NOTES

A NOTE ON THE MONSOON FISHERY FOR THREADFIN BREAMS OFF COCHIN

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ABSTRACT

The threadfin bream fishery by shrimp trawlers, constituted by *Nemipterus japonicus* and *N. mesoprion*, is subject to great seasonal and annual fluctuations, the total catch, as well as the catch rate, being highest during SW monsoon. It appears from the catch trends at various depths that nemipterids, which normally inhabit in the depth zone 75-100 m, migrate to 35-40 m during monsoon, coinciding with upwelling. The hydrographic conditions which might be causing this shift of the population is discussed.

The threadfin breams, locally called 'Kilimeen,' consisting mainly of the two species *Nemipterus japonicus* and *N. mesoprion*, form an important constituent of the trawler catches of the southwest coast, particularly during the SW monsoon. Exploratory trawling has shown their occurrence also in deeper waters (75-100 m), beyond the limit of the usual trawling grounds (Silas 1969; Tholasilingma et al 1968, 1973) along this region. Silas et al (1976) showed subsequently the existence of rich threadfin-bream resource on the continental shelf beyond 50 m depth, especially in the 75-100 m belt, along different parts, often forming as much as 75% of the trawl catches.

An important character with regard to the nemipterid fishery off the southwest coast, especially south of 10°N, is the occurrence of its sudden peaks during the SW monsoon and its equally sudden disappearance. This wide seasonal fluctuation along the west coast is attributed generally to the complex and changing conditions of the Arabian sea (Banse 1959, 1968, Murthy 1965, Murty and Edelman 1966, Sankaranarayanan and Qasim 1968). In this note the seasonal fluctuations of the physical, chemical and biological parameters in the continental shelf waters off Cochin are reviewed and an attempt is made to correlate these fluctuations with that of the threadfin bream fishery of the region.

The data on nemipterid landings were collected from Cochin Fisheries Harbour. The hydrographical data on the continental shelf waters of the south-west coast of India were as recorded by Banse (1959, 1968), Ramamirtham and Jayaraman (1960), Murty (1965), Ramamirtham and Patil (1965), Sharma (1966, 1968), Lathipha and Murty (1978) and Ramamirtham (personal communication).

Threadfin breams formed the most important by-catch of the trawler landings at Cochin almost all the years of investigation, their percentage in the trawler landings ranging from 6.7 in 1978 to 34.2 in 1982, with a mean annual percentage of 21.2. In August and September the nemipterids contributed 59.5% and 53.3% of the trawler landings respectively (Table 1).

TABLE 1. *Estimated catch (kg), effort (units), catch rate (kg/unit) and percentage composition of threadfin breams in the catches of shrimp trawlers landed at Fisheries Harbour, Cochin (Average 1978-82).*

Month	No. units	Catch (kg)	Catch rate (kg)	% monthly catch to annual	% of total fish catch
Jan	4,179	6,076	1.45	0.32	1.90
Feb	5,003	59,675	11.92	3.21	4.78
Mar	5,496	1,07,596	19.57	5.79	9.83
Apr	5,508	38,573	7.00	2.07	4.38
May	6,716	43,378	1.45	2.33	3.86
Jun	3,218	20,002	6.21	1.07	3.88
Jul	2,009	2,21,856	110.43	11.94	3.88
Aug	1,964	8,99,486	457.98	48.43	59.54
Sep	1,536	4,30,970	280.57	23.20	53.28
Oct	357	14,633	40.98	0.78	13.84
Nov	2,030	3,012	1.48	0.16	0.85
Dec	5,277	11,656	2.20	0.70	1.24
Total	43,293	18,56,913	43.08	—	21.23

Catches and catch rates: The catch statistics of the nemipterids for the period 1978-82 are presented in Figure 1. The total landings ranged from 607 t in 1978 to 3,447 t in 1981, with a mean annual catch of 1,856 t. In 1978 the catch and the catch rate were maximum in September and minimum in May,

with no landings in January, March, April and December. In 1979, though the highest catch was in August, the maximum catch rate was recorded in September (979.8 kg|unit). There was no fishery during January-April and December. In 1980 also generally the catch and catch rates were on the higher side during July-September. In 1981 the highest catch was obtained in September (1040 t), at a catch rate of 528.6 kg|unit, but the highest catch rate of 615.6 kg|unit was observed in August. In 1982 the catch and catch rates were maximum in August.

