

PROCEEDINGS OF THE SYMPOSIUM  
ON  
**LIVING RESOURCES**  
*of*  
**THE SEAS AROUND INDIA**



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# POLYNEMID FISHERY RESOURCES OF INDIA

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## ABSTRACT

The polynemids contributing to fisheries along the Indian coasts are dealt with. The biological behaviour of the concerned species in relation to their fisheries, especially in the north eastern and north western parts of the country is discussed. The Bombay and Saurashtra waters are the richest, contributing to about 80% of the polynemid landings of this country. The species forming the bulk of the landings *Polydactylus indicus* (Shaw), one of the two polynemids which grows to over a metre in length, the other being *Eleutheronema tetradactylum* (Shaw). The declining trend in the fishery of *P. indicus* is reflected in the low yields of the total polynemids of this country in recent years.

## INTRODUCTION

POLYNEMIDS, popularly known as threadfins, are a group of partly pelagic and partly demersal fishes inhabiting the coastal waters. They occur from considerable depths to shallower waters of the seas and even enter fairly often the estuaries and back waters. The species do not form shoals, for which reason they are not in great abundance, but, moving in schools, they support fisheries of some magnitude. The polynemids in general, are classified as high class table fishes.

Threadfins are widely distributed throughout the tropical belt, but they form sizeable fisheries only in 6 countries, viz., Ghana, Ivory Coast (Africa), India, China, Philippines (Asia) and Australia. Of these, Ghana leads with the catches in the 3 years of 1964 to 1966, ranging from 2.3 to 7.7 thousand metric tons (Anon, 1966) giving an annual average of 5.4 thousand metric tons. India ranks second with the annual average of 2.8 thousand metric tons for the corresponding period; but the average catch of threadfins for the 10-year period from 1956 to 1965, has been recorded as 5.9 thousand metric tons (Kagwade, 1968). In the 3-year period referred to, China closely follows India with an average annual catch of 2.6 thousand metric tons and occupies the third place. Ivory Coast registers more or less steady yields between 1.0 and 1.7 thousand metric tons during these 3 years. This is followed by Philippines with an annual average of 0.3 thousand metric tons of polynemids and Australia with only 0.1 thousand metric tons of these mixed with a few other varieties of fishes in the said period. India's catch was, however, the highest till 1963 in the world polynemid fisheries.

Polynemids are spread over in the tropical waters of Atlantic, Indian and Pacific Oceans and are not so far known to occur in the Red Sea. The members of this group of fish are recognised easily by the presence, on the lower side of the pectoral fins, of free filamentous rays, varying in number and used by the fish as feelers. The nature and the number of these free filamentous rays assist the systematists in the classification of species. Most of the members are small, growing to about 15–25 cm in length but, two of them are known to attain a size of over a meter in length. Some species possess very large air bladder which is used in the making of isinglass. Threadfins are distinguished from the closely related mullets, by the possession of a lateral line. The purpose of this paper is to indicate the polynemid fishery resources in the Indian waters and the extent to which they are exploited at present,

## POLYNEMID SPECIES IN THE INDIAN WATERS

From the extensive literature on the systematics of fishes, the polynemids in the Indian Ocean are known to occur in the east coast of South Africa, Madagascar, Mauritius, Pakistan, India including Andaman Islands, Ceylon, Burma and Singapore.

There are 9 species recorded from the coastal waters of India (Fig. 1.) they being, *Eleutheronema tetradactylum* (Shaw), *Polynemus plebeius* Brouss., *P. sexifilis* Cuv. and Val., *P. sextarius* Bloch., *P. xanthonemus* Cuv. and Val., *P. heptadactylus* Cuv. and Val., *P. paradiseus* Linn. *P. microstoma* Bleeker and *Polydactylus indicus* (Shaw).

*E. tetradactylum* known as the Indian salmon, occurs all along the east and west coasts. The largest on record is slightly over 6 ft or 180 cm in length (Day, 1878). It is more an estuarine species and ascends higher up the rivers than any others of the family. The young ones of this are found in abundance in the lower reaches of the estuaries in Bengal on the east coast, viz., Hooghly estuary and Matla estuary at Port Canning (Chopra, 1951 and Malhotra, 1953). This is one of the species supporting the major threadfin fishery of Sunderbans (Bhimachar, 1959) on the east coast and of Bombay and Saurashtra on the west coast (Anon, 1941). Its distribution extends from India to China, Formosa, Philippines and North and West Australia.

