

Proceedings of the
FIRST WORKSHOP ON SCIENTIFIC RESULTS OF
FORV SAGAR SAMPADA

5-7 June, 1989, Cochin

Sponsored by

DEPARTMENT OF OCEAN DEVELOPMENT
&
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
NEW DELHI

Organized by

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
&
CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY
COCHIN

OCTOBER, 1990

Published by

Dr. P.S.B.R. JAMES

DIRECTOR

Central Marine Fisheries Research Institute

COCHIN - 682 031

Edited by

Dr. K.J. MATHEW

Central Marine Fisheries Research Institute

COCHIN - 682 031

VARIATION IN FISH CATCHES FROM THE CONTINENTAL SHELF BETWEEN QUILON AND GULF OF MANNAR AND ITS RELATION TO OCEANOGRAPHIC CONDITIONS DURING THE SOUTHWEST MONSOON PERIOD

A.V.S. MURTY, N. GOPALAKRISHNA PILLAI, M. ZAFFAR KHAN*,
K.U. SANIL KUMAR** AND SHANKAR V. ALAVANDI***

Central Marine Fisheries Research Institute, Cochin-682 031

ABSTRACT

The present paper is based on the fishing results of FORV *Sagar Sampada* during July-August, 1987 along the southwest coast of India. The fish fauna of the Quilon Bank and Wadge Bank has a dominant nemipterid element and the Gulf of Mannar area has a dominant population of barracudas. Nemipterids constituted 88.2 and 64.4% of the total trawl catch from the Quilon Bank and Wadge Bank respectively. Barracudas formed 58% of the total catch from the Gulf of Mannar. A comparison of the overall catch rates for the above three areas revealed that it was highest in the Gulf of Mannar (1,007 kg/hr) followed by Quilon Bank (555 kg/hr) and Wadge Bank (170 kg/hr). For nemipterids the maximum catch rate of 488 kg/hr was obtained from the Quilon Bank and 108 kg/hr from the Wadge Bank, whereas for barracudas it was 583 kg/hr from the Gulf of Mannar.

There is tremendous contrast among the three regions with respect to oceanographic conditions of the waters. Both temperature and salinity of the Quilon Bank waters are lower. The Wadge Bank waters are moderate in their temperature but high in salinity. The Gulf of Mannar waters are moderate with respect to salinity but warmer with regard to temperature and it differs much from the rest of the areas with respect to dynamic qualities. These waters showed thermal inversions in the middle region of the water column.

The bottom water temperature rather than salinity appears to be the probable reason for the species variations in the trawl catches of the region. Nemipterids were not present in the Gulf of Mannar waters, where the bottom temperature was high and barracudas were not present in the Wadge Bank and Quilon Bank, where the bottom waters were cool. Nemipterids constitute a good monsoon fishery off Cochin, where the upwelling cools the bottom waters and also reduces dissolved oxygen. Probably the good concentration of nemipterids in the Quilon Bank and Wadge Bank areas are due to the extended effect of upwelling towards the south down to Wadge Bank, as the drift currents which are southerly are favourable to cause this effect.

INTRODUCTION

The existence of good fishing grounds in the Wadge Bank and Pedro Bank areas are traditionally known to the fishermen of Kerala, Tamil Nadu and Sri Lanka. Exploratory surveys have indicated potentially rich fishing grounds off Quilon (Quilon Bank) for deep sea prawns and deep sea lobsters beyond the continental shelf edge.

The Quilon Bank and Wadge Bank attract the interest of fisheries scientists. Investigations on oceanography, primary and secondary production and fisheries were already carried out in the waters off the peninsular region of India. But they were all subject oriented, mainly limited to one or two aspects. The studies on the effect and influence of oceanographic parameters on the distribution and abundance of fish groups of southwest coast of India are comparatively little, but the work of Murty

and Edelman (1971), Pillai (1982) and Rao *et al.* (1973) are worth mentioning. An attempt is made in this paper to bring out the reasons for the existence of demersal fisheries in relation to environmental conditions.

MATERIAL AND METHODS

The area between Quilon and Gulf of Mannar (07° to 9°N and 75°28' to 78°43'E), in transects more or less parallel to latitudes, was surveyed during July-August, 1987 by FORV *Sagar Sampada*. Altogether 18 stations were covered. Temperature in the water column from surface to 70 m depth from discrete levels was observed by an instant reading T-S Probe (T.S.K. Japan, accuracy $T = \pm .2^{\circ}\text{C}$, $S = \pm .1$ ‰). Bottom trawling was conducted by employing the demersal HSDT-1 trawl designed and fabricated by CIFT, Cochin. The length of the foot rope was 44.7 m and the cod end mesh size was 40 mm. The

Present address * Bombay Research Centre of CMFRI, Bombay. ** Naval Physical Oceanographic Laboratory, Cochin - 682 016.

