

GEOBIOS 4 : 88-92, 1977

THE ECOLOGICAL FEATURES AND MACKEREL FISHERY OFF GOA

V.M. Abdul Hakkim and S.N. Dwivedi

National Institute of Oceanography, Dona Paula, Goa-403301, India

(Received January 4; Revised September 18, 1976)

ABSTRACT

The Indian Mackerel *Rastrelliger kanagurta* (Cuvier) constitutes about 64 percent of the total marine fish landing in Goa, but the catches fluctuate from year to year. In Goa waters, for the first time an attempt has been made to study the influence of ecological features on its abundance. The study gives the qualitative and quantitative abundance of plankton in fishing grounds along with its food.

INTRODUCTION

The Indian mackerel, *Rastrelliger kanagurta*

(Cuvier), is a pelagic shoaling fish and supports an important fishery along the Indian coast. It ranks next

to prawns and oil sardine in value, but its annual landings show wide fluctuations. For instance, in Goa in 1956, the catch was only 16,000 metric tons while in 1951, 1958 and 1960 it exceeded one lakh tons. Since these fluctuations affect both the fishery and the industry, the problems affecting its appearance is of national importance. In Goa, mackerel constitutes 64 % of the total marine fish landings (Dhawan and Belurker, 1973), but its annual landings in the past have shown wide fluctuations.

Various aspects of mackerel fishery in India have been studied by Chidambaran and Menon (1945), Sekharan (1962), George and Banerji (1964). In addition to these, the influence of hydrobiological features on the fish has often been stressed by Pradhan and Reddy (1962), Pannikar (1949), Murthy (1965). Similar results were reported by the United States Bureau of Fisheries on the Atlantic mackerel, *Scomber scombrus* (Linnaeus).

MATERIAL AND METHODS

Along the Goa coasts, large quantities of mackerel are landed by Purse-seines. During the season nets were operated in the nearshore waters once, twice or even thrice daily. The ecological parameters; temperature, salinity, oxygen, nutrients and plankton

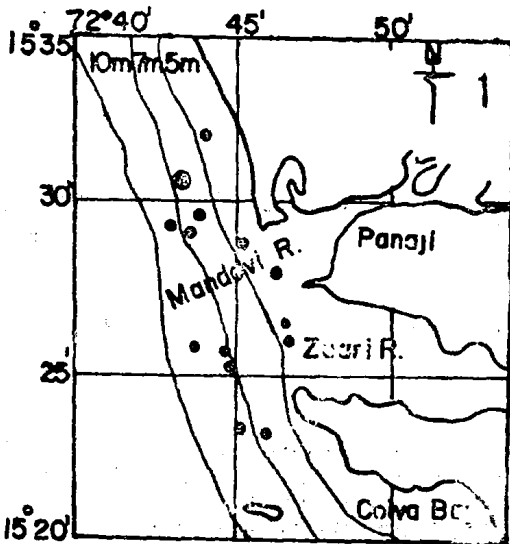


Fig. 1. Location of fishery grounds.

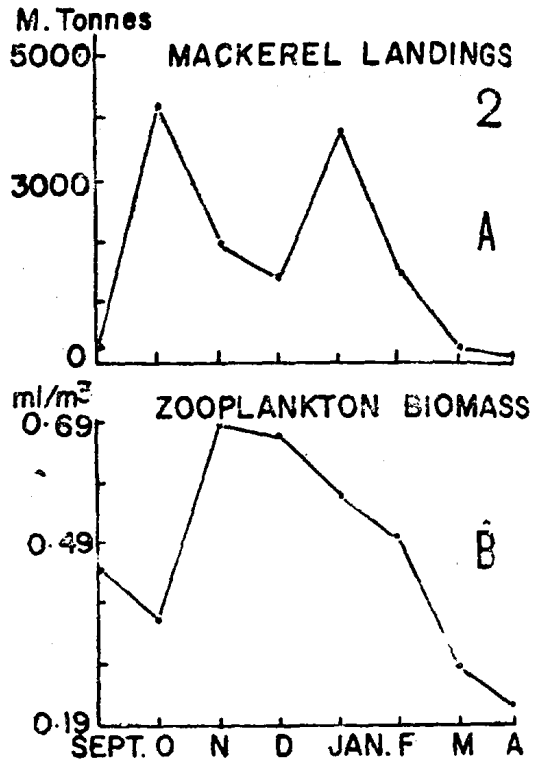


Fig. 2. Landings of Mackerel in Goa from September, 1973 to April, 1974 (A) and zooplankton biomass found in Mackerel guts (B).

were recorded from selected fishing grounds once in a week (Fig. 1). The fish landings were recorded regularly from the landing centres. The gut contents were studied by "points" method with Frost's modifications.

RESULTS

The fishing area is limited to neretic waters and generally does not extend more than 5 km from the coast. The catches fluctuate from year to year (Table 1). During 1973 the mackerel appeared in September and continued until April 1974.