*P. plebeius* which grows to about 25 cm. in length is known to occur in the sea and brackish-waters in the north-western parts of India. It is found in abundance in the trawling grounds of West Pakistan (Qureshi and Burney, 1952). This species is widely distributed in the Indian and Pacific Oceans from the coast of Natal to Thailand, Japan, Formosa, Philippines, Australia, Solomon Islands, Samoa and Fiji Islands.

*P. sexifilis* is recorded from the East Coast of India (Day, *loc. cit.*). It occurs stray and does not support a fishery.

*P. sextarius* is commonly present in both the coastal waters of India. It grows to about 19 cm. in length. At Madras it is one of the major species supporting the polynemid fishery. Its distribution is noted from the East Coast of Africa to Thailand, China and Australia.

Day (*loc. cit.*) has stated the distribution of *P. xanthonemus* to be in the seas from India to China, but he could not obtain this species from Indian waters.

*P. heptadactylus*, solely a marine species, is found in all the coastal waters of India. It grows up to about 30 cm. in length and occurs in abundance forming a fishery in the Bombay and Saurashtra waters in the north-western part of the country (Kagwade, 1968). Its general distribution is from India through Malaya and Indonesia to New Guinea.

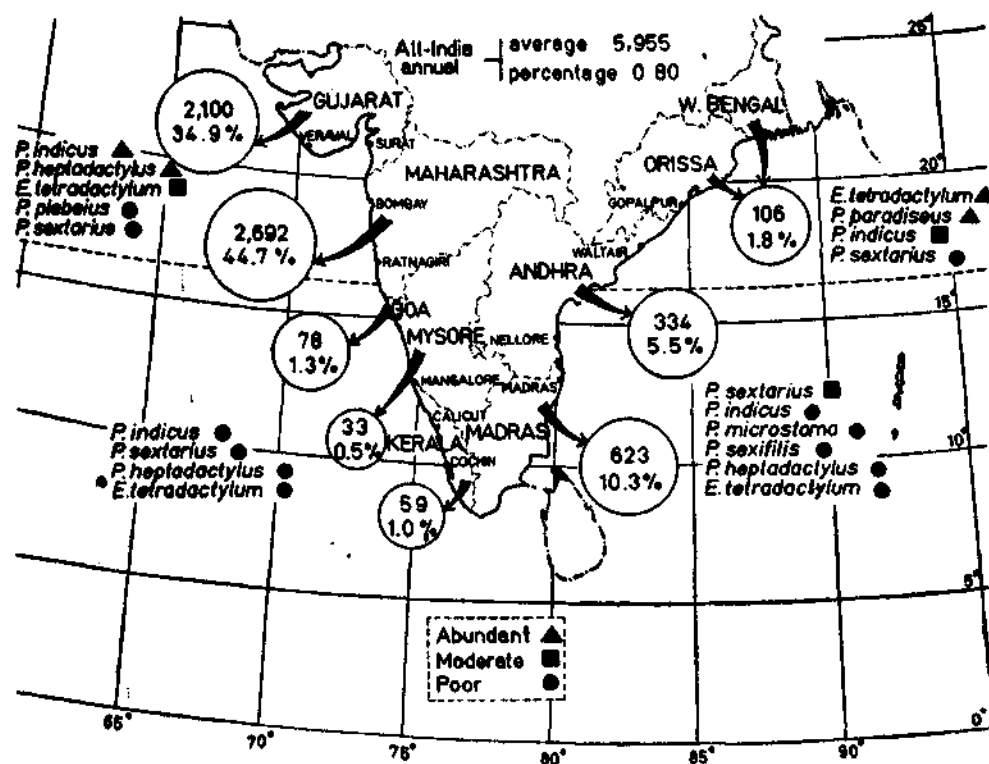
*P. paradiseus*, commonly called mango fish because of the long pectoral filaments, is mostly confined to the region between Bengal and Central Andhra (Kakinada) and attains a size of about 23 cm. in length. This estuarine species is known to enter the Hooghly river up to about 150 miles from sea for breeding, from about April to June (Chopra, *loc. cit.*). It is the second member contributing to the threadfin fishery of Sunderbans. Day (*loc. cit.*) refers to its distribution from India and Burma to Malay Archipelago.

