable for successful fisheries. In view of this, it is felt desirable to discuss the fluctuations in fisheries and the effect of upwelling on to the continental shelf of cool, oxogen low intermediate waters of the Arabian Sea on the fisheries resources available especially on the south-west coast of India. Before proceeding to detail the influence of upwelling, a general outline of the fluctuations as observed in the exploited marine fisheries resources will be useful.

Marine Fish Production along the coasts of India

India has a coastline of about 5,650 km. The annual marine fish production in India for 1974 and 1975 have been estimated at 1.218 and 1.423 million tonnes respectively. The overall picture of the present status of the exploited marine fishery respurces will be useful to understand the fluctuations in fisheries. In Table 1 some facts on our exploited marine fishery resources are given in order to highlight the trends in marine fish production.

TABLE 1: *Details of State-wise marine fish catch.*

States	Marine fish yield during the period 1962–1975 (in tonnes)			Percentage in total all India catch
	Maximum (year)	Maximum (year)	Average	
Kerala	4,88,269 (1973)	1,92,470 (1962)	3,44,788	35.0
Maharashtra	2,56,619 (1975)	1,23,916 (1968)	1,69,377	17.2
Tamil Nadu	2,29,365 (1975)	1,06,029 (1965)	1,56,922	15.9
Gujarat	1,93,775 (1975)	75,633 (1967)	1,00,444	10.2
Andhra Pradesh	1,58,818 (1974)	60,521 (1962)	88,692	9.0
Karnataka	1,16,936 (1970)	39,176 (1963)	78,851	8.0
Goa	39,980 (1971)	12,460 (1967)	23,269	2.4
W. Bengal & Orissa	45,761 (1975)	8,387 (1962)	20,336	2.1
Lakshadweep	2,931 (1975)	79 (1964)	1,115	0.1
Andamans	1,104 (1975)	148 (1964)	493	0.1
All India	14,22,693 (1975)	6,44,244 (1962)	9,84,287	100

a) All India marine fish production

The annual marine fish catch during 1962–1975 ranged from 644,244 tonnes

(1962) to 1,422,693 tonnes (1975), with an average of 984,160 tonnes. Inaia ranked seventh in the world's fish producing countries, the first six countries being Peru, Japan, USSR, Norway, U. S. A. and Chile. India's contribution is about 40% of the marine fish production of all the countries in the Indian Ocean region.

Fishing at present is mainly confined to the coastal waters upto 50m depth. Along the south-west coast of India, fishing has been extended of late to grounds upto about 450m for perches, deep-water lobsters, prawns and other demersal fishes. The major group or species of pelagic fish along the Indian coasts consist of oil sardine, lesser sardines, *Chirocentrus* spp., *Hilsa* spp., *Anchoviella* spp., *Trissocles* spp., other clupeids, mackerel. seerfishes, tunnies, Bombay duck, half beaks, gar fishes, flying fishes, ribbon fishes, carangids, *Sphyraena* spp., and *Mugil* spp. Demersal fishes of importance comprise elasmobranchs, eels, cat fishes, perches, lizard fishes, red mullets, polynemids, sciaenids, silver bellies, *Lactarius*, pomfrets, soles, prawns, other crustaceans, and cephalopods. In Lakshadweep, the bulk of the catch consists of tunas, particularly the skipjack. Perches and anchovies form the major fishery in Andaman Islands.

The total catch along the west coast shows considerable annual and seasonal fluctuations. Although there has been a steep decline in the total catch due to the failure of oil sardine and mackerel fisheries during 1971 and 1974, an overall increase from 1962 to 1975 is noticeable. Along the east coast, a general increasing trend is noticeable except for minor decline in 1965, 1969, 1971 and 1974. The average catch for the west coast is about 75% of the total all India landings, while it is only 25% for the east coast. Multiple species fishery such as those of oil sardine, mackerel and Bomhay duck contribute to the major fisheries of the west coast.

Among the maritime states Kerala ranks first in the total marine fish production in the country (35%) followed by Maharashtra (17.2%), Tamil Nadu (15.2%), Gujarat 10,2%), Andhra Pradesh (9%),, Karnataka (8%), Goa (2.4%) and West Bengal and Orissa (2.1%). The Union territories of Andamans and Lakshadweep contribute less than 0.2 percent. The average catch data for the period 1962–1975 indicate that the best fishing season for the country as a whole is during the fourth quarter viz., October to December when all the maritime States of the west coast of India record higher landings. For Maharashtra and Gujarat, the period July to September (3rd quarter) and for Kerala and Karnataka the period April to June (2nd quarter) show relatively poor landings. On the east coast the period of higher landings vary from state to state. In West Bengal and Orissa, the peak fishing period is during October to December (4th quarter) while in Andhra Pradesh and Tamil Nadu it is from January to March (1st quarter). Fishing is relatively poor in these two States during the period April to June (2nd quarter).