The monthly average values of the hydrographical features are given in Table 2. The environment was almost stable and abrupt changes in temperature, salinity and oxygen were not observed during the period. But nitrate and phosphate concentrations showed a progressive decrease as season advanced.

Temperature fluctuated between 26.9° to 30.7° C

Table 1. Landing of Mackerel in Goa from 1966 to 1973 (Source : Directorate of Fisheries, Goa).

Year	Quality (in m. tons)	Percentage of Mackerel in total fish catch of Goa
1966	9,880	40
1967	4,016	32
1968	6,301	33
1969	25,872	86
1970	14,585	70
1971	33,358	89
1972	19,999	66
1973	7,617	48

and the minimum was recorded in December. Salinity was always high, never falling below 31.5‰. It varied irregularly between 30.15 to 33.82 ‰. The dissolved oxygen did not show regular pattern and fluctuated between 3.65 and 4.97 ml/l. Both nitrate and phosphate concentrations were high in September but decreased with the progress of the season. The maximum values observed were 1.4 and 1.5 $\mu\text{g}/\text{l}$, respectively. The range of decrease was found to be 0.9 $\mu\text{g}/\text{l}$ for both nitrate and phosphate.

Zooplankton biomass was comparatively high during the season. However, in October when maximum mackerel landing was recorded, its standing crop was relatively low 0.39 ml/m^3 (Fig. 2). With the progress of the fishing season biomass gradually decreased and reached the minimum of 0.21 ml/m^3 in April.

The major plankton constituents in the water and in the gut are shown in Fig. 3. *Coscinodiscus* was the most important both in the gut and in the environment. *Biddulphia*, *Rhizosolenia*, *Copepods*, *Cladocera*, fish eggs and crustacean larvae were also dominant. Medusae mostly *Diphyes*, *Chaetognaths*, *Lucifers*, etc. were also found in many collections. But neither they constituted any significant part nor they occurred throughout the season. In general, only a quantitative variation in plankton from month to month was observed.

During the months from November to February, most of the fish was caught from mixed shoals with lesser sardines and anchovies. Amongst 340 specimen

examined from these catches, 258 contained large proportions of fish remains in their guts.

DISCUSSION

The monthly mackerel landings showed wide fluctuations but a corresponding change in the ecological parameters studied was not obvious. Among the environmental parameters, temperature increased almost progressively from October to April. The comparative variation of slight low temperature from October to January is due obviously to the effect

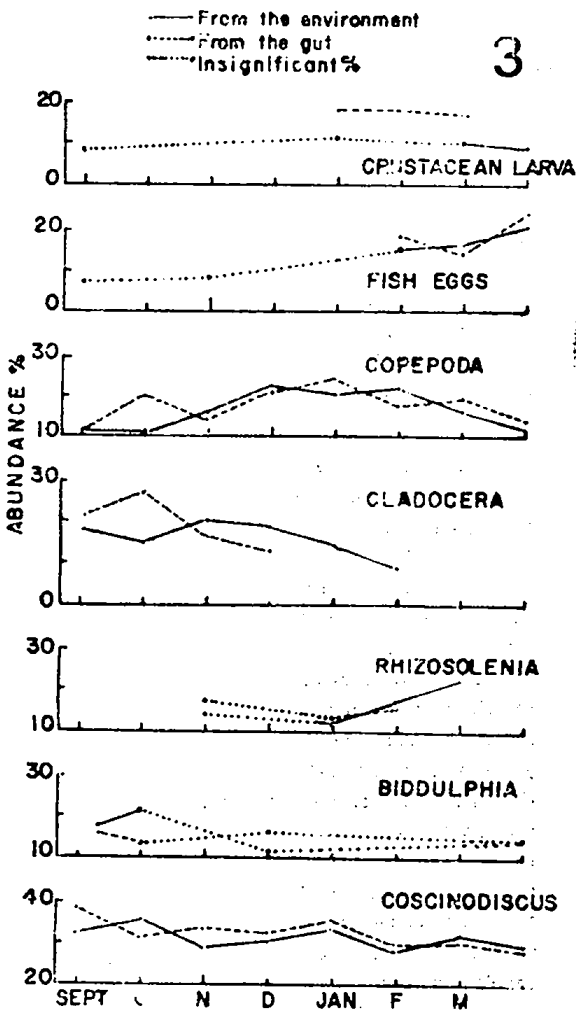


Fig. 3. Composition of zooplankton in the environment and in Mackerel guts.

of winter. But this limited fall in temperature did not hinder the movement of mackerel shoals as is obvious by higher catches during these months. Pradhan and Reddy (1962) have shown that mackerel is susceptible to temperature and variations of 3.7°C affect the fishery. During present studies the total range of temperature was 3.2°C, fluctuating between 26.9 and 30.1°C. The catches were higher particularly when temperature was below 28.3°C. Pradhan (1956) has reported very good catches in the Karwar area between 25 and 29°C temperature. It appears, temperature is not the only factor which influences the movement of mackerel in the coastal waters.

copepods was also low as compared to other months (Fig. 3).