*P. microstoma* has been recorded for the first time from the Indian coast by Rajapandian and Murthy (1966). This was obtained in the trawl catches, off Mandapam in the Gulf of Mannar. It is not known to form a fishery in this country. It is found to occur in the Indonesian islands, Formosa, Philippines and New Guinea.

*P. indicus*, like *E. tetradactylus*, is found all along the coasts of India growing to over a meter in length and forms one of the major threadfin fisheries of this country, especially, in the Bombay

## THE LANDINGS OF POLYNEMIDS (IN M. TONS) IN INDIA DURING 1956-'65

### STATE-WISE ANNUAL AVERAGE AND PERCENTAGE



YEAR	CATCH	% IN TOTAL MARINE FISH	YEAR	CATCH	% IN TOTAL MARINE FISH
1956	8,803	1.23	1961	5,745	0.84
1957	14,501	1.66	1962	2,713	0.42
1958	5,722	0.76	1963	4,331	0.66
1959	7,454	1.28	1964	2,154	0.25
1960	6,421	0.73	1965	1,704	0.20

FIG. 1. Distribution pattern of the polynemid species of India and their total landings in 1955-65.

and Saurashtra waters. It is the third member contributing to the threadfin fisheries of Sunderbans. The distribution of this species is known from Madagascar to Malacca and further east to Australia.

### FISHERY

The extent of the potential resources of polynemids in the Indian waters can be judged from the works of Chopra (*loc. cit.*), Malhotra (*loc. cit.*), Mohamed (1955), Bhimachar (*loc. cit.*), Jayaraman *et al.* (1959), Nayak (1959), Deshpande (1962) and Kagwade (1965 and 1968). This group of fishes is noticed annually to form about 0.80% of the total landings in the 10-year period of 1956-65 (Kagwade, 1968). The major portions of 44.7% and 34.9% of the landings (Fig. 1) are from Maharashtra and Gujarat respectively; thus the bulk of about 80% of the polynemids of the country come from these two north-western states. Of the remaining 20% which is obtained from all other parts of the country, nearly one half comes from Madras State. There appears to be no fishery of any importance of this group of fishes in the seas around Andamans and Laccadives.

### FISHING METHODS

Polynemids are fished by different types of gears, the most commonly used ones being seine nets, gill nets, long lines and hand lines which are all operated by the country crafts, either sailed or mechanised for propulsion. They are known to take both live as well as dead baits in line fishing. In the north-western part of the country where they are found in abundance, they are fished with stake nets ('Dol'), bottom set long lines ('Khanda') and bottom drift gill net ('Waghra Jal'). Of these, the last one is a specialized gear employed almost exclusively for *P. indicus* during the season. The description and the working of this net has been dealt in detail by Deshpande (*loc. cit.*). Excepting in this part of the country (Maharashtra and Gujarat) in no other place of India, there has been any kind of special gear employed to capture exclusively any of the polynemid fishes. In all other types of gears stated earlier, polynemids are landed incidentally along with other demersal fishes. Polynemids are also landed by large trawl nets, viz., the otter trawl and bull trawl, which are operated by the trawlers (Nayak, 1965).

### COMMERCIAL CATCH

The species occurring in commercial abundance in the north-western part of the country are *E. tetradactylum* ('Rawas'), *P. indicus* ('Dara') and *P. heptadactylus* ('Shende'). Of these *E. tetradactylum* is obtained mostly in the inshore fishery though individuals at times appear in the trawl landings also. In January-April and July-September, they appear in abundance (Karandikar and Palekar, 1950).

