HYDROLOGICAL CONDITIONS IN THE INSHORE REGION OF KARWAR DURING 1965-1967

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ABSTRACT

Studies on the hydrological conditions off Karwar were undertaken on board one of the vessels of I.N.P. during the years 1965 to 1967. The inshore samples collected from surface, 10 m and bottom (15-31 m), showed quite distinct demarkation in the distribution of physico-chemical properties. The average monthly values of pH fluctuated between 8.0 and 8.4. Dissolved oxygen reached its maximum in the sub-surface layers. Saturation and supersaturation values were frequently observed at 10 m and 15-31 m than that at surface, indicating the zone of maximum photosynthesis below the surface waters. The distribution of nutrient salts showed that they are concentrated at bottom.

INTRODUCTION

The shelf region off Karwar is one of the important shrimp trawling areas of the west coast of India; hence it was considered worthwhile to study the hydrography of this area and its variation with seasons. A detailed report on the hydrography of Karwar Bay has already been published (Annigeri, 1968). In this paper the hydrological features of the inshore regions of Karwar during 1965-1967 are dealt with, based on studies made on board the I.N.P. trawler *Karwar-I*. For previous work, mention may be made of Banse (1959), Noble (1968) and Ramamirtham (1967).

METHODS

Water samples were collected from surface, 10 m and bottom (depth varied from 15 to 31 m) using a Cassella bottle and dissolved oxygen, salinity, pH, inorganic phosphate, nitrite and silicate contents were determined. This investigation was carried out from November 1965 to May 1967 with a break from April to October 1966 on account of the non-availability of the vessel. Fig. 1 shows the location of stations sampled. The samples were collected generally between 0700 and 0900 hrs, though on some occasions the time had been extended up to 1000 hrs. Temperature was measured as soon as the sample was hauled on board. The pH values were determined by a Lovibond

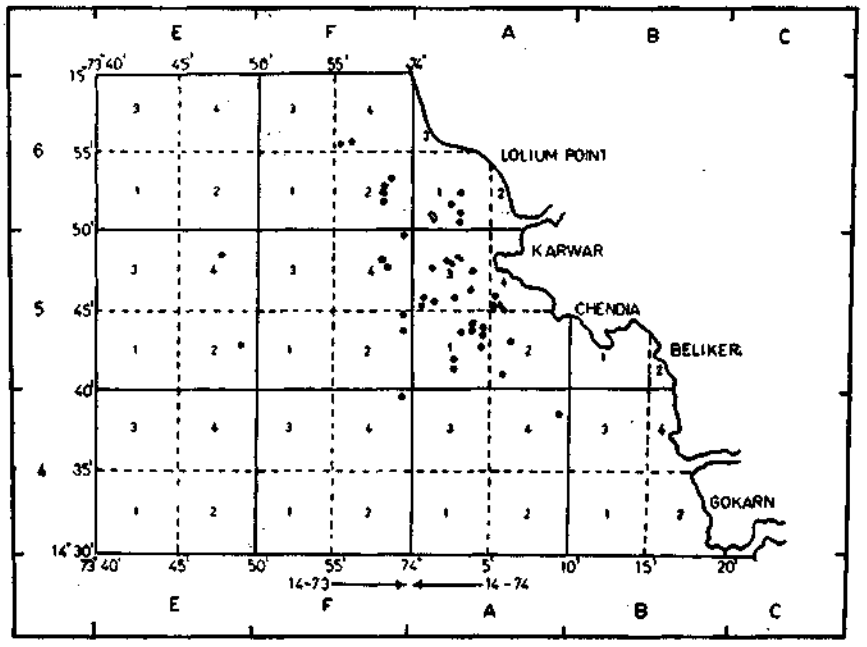

Fig. 1. The areas covered during each voyage. Solid circles indicate location of samplings.

comparator, with Thymol blue indicator, determination of salinity was made by Mohr's method, of dissolved oxygen by Winkler's method, and of dissolved phosphates, nitrites and silicates were estimated by Robinson and Thompson's (1948 a, b and c) method.