b) **Variety wise abundance**

The first five categories whose landings are over 40,000 tonnes are the oil sardines, Bombay duck, crustaceans (chiefly the penaeid and non-penaeid prawns), mackerel and elasmobranchs. The landings of other sardines, ribbon fishes, cat fishes, sciaenids, *Anchoviella* spp., carangids, other clupeiform fishes, *Leiagnathus* and pomfrets are between 20 and 40 thousand tonnes.

i) *Pelagic Fishery*

The landings of mackerel, oil sardine and Bombay duck which are the most important fisheries on the west coast are given in Table 2. It is evident that the landings of pelagic fishes along the west coast of India, particularly during the last few years show wide fluctuations. The decline in the fishery for Bombay duck in Gujarat (1972-1974) and the partial failure in the mackerel and oil sardine fishery in some years along the Kerala, Karnataka and Goa coasts have been mainly responsible for this. An all time high catch of mackerel of about two lakh tonnes was recorded along Kerala, Karnataka and Goa coasts during 1971, but the catch fell to 37,462 tonnes in 1974 and 45,947 tonnes in 1975. The oil sardine catch during 1968 which was an all time high record of 3.02 lakh tonnes declined to 1.27 lakh tonnes in 1972. Subsequently, it has showed some increase in 1975 (159,240 tonnes). The annual catch of oil sardine for 1962–1975 period was 191,692 metric tons. The lowest catch of 63,647 tonnes was in 1964 and the highest catch of 3,01,641 tonnes in 1968 formed about 31.9% of the total catch that year. It may be seen that the annual fluctuations in the catches of no other species of commercial fish are so marked as those of oil sardine. When the fishery is good, it forms about a third of the marine fish catch of the country. The fisheries for sardine are important in two maritime States, Kerala and Karnataka. It is seen that Kerala's oil sardine catch is about a half of the marine fish catch of the State and it is about 8 times the catch of the oil sardine in Karnataka. The unique position of Kerala in the oil sardine fishery of India is abundantly clear from the above.

TABLE 2: *Total all India catch of Mackerel, Oil Sardine and Bombay Duck for the period 1962-1975 (in tonnes)*

	Mackerel	Oil Sardine	Bombay Duck
1962	29,103	1,10,299	83,934
1963	76,980	63,647	91,853
1964	23,863	2,74,333	81,342
1965	43,095	2,61,863	73,894
1966	31,959	2,47,214	77,363
1967	29,445	2,56,326	74,942
1968	21,703	3,01,641	82,501
1969	91,837	1,74,249	76,276
1970	1,37,607	2,26,984	78,443
1971	2,04,575	2,09,261	71,508
1972	1,08,971	1,27,568	51,570
1973	79,423	1,44.395	64,345
1974	37,462	1,26,676	61,138
1975	45,947	1,59,240	99,614
Average	68,712	1,91,693	76,337

Oil satdine occurs in abundance supporting a good fishery from Quilon in the south to Ratnagiri in the north. Beyond

the northern border of Karnataka, the catches dwindle. In Tamil Nadu and Andhra Pradesh only stray catches are met with. In both the States. Kerala and Karnataka, the landings in the fourth quarter are the highest, in the first quarter moderate and in the third and second quarters poor. The fishery commences on the west coast after the south-west monsoon. Big sized fishes in advanced stages of maturity along with small sized sardines appear in August–October. In the peak fishing season from September to January the catches consist chiefly of juveniles ranging from 12 to 15 cm., the fishery gradually decreases and is closed by about April.

The annual average of the mackerel landings in India during 1962–1975 was 68,712 tonnes. The lowest catch of 21,703 tonnes was in 1968, and the highst catch of 204,575 was in 1971. Unlike the oil sardine fishery which is confined to the west coast, the mackerel is found on both the coasts, although the bulk of the landings to the extent of about 80% are on the west coast. The annual average landings have been highest in Karnata, in October–November. However, in Karwar and South Kanara two peaks are noticed, one at the beginning and the other at the end of the fishing season. The mackerel landings are highest in the fourth quarter and moderate in the first quarter and poor in the second and third quarters of the year in Maharashtra, Karnataka and Kerala States. In Tamil Nadu, the third quarter's catches are the highest and the fourth quarter's the lowest. In Andhra, the catches are uniformly moderate in all the quarters except in the third quarter when they are lowest. Mackerel fishery is confined to the inshore regions, but small numbers are occasionally obtained from deeper waters off the coasts of Bombay and Saurashtra.