*P. indicus* occurs to a large extent in the inshore fishery from December to May (Deshpande, *loc. cit.*). In the landings from trawlers operating in deeper waters too, it forms a fair proportion. The intensive exploratory fishing by the Government of India Cutters 'M.T. Ashok' and 'M.T. Pratap' of the Deep Sea Fishing Station, Bombay and the commercial fishing operations by the Japanese vessel 'Taiyo Maru-17' as early as 1951, have located rich trawling grounds of this species on the continental shelf of Bombay and Saurashtra waters (Jayaraman *et al.*, *loc. cit.*). The yield for the 7-year period 1950-51 to 1956-57 (Nayak, 1959) has been found to fluctuate between 12.8% and 26.0% with an annual average of 19.1% in the total trawl landings. A fall in the yield of this species is indicated in the operations by the trawlers 'Arnala'-Paj' and 'Satpati'-Pilotan' of the New India Fisheries Company, a commercial concern, during the period 1956-63 (Kagwade, 1965). It has been observed that during this 8-year period, the fall has been gradual from 5.36 to 0.89% in the total annual catches, thus putting before us great many questions on the exploitation, conservation and management.

The magnitude of the fishery of *P. heptadactylus* in trawling grounds was not known earlier to 1956 until the New India Fisheries trawlers started maintaining separate catch record for this species in their log books. It has been noticed that during the 8-year period between 1956 and 1963, it formed 2.89% on an annual average in the total catch of all fish (Kagwade, 1968). Though not well marked, there was slight decline in the annual yields from 1959 in Cambay and Porbundar and from 1960 in Veraval.

#### DISTRIBUTIONAL PATTERN IN RELATION TO REGIONS AND SEASONS

Based on the latitudes and longitudes, this vast stretch of the continental shelf from Bombay to Kutch, has been charted into 6 major regions of Bombay, Cambay, Veraval, Porbundar, Dwarka and Kutch from south to north in the order (Jayaraman *et al.*, *loc. cit.*; Rao *et al.*, 1966 and Rao, 1967). Further these regions are divided into smaller areas or units of 600 nautical square miles each, for convenience. They are either numbered serially or named alphabetically (Fig. 2).

From the results already on record, it is noticed that Dwarka is the richest of all regions for 'Dara'. During the early years when there was intensive fishing in this region, about 90 to 99% of the annual 'Dara' yield was from here and the species formed to the extent of about 22% in the total annual fish landings from this region. Its annual catch rate was going up to 145 kg. per hour in some years (Kagwade, 1965). Subsequently when Kutch was being heavily exploited, there was a major shift in the bulk of 'Dara' yield from Dwarka to Kutch, the latter region sometimes contributing up to 88% to the total annual 'Dara' landings. Taking into account the catch rates and percentage catches, it is found that Dwarka is better than Kutch. The remaining 4 regions Bombay, Cambay, Veraval and Porbundar recorded 'Dara' of very low order.

The location of 'K' and 'M' in Dwarka region as extremely rich grounds for 'Dara' is in essence, a very great achievement in the history of its fishery. The annual catch rates from these areas were very high exceeding mostly 100 kg. per hour and sometimes even 200 kg. per hour. During the season, the catch rates have even exceeded 300 kg. per hour in some months.

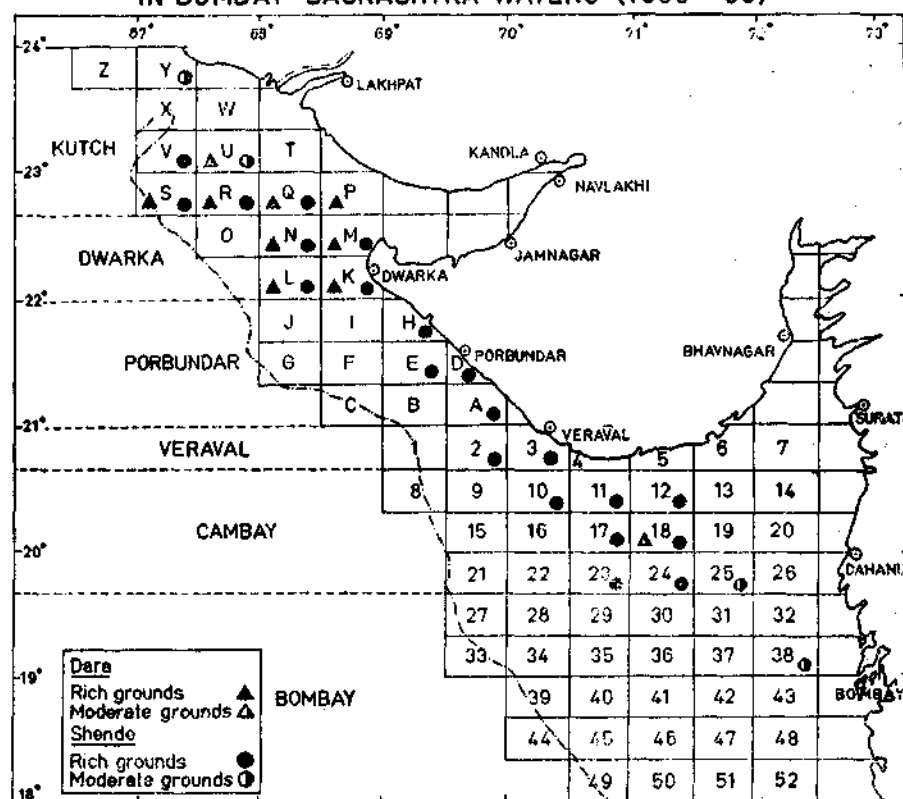
The best yields for 'Dara' are found to be from November to March, though catches of some magnitude continue to be obtained till May; during the rest of the year the catches are poor. 'Dara' is known to prefer waters below 45 meters deep and temperature below 24°C. The fishery is also influenced by the lunar phases, the catches being better in the neap tide periods in the trawler landings and in the spring tide periods in those landed by gears operating in the inshore waters.