*** Central Institute of Brackishwater Aquaculture, Madras.

fishery data were analysed and discussed in the light of the oceanographic conditions of the region under investigation.

RESULTS AND DISCUSSIONS

T-S diagram for the three different areas, namely Quilon Bank, Wadge Bank and Gulf of Mannar are prepared and shown in Fig. 1. There was a tremendous contrast among the three regions with respect to oceanographic conditions of the waters. As far as the salinity is concerned, the Quilon Bank waters are much diluted with the lowest salinity having a surface value of about 34 ‰ with gradual increase with depth, reaching 34.6 ‰ at 70 m depth. The Wadge Bank waters are of highest salinity with a value of 36.0 ‰ at the surface and at the bottom with a slight increase at mid-depth (40 m) touching a value of 36.15 ‰. The Gulf of Mannar waters are very moderate in their salinity values ranging from 35.5 to 35.7 ‰.

The contrast of the three waters with respect to temperature conditions is interesting. At the Quilon Bank, while the surface waters are of moderate temperature (26°C), vertical cooling in the water column is so rapid that it reduced to 21.0°C at 70 m depth. The surface water temperature of the Wadge Bank was 27°C, while the bottom (70 m) temperature of the region was less than 24°C. In Gulf of Mannar, the surface water temperature was moderate, almost very close to that of the Quilon Bank. But there was thermal inversions in the mid-depth of 30-50 m, and at 50 m depth the temperature was 28.75°C. Barring one or two layers, the temperature range of the water layers of Gulf of Mannar was very narrow (26.0-27.5°C). Thus the Gulf of Mannar water mass differs from either Quilon Bank or Wadge Bank by attaining narrow ranges of temperature and salinity.

The lowered temperature conditions of subsurface and bottom waters of Quilon Bank and Wadge Bank when compared to Gulf of Mannar waters can be interpreted in terms of differences of intensity and spread of upwelling.

Based on the dynamic depth variations during summer relative to winter, it was inferred that upwelling effect was reduced from about Cochin towards south upto Cape Comorin in the shelf and off shelf waters along the west coast of India (Lathipha and Murty, 1978). Pillai (1982) presented the average depth of 23°C isotherm during mon-

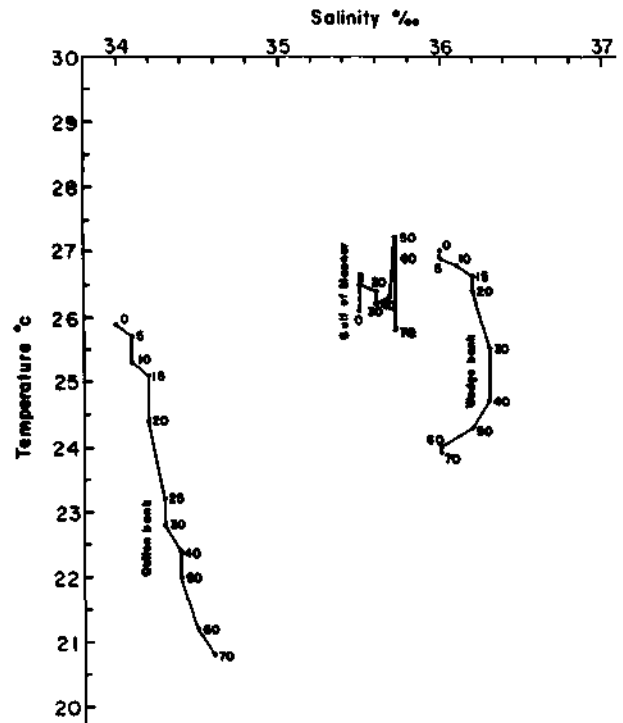


Fig. 1. Hydrographic conditions in the three fishing zones.

soon period from Cochin, Quilon and Cape Comorin for the years 1973 to 1978. The shallower the depth of the isotherm, the more would be the intensity of upwelling. Consistently the depth increased from Cochin to Cape Comorin through Quilon. The average depth of the 23°C isotherm for the above six years is 15, 20 and 40 m respectively for Cochin, Quilon and Cape Comorin.