Results

Distribution of physico-chemical properties :

a) *Temperature* — Data for the two periods, viz., November 1965-March 1966 and November 1966-May 1967, showed that bottom temperatures were invariably lower than those above. The minimum and maximum temperatures for the former period at surface, 10 m and bottom were 27.5 and 30.4°C; 27.3 and 30.4°C; 27.0 and 30.3°C and for the latter period 27.1 and 30.0°C; 27.1 and 30.0°C; 27.1 and 29.4°C respectively. The average temperature at surface, 10 m and at bottom varied from 28.06 to 29.96°C, 28.00 to 29.63°C and 27.26 to 29.43°C and from 27.40 to 30.00°C and 27.10 to 30.00°C and 27.10 to 30.00°C in 1965-66 and 1966-67 respectively.

During 1965-66, temperature was found to decrease from November to January and then steadily increase upto March (Fig. 2A), while in 1966-67,

temperature was lowest in November because of cyclone and rain. After November temperature increased up to May.

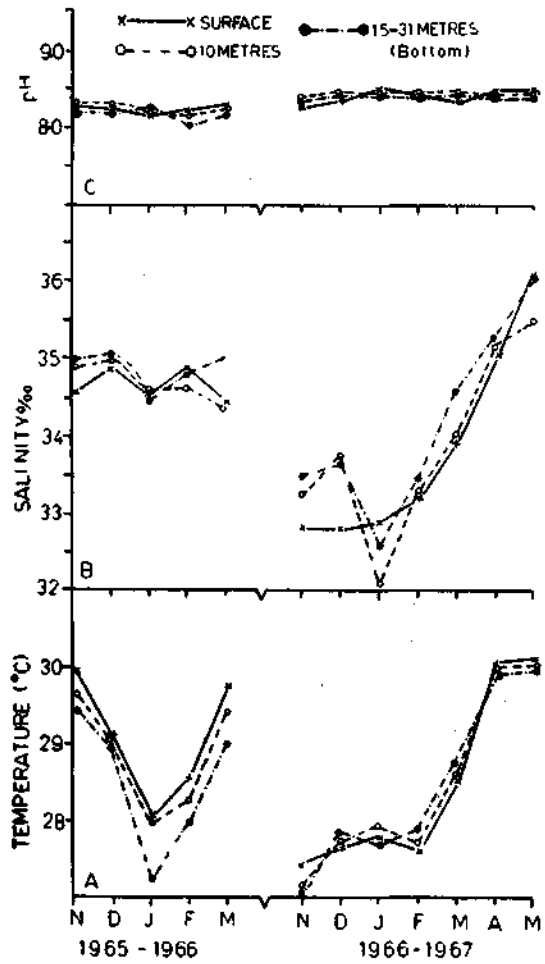

Fig. 2. Seasonal variation of A-temperature B-salinity and C-hydrogen-ion concentration in the inshore area.

b) *Salinity* — In 1965-66 the average salinities fluctuated within narrow limits, the maximum and minimum at surface being 34.91 and 34.41°/$_{oo}$, at 10 m 35.03 and 34.38°/$_{oo}$, and at bottom 35.07 and 34.51°/$_{oo}$. In 1966-67 these fluctuated widely showing the maximum and minimum averages at surface 36.04 and 32.78°/$_{oo}$, at 10 m 35.43 and 32. 05°/$_{oo}$ and at bottom 36.04 and 32.54°/$_{oo}$.

The variations in salinity were not similar during these two periods. In 1965-66, salinity values were highest in December at 0 and 10 m levels and in March at bottom. In 1966-67 the values were highest at all levels in May. The lowest salinity was registered in January during both the periods.

c) *Hydrogen ion concentration* (pH) — From Fig. 2(C), it will be clear that the average monthly pH at all depths fluctuated between 8.0 and 8.4. The lowest pH of 8.0 was observed at bottom during February 1966 and the highest at the surface during January 1967. Though the bottom waters invariably showed comparatively lower pH, the variation of these values from surface to bottom was not significant, except in February 1966.