Hardly anything is known about the pelagic fishery resources of the north-west coast and the east coast. Available information indicates the occurrence of mackerel, sardine, lesser sardines, anchovies and other important groups of pelagic fishes from these areas also. Epipelagic and mesopelagic fishes such as Myctophidae and oceanic squids also are found in quantities in these areas. Planned exploratory surveys in these areas are essential to assess the pelagic fisheries potential.

iii) **Demersal fishery**

The landings of demersal fishes, particularly penaeid and non-penaeid prawns, sciaenids, silver bellies and pomfrets showed an increase during the period 1968–1975, though in 1974 there is a marginal decline in most of the demersal fisheries. The major factor contributing to the slight but steady increase in demersal fish catch for the country as a whole from 1968 to 1975 is the marked increase in the total catch of marine fish for Maharashtra during the above period consequent on the steep increase in the catch of prawns there. The crustaceans have formed about 11% of the total marine fish catches of India in the annual average landings. Prawns are caught in all the maritime States of India, and the landings (based on the average for 1970–1975) show that Maharashtra leads with a catch of 82,328 tonnes followed by Kerala with 55,210

tonnes and Andhra Pradesh with a catch of 8,982 tonnes. As regards seasonal trends, in Gujarat and Maharashtra crustacean catches are the highest in rhe second quarter and lowest in the third quarter, in the first and fourth quarters the landings are fairly high. In Kerala, the catches are moderate in the second and fourth quarters and poor in the first quarter. In Tamil Nadu, although the fourth quarter, catches are the lowest, there is no significant variation from quarter to quarter. Trawling is almost exclusively carried out for prawns on account of the export market. The overall anticipated increase in the demersal catch of the country is to some extent effected by the increased effort in only limited grounds and the lesser exploitation of other demersal resources. The economic feasibility of operating larger fishing vessels in offshore and distant grounds have to be investigated with a view to diversification in fishing. This is especially important for the shelf waters of Maharashtra and Gujarat as well as along most parts of the east coast.

It is evident from the above that the landings of fishes, both demersal and pelagic have shown large fluctuations. The existing fisheries are seasonal, the season being clearly demearcated by the two monsoons. In some years very large shoals of fish are found in coastal waters, while in other years no such large scale incurrsion to the coastal waters occurs. It is not known whether the violent fluctuations were the refections of the stock potential or merely changes in distribution and availability owing to variations in the environmental conditions. It is difficult for the industry for planned exploitation of the resources in the absence of this information. A definite knowledge of the resources position and its availability is essential to decide on the type and number of fishing vessels to be operated, the nature and extent of the shore facilities to be established, the methodologies for the handling, processing and distribution of the catches and the magnitude of the investments required.

There are good pelagic fishery resources constituted chiefly by the sardines and mackerel and also a fair abundance of demersal fishery resources constituted by a variety of ground fishes, prawns and other crustaceans. The potential of the resources is believed to be much greater than the present production. Exploratory and scientific expeditions in recent years have furnished valuable information on the available resources along our coasts and also to some extent on the environmental factors determining the fluctuations in the important zonal fisheries. Quantitative assessments of the potential fisheries resources have been made by various methods in recent years which provide valuable information on the possibilities of large scale fishing. These will be dealt in the subsequent parts of this series.

"Pesticide and Heavy metal pollution"

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Introduction

Polluted air ! Poiluted water ! Polluted earth ! Experts worldwide are being frightened with the growing problem of pollution. Scientists and technicians endeavour to solve the problem of planetary contamination before it reaches the point of no return. Can we keep quiet when our environments are dying ? To-day it is practically impossible to maintain absolutely clean air and pristine pure water. However we may control the entry of pollutants into ecosystems to a tolerable level, Only recently we have become aware of the fact that we are exceeding nature's ability and capacity to reprocess the kinds and qualities of wastes which are being produced.

Industrial Pollution

Industrial wastes often contain the metal components like copper, mercury, zinc, arsenic, nickel, lead etc. In the early 1950's, fishermen and their families around Minamata Bay (Japan) were stricken with a mysterious neurological illness. The Minamata disease, as it came to be called, caused progressive weakening of the muscles, loss of vision, impairment of other cerebral function, eventual paralysis and in some cases Coma and death. It caused structural injury to the brain. People soon observed that Minamata sea birds and household Cats, which like the fisherfo lk subsist mainly on fish, showed signs of the same disease. This led to the discovery of high concentrations of mercury compounds in fish and shell fish taken from the Bay and the source of mercury was traced to the effluent from a factory, Since then there have been several other alarming incidents.

In 1956 and 1960 outbreaks of mercurial poisoning involving hundreds of persons took place in Iraq, where farmers who had received grain seeds, treated with mercurial fungicids ate them instead of sowing them. There were similar outbreaks later in Pakistan and Gautemala. In Sweden, mortalities of game birds and other wild life, which fed on mercury