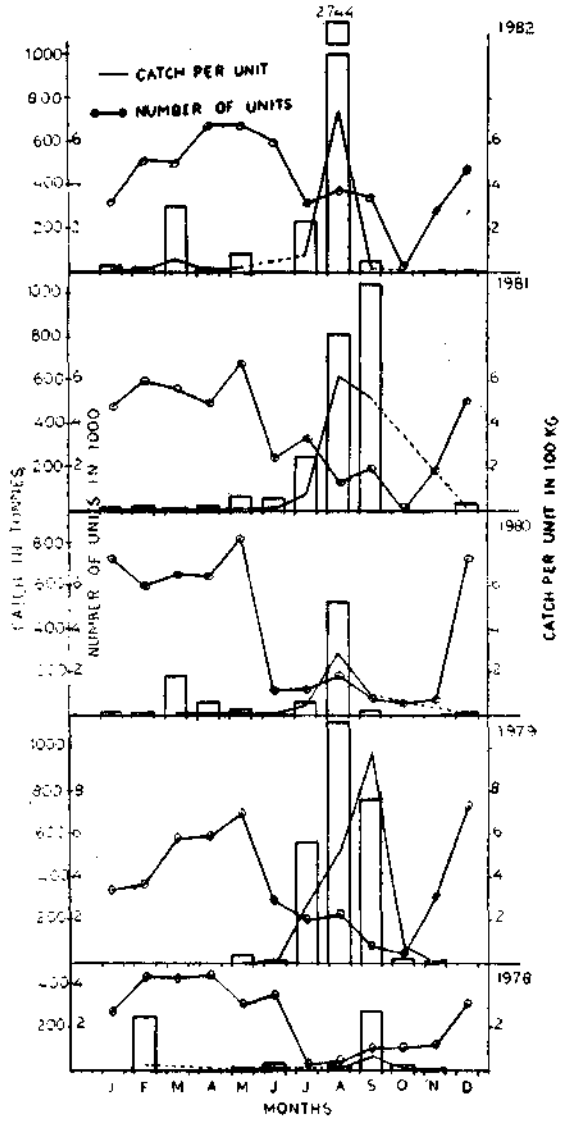

FIG. 1. Monthwise effort (in units), landings (in tonnes) and catch-rate (in kg|unit) of threadfin breams at Cochin Fisheries Harbour during 1978-82.

Hydrography and nemipterid fishery: One of the main features of the Arabian sea is that temperature, salinity, dissolved oxygen, nutrients, etc are subject to almost an annual rhythm under the influence of monsoon. According to West Coast of India Pilot (Anon 1950), after the onset of SW monsoon the coastal current becomes considerably stronger and, consequently, dense, cold and the oxygen-deficient deep water rises and enters onto the shallower parts of the shelf along the entire west coast of India. Banse (1959) has observed strong upwelling along the west coast from 8° to 15°N during the whole SW monsoon season. Ramamirtham and Jayaraman (1960) observed that upwelling in the continental shelf off Cochin from the middle of August to the middle of October resulted in the entire shelf being pervaded by cold (below 22°C), highly saline and poorly oxygenated water (less than 0.5 ml|L) except in a thin layer of 10 m at the top. During the period of active sinking (November-February) the entire water on the shelf becomes highly saline and the thermocline is found at deeper waters about 75-100 m and the oxygen-minimum at 150 m beyond the shelf. During March and April the isotherms are horizontal resulting in stable conditions. Sharma (1966) noticed a gradual upward tilting of the thermocline towards the coast from February, reaching the surface by July through the end of August, indicating an upward movement of water from the sub-surface depths. He also observed that, though the cessation of upwelling is evident in July-August, the thermocline continues to rise till an equilibrium is reached and is maintained in that position for one or two months. Banse (1968) observed that the temperature-salinity relation (T. S. relation) of the water encountered on the shelf off Cochin in June 1959 was quite similar to that of offshore waters at other stations and the new sub-surface water was formed by mixing of the upwelled water with low saline surface water, the water mass being characterised by a lairfy constant degree of salinity through a range of several degree of temperature. Sub-surface water with similar properties is apparently formed each year, and the similarity of the slope of the T.S. relation suggests the mechanism of its formation as similar from year to year. The studies made by Lathipha and Murty (1978) showed that upwelling is more pronounced in the middle and southern regions of the coast where the dynamic depth is the lowest. Sankaranarayanan and Qasim (1968) observed that the seasonal changes in temperature, salinity and oxygen reflected the characteristics of upwelled water from June to October in the inshore regions off Cochin.

Routine hydrographic observations in the region off Cochin conducted by Ramamirtham et al (personal communication) has revealed that the intensity of upwelling was quite heavy during the monsoon periods of 1978-82, the thermocline was found to start at 4-6 m depths during the peak season at the sta-

tions where the bottom depth was 10-20 m. The bottom temperatures also were very low, ranging from 21° to 23°C; these values being observed usually at the lower parts of the thermocline during the premonsoon period.