Mackerel is a plankton feeder (Pradhan, 1956; Bhimachar and George, 1952). The qualitative variations of the plankton constituents of the gut was found generally to coincide with that of their presence in the environment (Fig. 3). Earlier observations of Noble (1962) has shown that the food of mackerel varies with the variety of plankton in the inshore waters. However, a certain amount of selectivity in feeding is evident because organisms like *Noctiluca*, *Sagitta*, *Medusae* etc. were totally absent in the gut indicated carnivorous

Table 2. Hydrographic features of the fishing ground during 1973-74 (monthly average values).

Month	Temp. °C	Salinity %	Dissolved O ₂ ml/l	N ugat/l	P ugat/l
September 1973	27.5	31.51	3.92	1.2	1.4
October 1973	27.4	31.66	3.80	0.3	1.1
November 1973	27.2	33.16	3.94	0.8	0.9
December 1973	27.1	33.52	4.80	0.6	0.8
January 1974	27.4	33.37	4.73	0.7	0.7
February 1974	28.3	33.20	4.08	0.7	0.7
March 1974	29.9	33.71	3.98	0.6	0.7
April 1974	30.1	33.65	4.85	0.5	0.5

Salinity is often regarded as an important factor affecting the fishery (Harvey, 1945). During the season salinity has shown little fluctuations and the variation was within 2.36%. The variation does not show any regular pattern and may be due to the presence of the estuaries carrying fresh water. Probably this narrow fluctuation in salinity may not have any adverse effect on the fishery. Dissolved oxygen has an important role in fish biology. Sometimes due to upwelling, certain areas may become deficient in oxygen (Sankaranarayan and Qasim, 1967) and in these areas mackerel fishery can be adversely affected. During the present study, dissolved oxygen remained comparatively high and the range of variation was only 1.32 ml/l. Both nitrate and phosphate have showed a progressive fall from September and they influenced the zooplankton biomass which came down to 0.37 ml/m³. Analysis of zooplankton during the month showed the abundance of medusae, mostly *Diphyes spp.* and a few *Sagitta spp.*, constituting about 6% of the total zooplankton. Further, the percentage composition of cladocera and

feeding to some extent and may be due to absence of sufficient plankton food when the fish takes to alternate feeding habits.

During the year 1973-74 the environmental parameters near Goa of the mackerel fishing grounds described most probably indicate the combined effect of the total environment which determines the movement of the fish to the nearshore waters rather than any single hydrobiological factors. In order to delineate the dominant factors responsible for its appearance near the coast still require long term and intensified study of other known fishing grounds.

REFERENCES

- Bhimachar, B. S. and George, P. C. Observation on the food and feeding of the Indian mackerel, *Rastrelliger kanagurta* (Cuvier). *Proc. Ind. Acad. Sci.* 1952, 36, 105-118.

- Chidambaran, K. and Menon, M. D. The co-relation] of the west coast (Malabar and South Kanara) fisheries with plankton and certain oceanographic factors. *Proc. Ind. Acad. Sci.*, 1946, 22, 355-367.
- Dhawan, R. M. and Belurkar, M. K. Status of fishing industry in Goa, Daman and Diu 1972 and 1973. *Publ. Directorate of Fish. Govt. of Goa, Daman and Diu. Panaji. Sept.*, 1973, 74, 1-16.
- George, K. C. and Banerji, S. K. Age and growth studies on the Indian mackerel *Rastrelliger kanagurta* (Cuvier) with special reference to length frequency data collected at Cochin. *Ind. Jour. Fish.*, 1964, 11, 621-638.
- Harvey, H. M. *Recent Advances in Chemistry and Biology of Sea Water*. Cambridge University Press, London, 1945.
- Murthy, A. V. S. Studies on the surface mixed layer and its associated thermocline off the west coast of India and the inferences thereby for working at a prediction system of the pelagic fisheries of the region. *Ind. Jour. Fish.*, 1965, 12, 118-134.
- Noble, A. The food and feeding habits of the Indian mackerel *Rastrelliger kanagurta* (Cuvier) at Karwar. *Ind. Jour. Fish.*, 1962, 9, 701-713.
- Pannikar, N. K. The biology of pelagic fishes. *Proc. Ind. Paci. Fish.*, 1949, Council 1st meeting Singapore, pp. 123-132.
- Pradhan, L. B. Mackerel fishery of Karwar. *Ind. Jour. Fish.*, 1956, 3, 141-145.
- Pradhan, L.B. & Reddy, C.V.G. Fluctuations in mackerel landing at Calicut in relation to hydrographical factors. *Ind. Jour. Fish.*, 1962, 9, 100-109.
- Sankaranarayan, V. N. and Qasim, S. Z. The influence of some hydrographical factors on the fisheries of Cochin area. *Symp. on Ind. Ocean*, New Delhi, 1967, 846.
- Sekharan, K. V. On the mackerel fishery of the mandapam area. *Ind. Jour. Fish.*, 1962, 9, 714-727.