Johannessen *et al.* (1987) observed from oxygen data for August, 1974 that the water having depleted oxygen retreated to the shelf edge and beyond, as we proceed southward from Cochin, Quilon and Cape Comorin, indicating the reduction in the area of spread of upwelling towards the coast in the south when compared to north.

The trawl catch composition from the three regions namely Quilon Bank, Wadge Bank and Gulf of Mannar during the cruise are presented in Tables 1 & 2. The fish fauna of the Quilon Bank and Wadge Bank have a dominant population of barracudas. Nemipterids constituted 88.2 and 64.4% of the total trawl catch from the Quilon Bank and Wadge Bank respectively. Barracudas formed 58% of the total catch from the Gulf of Mannar (Fig. 3). A comparison of the overall catch rates for the above three areas revealed that it was highest in the Gulf of

VARIATIONS IN FISH CATCH AND OCEANOGRAPHIC CONDITIONS

TABLE 1. Average group-wise catch (kg) and catch rate (in parenthesis) obtained in various regions surveyed

Species/groups	Quilon Bank	Wadge Bank	Gulf of Mannar
Sharks	Nil	16 (2)	167 (83.3)
Rays	13 (2.3)	20 (2.5)	67 (33.3)
Nemipterids	2,695 (488)	874 (108.2)	Nil
Barracudas	Nil	Nil	1,166 (583.3)
Perches	134 (24)	173 (21.7)	255 (127.5)
Lizard fish	16 (3)	24 (3)	Nil
Carangids	35 (6)	80 (10)	167 (83.3)
<i>Penaeus indicus</i>	42 (7)	21 (2.6)	8 (4)
<i>Priacanthus</i> sp.	28 (5)	12 (1.5)	Nil
<i>Upeneus</i> spp.	Nil	13 (1.7)	Nil
Squids & cuttle fish	42 (8)	14 (5.5)	45 (22.5)
Misc. fishes	52 (9)	79 (9.9)	138 (69)
Total	3,057 (555)	1,356 (169.5)	2,013 (1006.5)

TABLE 2. Percentage composition of dominant group of fin fishes and shell fishes caught by bottom trawl from various regions

Groups	Quilon Bank	Wadge Bank	Gulf of Mannar
Sharks & rays	Nil	Nil	11.6
Barracudas	Nil	Nil	57.9
Nemipterids	88.2	64.5	Nil
Perches	4.4	12.8	12.7
Squids & cuttle fishes	1.4	3.2	2.2
Carangids	1.2	5.9	8.3
Other fishes	4.8	13.6	7.3

Mannar (1,006.6 kg/hr) followed by Quilon Bank (555 kg/hr) and Wadge Bank (170 kg/hr). For nemipterids the maximum catch rate of 488 kg/hr was obtained from the Quilon Bank, whereas for barracudas it was 583 kg/hr from the Gulf of Mannar (Fig. 2).

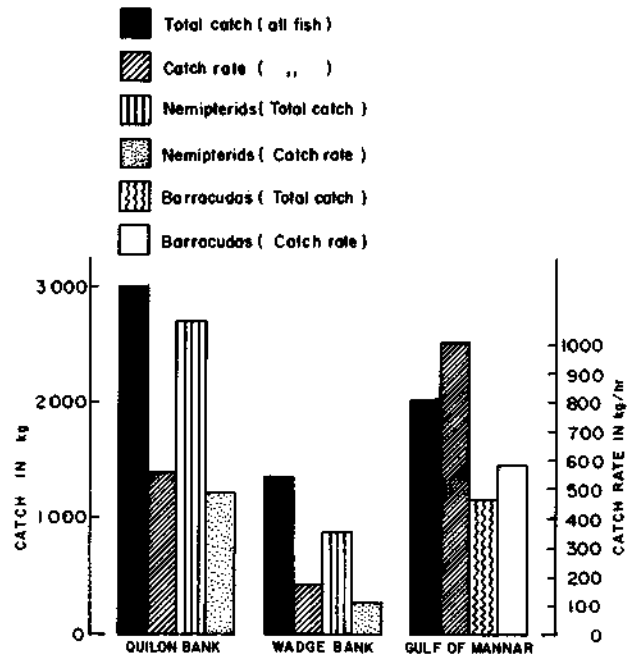


Fig. 2. Total catch and catch rate of all fish, nemipterids and barracudas obtained from three different fishing zones.



