Hydrographic Conditions in the Region off Hosbettu, South Kanara Coast and its Influence on Pelagic Fisheries

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Observations on the oceanographic parameters like temperature, salinity, pH, dissolved oxygen and transparency were made at four stations off the Hosbettu region, along South Kanara coast. Temperature and salinity of columnar waters were found to have direct effect on the fishery of oil sardine and Indian mackerel of the region. However the pelagic fishery was indirectly influenced by pH, dissolved oxygen and transparency in the study area.

The application of oceanographic knowledge to fishery problems can result in better understanding of relations between the behaviour of fish stocks and their environment and will promote the formulation of fisheries prediction systems. The pelagic fishery resources of India for the past two decades have shown wide fluctuations. Presently, oil sardine *(Sardinella longiceps)* forms the major pelagic fishery, followed by Indian mackerel *(Rastrelliger kanagurta)* in the purse seine landings along the coast of Karnataka. Fish landing, usually showed wide fluctuation in the biomass of pelagic fishes from one season to other in the coastal waters (Hela & Laevastu, 1962). These changes in fish shoals could possibly occur due to the influence of environmental and hydrological factors (Shekharan & Dulkhed, 1963; Prabhu *et al.*, 1967; Suresh *et al.*, 1978). Therefore, a systematic study of some of the hydrographic parameters were undertaken and efforts were made to correlate the same with the occurrence of fisheries population.

Materials and Methods

Four stations were fixed in the depth range of 20 to 30 m off the Hosbettu region (Fig. 1). Water temperature and salinity were read in the field with the help of a STD (salinity-temperature-depth) meter. Readings were recorded at an interval of 2 min at each station. Samples were collected for dissolved oxygen and pH analyses at surface, mid-depth and bottom water by using Nansen sampler. All the samples were analysed following the method of Strickland & Parson (1972). Since, much of the fishing activity in this area is confined to 20 m depth only, the average value of temperature and salinity upto 20 m depth for all the stations were used for the computation of the results. Data on monthly landings of oil sardine and Indian mackerel were obtained from Department of Fisheries,

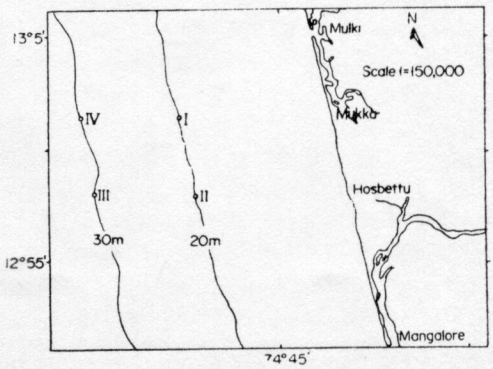

Fig. 1. Map showing location of sampling stations.

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Government of Karnataka, Mangalore. This data were considered as representative for study area as it is the only landing centre nearest to the sampling site. Transparency of water was measured by means of secchi disc and extinction coefficient (K) calculated using the formula $K = 1.7/D$, where D is the secchi disc reading in meters (Poole & Atkins, 1929).

Results and Discussion

Hosbettu region along Mangalore coast is known for its rich pelagic fisheries in particular sardine and mackerel. In order to predict, if there exists any possible relationship between oceanographic parameters and oil sardine/mackerel fish catches, the entire region around Hosbettu station was considered as single unit. The average values for temperature and salinity of water column for 4 stations were computed for each month and are plotted with catches of oil sardine and Indian mackerel for respective months (Fig. 2).

The oil sardine *(Sardinella longiceps)* catches in the coastal waters of Mangalore were found to be high during the months from September to December with the peak values in September (Fig. 2). During the period the temperature and salinity of water column ranged between 28.32 to 29.17°C and between 33.66 x 10^{-3} to 34.18 x 10^{-3} respectively. Low catches were observed during the period from January to May. At this time the temperature and salinity values were normally higher except in January than the above mentioned optimum range. The oil sardine catch was found to be minimum in March (14 tons) and maximum during the month of September (4563 tons).

Maximum Indian mackerel catch *(Rastrelliger kanagurta)* was observed during October and catches were considerably higher in September and November as compared to catches during other months (Fig. 2). Indian mackerel catch was observed to be less during the period from December to May. During high catches of the Indian mackerel the temperature and salinity values ranged between 28.65 and 29.17°C and from 33.66 x 10^{-3} to 34.18 x 10^{-3} respectively. The temperature range is narrower compared to oil sardine abundance and salinity range being same. During the period of low catches of mackerel the temperature and salinity values were not within the optimum range.

The pH values ranged from 8.0 to 8.6. The lower pH values were observed during September and higher values in the month

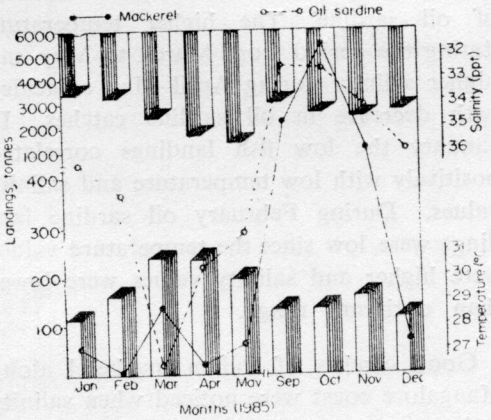

Fig. 2. Average values of water column temperature, salinity and its comparison with oil sardine and Indian mackerel catches.