The studies carried out on the hydrography of the inshore waters off the west coast of India have shown the presence of highly saline, cold and oxygen-deficient (less than 0.5 ml|L) water during the SW monsoon due to upwelling. The deoxygenation of near-bottom water is reported to result in the regular disappearance of fishes making vast areas on the continental shelf devoid of commercially exploitable concentration during the SW monsoon (Banse 1968). But an analysis of the demersal catches in the trawling operations off Cochin showed that the inshore fish populations are not depleted to such an extent as to make commercial trawling unviable. The catch per unit was found to be comparatively high during monsoon, the average monthly catch rate for the period 1978-82 fluctuating between 244.9 kg|unit in June to 727.6 kg|unit in August in monsoon, whereas the highest catch rate was recorded in October and the lowest in December. The mean catch rate for the shrimp trawlers during monsoon for the period 1978|82 was found to be 388.4, 718.8, 235.3, 479.2 and 364.4 kg|unit during 1978, 1979, 1980, 1981 and 1982 respectively. The combined catch rate for the pre-monsoon and post-monsoon were 272.4, 162.1, 156.7, 92.3 and 165.0 kg|unit for the above period. Thus the catch rates were higher during monsoon months. This was mainly due to the highly successful 'Kilimeen' fishery in monsoon at intermediate depth zones off Cochin. The threadfin bream population which is found in good concentration in deeper waters may be moving to shallower regions during July-September, owing to the influx of oxygen-dificient waters from below the thermocline. The catch rate of threadfin breams by mechanised trawlers in the premonsoon and post-monsoon months, when trawling is primarly done for shrimps in shallower waters, is very low, often less than 5 kg|unit. Thus it is most probable that, during upwelling, the nemipterid fishes migrate towards the shallower regions along with the ascend of sub-surface water onto the continental shelf.

Several earlier workers have also observed the relationship of fish migration with dissolved-oxygen concentration in the environment. Carruthers et al (1959) reported that, in the Bombay region, the fish migrates to shallow regions to avoid low oxygen concentration. Banse (1959) observed that off Cochin the fish, mostly *N. japonicus*, were available only when the oxygen content was above 0.25 to 0.50 ml|L. When the badly aerated water suddenly covered the shelf and deteriorated there in June, the fishes (and prawns) either pressed against the shore or migrated to deeper waters. Krishnamoorthi (1973) observed that the peak months of abundance of *N. japonicus* along Andhra-Orissa coasts were generally from January to April coinciding with the reported period of upwelling. Sankaranarayanan and Qasim (1968) noticed that the minimum values of temperature and oxygen at the bottom coincided with the lowest catch off

Cochin. However, off Quilon about 80 km south of Cochin where the dissolved-oxygen content was higher, they recorded comparatively good catches which suggests migration of fish from poorly oxygenated waters towards deeper waters or to other more favourable coastal regions. The surveys made by the Pelagic Fishery Project (Anon 1978) revealed that when the cool waters of thermocline with the associated oxygen-minimum layer (0.5 ml|L), normally found at depths of 100-150 m, rose along the shelf during upwelling, a part of the fish population moved in front of it into shallow surf-mixed waters and another part moved offshore away from the centres of strong upwelling. Rao et al (1960) showed that the oxygen-dificient colder sub-surface waters of the shelf area due to upwelling during monsoon made the prawns and fishes leave their normal habitat either to the shore or to deeper waters and that no direct relationship existed between mudbank formation and availability of fish.

Depthwise distribution: An analysis of the length distribution of *N. Japonicus* in the shrimp trawlers indicated that the ranges and dominant modes were generally on the higher side during July-September, when trawling was primarily done for threadfin breams in the deeper grounds. During the other months, when trawling was primarily in the shallower grounds for the prawns, their size range and modes were smaller. This indicates an increase in size distribution in relation to depth. Naghabhushanam (1966) observed an increase in size with depth in most of the bony fishes and prawns, which is confirmed by the present observations. A qualitative difference in the percentage composition of different categories of bony fishes was also noted by him with reference to the depth of the trawling grounds, the juveniles constituting 70% of the catch up to 20 m.

Krishnamoorthi (1973) observed a localisation of population of *N. japonicus* in certain latitude zones lying very near the river systems and inferred that the large discharge of nutrient waters from the river systems caused this localisation to a certain extent and showed that *N. japonicus* generally prefered deep water habitat, confirming the observation of Hida and Pereyra (1966) that the threadfin breams provided high catch rates and dominated the catches in 74-183 m depth ranges.

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