The regions Cambay, Dwarka and Kutch are found to be more or less equally good for 'Shende' (Kagwade, 1968). Some of the areas like '11' and '10' in Cambay and 'K', 'M' and 'N' in Dwarka regions registered 'Shende' of over 100 kg. per hour, and even up to 177 kg. per hour in some months. Its fishery has no well defined season and good catches are obtained all round the year. It prefers deeper waters up to about 70 meters where they are recorded to occur in abundance. The trawl catches are more during neap tide periods than during spring tide periods.

#### LIFE-HISTORY

'Dara' has a characteristic size distribution pattern in the Bombay and Saurashtra waters. The trawl catches from Dwarka and Kutch comprise almost all the juveniles which are termed 'Chelna'. These constitute the first 3-year classes, the growth in the first year being about 35 cm. and 20 cm. each in the second and third years (Nayak, 1959). It matures for the first time at about the length of 80 cm. Large mature 'Dara' of over 4 years whose actual age cannot be determined in the absence of information on the method of age reading, are available in considerable numbers

**PRODUCTIVE AREAS AND REGIONAL ANNUAL AVERAGE LANDINGS OF  
"DARA" AND "SHENDE"  
IN BOMBAY-SAURASHTRA WATERS (1956-'63)**



DARA			SHENDE	
CATCH (kg)	C.P.H (kg)	REGION	CATCH (kg)	C.P.H (kg)
19,860	13.97	KUTCH	38,714	26.92
62,103	104.87	DWARKA	14,897	25.15
1,288	1.38	PORBUNDAR	13,100	14.03
384	0.95	VERAVAL	6,863	17.04
377	0.35	CAMBAY	25,824	24.11
128	1.03	BOMBAY	396	3.24

FIG. 2. Relative regional abundance and productive areas for 'Dara' and 'Shende' in the north-western part of India. For 'Dara' rich ground have given over 101 kg/hr and moderate between 51 and 100 kg/hr; for 'Shende' rich grounds have given over 51 kg/hr and moderate between 26 and 50 kg/hr.



in the Gulf of Cambay and the Gulf of Kutch where there are flourishing gill net fisheries during the season. The dominant size group is 91–100 cm, which by judging in relation to the rate of growth in the first 3 years, could be presumed to be in the fifth year. Such adult members are very rare in the trawl catches. Individuals in the ripe stage of maturity are collected from the Gulf of Kutch. The adults therefore seem to enter the gulf for spawning and the young ones migrate towards Dwarka which probably may be the nursery ground for the species. The spawning is more than once a year and each time the liberation of the eggs is in batches.