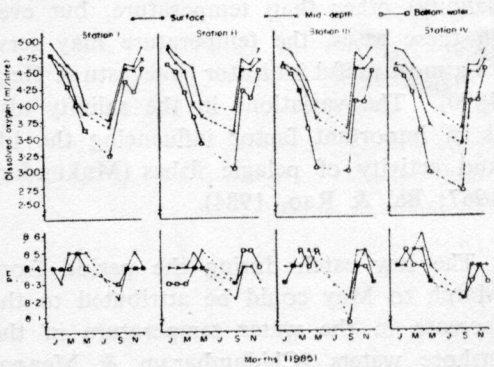

Fig. 3. Distribution of dissolved oxygen and pH in water column.

of May. Dissolved oxygen values which ranged between 2.65 to 4.98 ml/l suggest that the waters between the stations were well saturated. Minimum values were found in September and maximum values during the month of January (Fig. 3). Low values of extinction coefficient (K) indicated that the waters were clear during the month of March (Fig. 4).

Fish search ideal environmental conditions in order to have sufficient availability of food. A proper knowledge of interrelationship between hydrological conditions and fish population is necessary for proper harvesting of available fisheries resources.

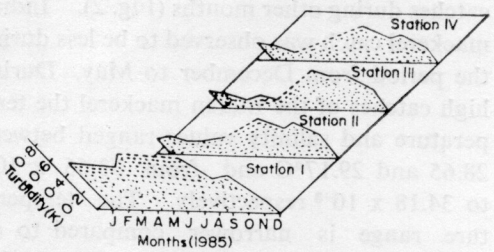

Fig. 4. Turbidity values (K) at four stations.

Each species is known to have its own temperature preferences, eventhough they can survive in varying temperature ranges to some extent (Galstoff, 1924). The behaviour of fish is frequently influenced by environmental factors (pH, dissolved oxygen, salinity) other than temperature, but even in these cases, the temperature may serve as a most useful indicator (Laevastu & Hela, 1970). The variations in the salinity also is an important factor influencing the life and activity of pelagic fishes (Mukundan, 1967; Bal & Rao, 1984).

The low catch during the period from March to May could be attributed to the increase in the water temperature in the inshore waters (Chidambaram & Menon, 1945). Some of the fishes are able to perceive water temperature changes smaller than 0.1°C (Laevastu & Hayes, 1981). A definite correlation exists between the concentration of temperate species like cod, herring and haddock and the water temperature. Thus whatever bethe actual causes, the fluctuation in the catches of many pelagic species are controlled by temperature. Annigeri, (1972) observed good fishing season for oil sardine during the period when temperature and salinity ranged between 27.8 to 29.3°C and between 32.59 x 10^{-3} to 34.89 x 10^{-3} respectively along Mangalore coast. However, Benakappa *et al.* (1979) noticed good landings of oil sardine and Indian mackerel along Mukka-Kaup region when surface waters showed a temperature range of 29.86 to 30.15°C and salinity range of 32.75 x 10^{-3} to 33.15 x 10^{-3}. In the present study, the temperature ranges observed were relatively narrow which could be attributed to the difference in tolerance capacity of different age groups. This needs further confirmation by conducting more detailed studies on the occurrence of different sizes of oil sardine.

It can be revealed from highly significant multiple correlation coefficient ($R = 0.9917$; $p < 0.01$) between temperature-salinity and oil sardine catch that the salinity and temperature play a vital role on the abundance of oil sardine. The higher temperature during the period from March to May and higher salinity during April–May coincided with decrease in oil sardine catches. In January the low fish landings correlated positively with low temperature and salinity values. During February oil sardine landings were low since the temperature values were higher and salinity values were lower than optimum range.

Good catches of Indian mackerel along Mangalore coast were noticed when salinity and temperature values were within the range from 32.59 x 10^{-3} to 34.89 x 10^{-3} and from 28.4 to 29.9°C respectively

(Suresh *et al.*, 1978). In the present study, good Indian mackerel catches were observed when average columnar water temperature was within above mentioned range during September to November. During the month of December and January, when the temperature were lower than optimum range, catches were less. Indian mackerel catches were also poor during February, March, April and May, since temperatures were higher than optimum range. A study on salinity and Indian mackerel catch data revealed that, when the columnar salinity were within the above range, the mackerel catches were good provided columnar temperature too fell in the optimum range and when the salinity values were lower or higher than this range (33.66×10^{-3} to 34.28×10^{-3}) the landings were negligible.

The pelagic fish landings were generally good when pH values ranged between 8.2 and 8.6 provided temperature and salinity values were within the optimum ranges. Rao & Madhavan (1964) reported that actively migrating fishes can detect even slight changes in pH of water. The surface water column along the west coast of India is found to have pH of 8.0 to 8.3 during summer which is a favourable range for pelagic fishes (Bal & Rao, 1984). The columnar water in the study area were well saturated with dissolved oxygen. In general, the value for dissolved oxygen showed positive correlation with the oil sardine catches which suggests that the dissolved oxygen in the water column can also influence the fish distribution (Maddikery, 1981).

Another factor in controlling diurnal and seasonal migration of some fishes could be water transparency. Fishes like tuna are known to locate their prey at close ranges (Hela & Laevastu, 1962). During the period of good pelagic fish landings off Hosbettu, transparency of water was low in September as indicated by higher values of extinction coefficient (K) (Fig. 4), which was mainly due to inland drainage brought by adjoining river during rainy season. Apart from this transparency also affect the column productivity which inturn may influence fish production.

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