Fig. 3. Percentage composition of dominant groups of fishes landed from Quilon Bank, Wadge Bank and Gulf of Mannar.

The depth-wise catch rate obtained for nemipterids and barracudas from the three regions is given in Table 3. The pattern of distribution and abundance of nemipterid in relation to depth at both Quilon Bank and Wadge Bank regions were almost the same. The data revealed that the maximum catch rate at Quilon Bank (9,375 kg/hr) and Wadge Bank (2,327 kg/hr) was obtained from the depth zone of 60 to 80 m.

The commercial landings of nemipterids and barracudas during the southwest monsoon period

TABLE 3. Depth-wise catch rate (kg/hr) obtained for nemipterids and barracudas

Areas & groups	20-40m	40-60m	60-80m	80-100m
<i>Quilon Bank</i>				
Nemipterids	Nil	2,202	9,375	Nil
<i>Wadge Bank</i>				
Nemipterids	Nil	1,700	2,327	1,733
<i>Gulf of Mannar</i>				
Barracudas	4,666	Nil	Nil	Nil

TABLE 4. The commercial landings (in kg) of nemipterids and barracudas at Cochin, Sakthikulangara and Tuticorin centres during the southwest monsoon period

Landing centres	1985		1986		1987		1988	
	Nemipterids	Barracudas	Nemipterids	Barracudas	Nemipterids	Barracudas	Nemipterids	Barracudas
Cochin	854	7	5,606	-	3,178	12	2,941	154
Sakthikulangara	16,853	72	23,976	17	12,285	46	12,206	268
Tuticorin	321	50	-	-	-	-	-	-

at Cochin and Sakthikulangara on the west coast and at Tuticorin on the east coast during the years 1985 to '88 are presented in Table 4 (Anon., 1989). From the table it is understood that there is an encouraging catch of nemipterids from south of Cochin culminating at Sakthikulangara. But at Tuticorin both nemipterids and barracuda fisheries are almost negligible. Thus nemipterids constituted a good monsoon fishery off Cochin and especially off Sakthikulangara, where upwelling cools the bottom waters and also reduces dissolved oxygen. Probably, the good concentration of nemipterids in the Quilon Bank and Wadge Bank areas are due to the extended effect of upwelling towards south down to Wadge Bank, as the drift currents have perhaps lead to this effect. (During this season, the coastal currents are southerly).

From the view point of species contrast (barracudas verses nemipterids) and the characteristic difference of Gulf of Mannar waters verses the waters of Wadge Bank or Quilon Bank, the physiologi-

cal conditions of these species are governed more by the subsurface and bottom water temperatures rather than salinities of the waters, nemipterids preferring the colder upwelled waters of Quilon-Wadge Bank region and barracudas preferring non-upwelled and turbulent Gulf of Mannar waters. It is interesting to note from Table 3 that nemipterids completely avoided the shallow waters upto 40 m from the coast, where the upwelling effect might not have reached from offshore waters. Barracudas confined themselves to shallow waters (less than 40 m depth) and completely absent in deeper waters beyond 40 m offshore.

REFERENCES

- ANON. 1989. Marine fish production in India - 1985-'86. *Mar. Fish. Infor. Serv., T&E Ser., No. 91*: 1-32.
- JOHANNESSEN, O.M., G. SUBBARAJU AND J. BLINDHEIM 1987. Seasonal variations of the oceanographic conditions off the south west coast of India during 1971-'75. *Fisk Dir. Skr. Ser. Hav Unders.*, 18: 247-261.
- LATHIPHA, P.N. AND A.V. S. MURTY 1978. Studies on upwelling along the west coast of India using geopotential anomaly. *Indian J. mar. Sci.*, 7: 219-223.
- MURTY, A.V.S. AND M.S. EDELMAN 1971. On the relation between the intensity of the southwest monsoon and oil sardine fishery of India. *Indian J. Fish.*, 13 (1 & 2): 142-149.
- PILLAI NARAYANA, V. 1982. Physical characteristics of the coastal waters off the southwest coast of India with an attempt to study the possible relationship with sardine, mackerel and anchovy fisheries. Ph. D. Thesis, University of Cochin, 111pp.
- RAO, D.S., C.P. RAMAMIRTHAM AND T.S. KRISHNAN 1973. Oceanographic features and abundance of the pelagic fisheries along the west coast of India. *Proc. Symp. Living Resources of the seas around India*, CMFRI, 400-413.