'Shende' in the inshore catches, is made up mostly of juveniles, with about 80% of them in the first year and the remaining 20% in the second and third years (Nayak, 1965). Fourth and above year classes are rare in the inshore waters. Specimens landed by the trawlers from the offshore are invariably adults, the first year class being totally absent and the second year class poorly represented. The third and the fourth year classes form the bulk of the catches and the fifth and above year classes appear in moderate percentages. The rate of growth in this species is about 83 mm. in the first year, 45 mm. in the second year, 30 mm. each in the third and fourth years, 24 mm. each in the fifth and sixth years and 18 mm. each in the seventh and eighth years. The fish attains maturity in its third year. The spawning takes place all round the year and its intensity seems to be more in the offshore waters. Unlike 'Dara' it is the juveniles of this species which inhabit the coastal waters. It forms the food of many predatory fishes, including 'Dara'.

#### CONCLUSION

Polynemids do not have very many species of commercial importance in the world fisheries. In India, of the 9 species stated earlier those which can be counted as contributing to fisheries of some magnitudes, are only 5. Gold Coast, presently known as Ghana, as indicated earlier, has rich resources of polynemid fishes; but the species contributing to the threadfin fisheries are only 3, viz., *Pentanemus quinquarius* (Linn.), *Polydactylus quadrifilis* (Cuv. and Val.) and *Galeoides decadactylus* (Bloch) (Irvine, 1947). In China *E. tetradactylum* and *P. sextarius*, in Philippines *E. tetradactylum*, *P. microstoma*, *P. plebeius* and *P. sealei* (Jordan and Richardson) and in Australia *E. tetradactylum*, *P. plebeius* and *P. sextarius* are known to support the threadfin fisheries of these countries. The waters around the Indonesian and adjacent islands, North Borneo, Celebes, New Guinea, etc. in the Indo-Pacific Ocean are inhabited by a number of species, but hardly any of these islands has a polynemid fishery of the size that could be listed in the world fisheries.

Excepting the special gear mentioned earlier, namely, 'Waghra Jal', a gill net which is used to capture *P. indicus* in the north-west coast of India, all the polynemids of the world are caught in gears commonly used for other fishes. In this connection it may be mentioned that in the eastern tropical Pacific Ocean, polynemids are attracted by artificial light at night and then collected by a net of fine mesh (Klawe and Alverson, 1964).

Like clupeids and horse mackerels, polynemids are mostly coastal fishes and some of these are known to enter estuaries and even lagoons, indicating that they are tolerant to great fluctuations in the salinity. Some species have to pass from one environment to the other, viz., marine to the estuarine and vice versa. Amongst the Indian species *E. tetradactylum* and *P. paradiseus* are observed to enter the estuaries and travel far interior into rivers. They form fisheries in both the marine and brackish-water environs. It may be stated that the juveniles of *P. paradiseus* between the sizes 81 and 150 mm. are not found in the Hooghly river (David, 1954) which may suggest that this species passes its juvenile stage in the estuary or the sea. In Ghana all of the 3 species mentioned enter the rivers and amongst these, the young ones of *G. decadactylus* are found to enter the lagoons via estuaries and delta systems connected therewith. Some polynemids show yet another type of movement as in the case of *P. indicus*, the adults of which during certain months move from deeper waters to the coastal regions wherefrom they enter the gulfs to breed. As stated earlier the juveniles are more in the offshore waters than in the inshore region. In close resemblance to this, *P. opercularis* and *P. approximans* in the eastern tropical Pacific Coast of America, have their young ones in the distant

offshore waters and the adults in the inshore waters (Klawe and Alverson, *loc. cit.*). The fisheries of such species are supported in their juvenile as well as adult phases of life. The movements of *P. heptadactylus*, purely a marine species, are different, the adults entering the deeper waters of the seas far off from the coasts. The fishery in the offshore grounds is supported mainly by the adults. The contribution by the juveniles in the inshore waters is, however insignificant. None of the polynemid species appears in abundance along the coast all round the year. They are seasonal, indicating periodic visits to the coasts. These visits may be of the nature of breeding migrations or for feeding. It is well known that the coastal waters are rich in food organisms because of the nutrients brought by the rivers during the rainy season.

It has been pointed earlier that there has been a fall in recent years in the trawler landings off *P. indicus* in India. The decline appears also in its inshore fishery. This species being the major one supporting the polynemid fishery, its decline is reflected in the general annual polynemid landings. The fall is from 14.8 metric tons in 1957 to 1.7 metric tons in 1965 (Anon, 1967). As in India, in China and Philippines also, though not very conspicuous because of their comparatively poor resources of polynemids, a trend towards decline is noticed in recent years. An exception to this is Ghana, one of the leading countries in the polynemid resources. She has stepped up her polynemid landings from 0.7 thousand metric tons in 1962 to 7.7 metric tons in 1966 (Anon, 1964 and 1966) and this is due to the rapid progress she has made in the fisheries development. Before this recent past, the fishing in Ghana was very limited.

The present decline in the polynemid fishery of this country is inexplicable with the available informations on the biology and life-histories of important commercial species. The reproductive potential of certain species is found to be very high as in *P. indicus* which has up to about 5 million eggs in a single breeding season (Karekar and Bal, 1960). It is a general biological principle that higher the fecundity greater is the rate of mortality. Information on the rate of recruitment and natural and fishing mortality rates of the species supporting the exploited fisheries is wanting, but when such information is available, we will be in a position to answer the causes of the fluctuations and forecast the fisheries.

It may not be quite out of place here to point out the possible baneful effects of the 'Waghra Jal' on the fishery. Though other groups of fishes, namely, 'Ghol' (*Pseudosciaena diacanthus* and *P. sina*), 'Koth' (*Otolithoides brunneus*), 'Tower' (*Scomberomorus commerson*) and sharks are gilled by this net, the major catch is 'Dara'. Its dominant size group by this gear is 91-100 cm. which means that they are all adults. The fishing season at Satpati, a fishing village 60 miles north of Bombay, begins in December and continues till May with peak catches from March to May. It has been stated that April to June period is the major spawning season for 'Dara' (Nayak, 1959). Evidently the shoreward migration of the fish during the season is for breeding. Their capture in large numbers before the spawning season is undoubtedly detrimental to the fishery as the individuals fail to get a chance to breed. Further, it may be pointed out that a sailing craft operating the 'Waghra Jal' in the inshore waters of the Bombay coast brings on an average 314 'Dara' per season whereas the mechanized craft using the same gear lands about 1,222 'Dara' which shows thus a four-fold increase (Deshpande, *loc. cit.*). A certain amount of restriction on the operation of this type of gear during and prior to the spawning period may possibly help to improve the annual yields which show a tremendous decline in recent years.

#### SUMMARY

Polynemid fishes occur in the tropical waters of the Atlantic, Indian and the Pacific Oceans. *Eleutheronema tetradactylum*, *Polydactylus indicus*, *Polynemus plebeius*, *P. sexifilis*, *P. sextarius*, *P. xanthonemus*, *P. paradiseus*, *P. heptadactylus* and *P. microstoma* are known to occur from the Indian coasts.

India's annual average catch of polynemids for the 10 year period of 1956 to 1965 is 5.9 thousand metric tons. They are fished by the seine nets, gill nets, long lines, hand lines and trawl nets. In Maharashtra and Gujarat States, special bottom drift gill net, the 'Waghra Jal' is effectively employed almost exclusively for *P. indicus*.

About 80% of the polynemid catches of India come from Maharashtra and Gujarat in the north-western coasts where the species supporting the fisheries are *P. indicus* ('Dara'), *P. heptadactylus* ('Shende') and *E. tetradactylum* ('Rawas'). Dwarka region is the most important one for *P. indicus*, Kutch ranking second. For *P. heptadactylus* Cambay, Dwarka and Kutch have been found to be equally good. The catches of *E. tetradactylum* are negligible. The productive areas of 'Dara' and 'Shende' have been charted. In the north-eastern coastal regions, *E. tetradactylum*, *P. indicus* and *P. paradiseus* support the threadfin fishery. In the southern regions of the east and west coasts there are no major polynemid fisheries. However, *E. tetradactylum*, *P. indicus* and *P. sextarius* occur in some quantities particularly in Madras State.

Polynemids are migratory fishes. Species like *E. tetradactylum* enter estuaries, like *P. indicus* enter the shallower waters of the gulfs and like *P. heptadactylus* move far into the offshore waters for breeding. Because of these seasonal migratory movements, they support fisheries in the offshore inshore and estuarine environments. The low yields of polynemids in this country in recent years are due to decline in the 'Dara' fishery in the north-western coasts, the causes of which are not sufficiently well understood.

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