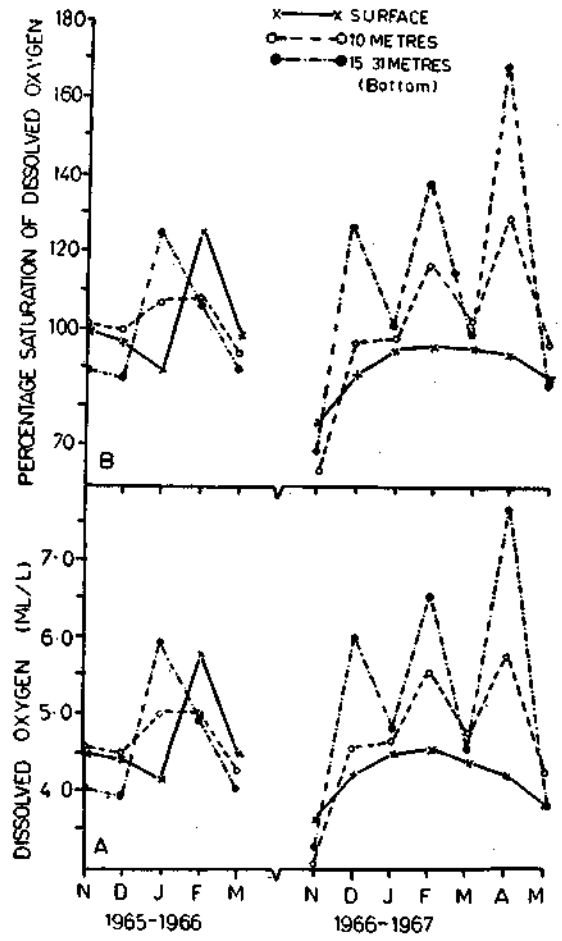

Fig. 3. A-seasonal distribution of dissolved oxygen (ml/1) and B-percentage saturation of dissolved oxygen.

d) *Dissolved oxygen* — Fig. 3A, shows the variation of dissovled oxygen during 1965-66 and 1966-67. The variation of average monthly dissolved oxygen concentrations in surface waters for 1965-66 was 4.14-5.77 ml/l in 1965-66 and 3.63-4.54 ml/l in 1966-67. In both periods the peak values were observed in February. The majority of values were found to lie between 4.15 and 4.60 ml/l. Only on two occasions the oxygen concentrations were below 4 ml/l (i.e. 3.63 ml/l in November 1966 and 3.85 ml/l in May 1967). The average oxygen concentrations at 10 m depth varied from 4.25 to 4.99 ml/l in 1965-66 and from 3.05 to 5.77 ml/l in 1966-67. The peak values were found in January during the first year; irregularly in the second year. The dissolved oxygen contents during both these periods were found to be higher at 10 m than at surface and were generally above 4.5 ml/l.

In bottom waters, the variation of average values of dissolved oxygen for 1965-66 was 3.90-5.92 ml/l and for 1966-67, 3.27-7.66 ml/l. During the former period maximum value was observed in January. In the latter period the oxygen values were generally high, exceeding 6 ml/l in December, February and April.

From Fig. 3B, it will be seen that only during February 1966 there was supersaturation at the surface. For the rest of the months the percentage saturation was between 75.80 and 99.13. On many occasions the sub-surface waters were found to be super-saturated with oxygen.

e) *Distribution of nutrients* — The variation of inorganic phosphates with depth showed that concentrations at the surface varied from 0.36 to 0.45 μg at/l during 1965-66 and 0.29 to 0.49 μg at/l during 1966-67. The corresponding variation at 10 m were 0.34 to 0.48 μ g at/l and 0.32 to 0.71 μ g at/l respectively. Phosphate concentration at bottom varied from 0.44 to 0.79 μ g at/l during the former period and from 0.35 to 0.98 μg at/l during the latter period. Thus the concentration of surface layer was low while those at subsurface were high (see Fig. 4A).

Higher concentrations of nitrites were frequently met with below the surface (Fig.4B). The range in minimum and maximum values at surface was from 0.05 to 3.00 μ g at/l; at 10 m from 0.04 to 3.03 μ g at/l and at bottom from 0.13 to 4.14 μ g at/l.

The fluctuation of silicate concentration for both periods has been presented in Fig. 4C. During 1965-66, the peak value was observed in December for sub-surface waters and in January for surface waters. But during the year 1966-67, which was characterised by rain and cyclone in November the concentrations were higher in that month and afterwards they were found to be lower.

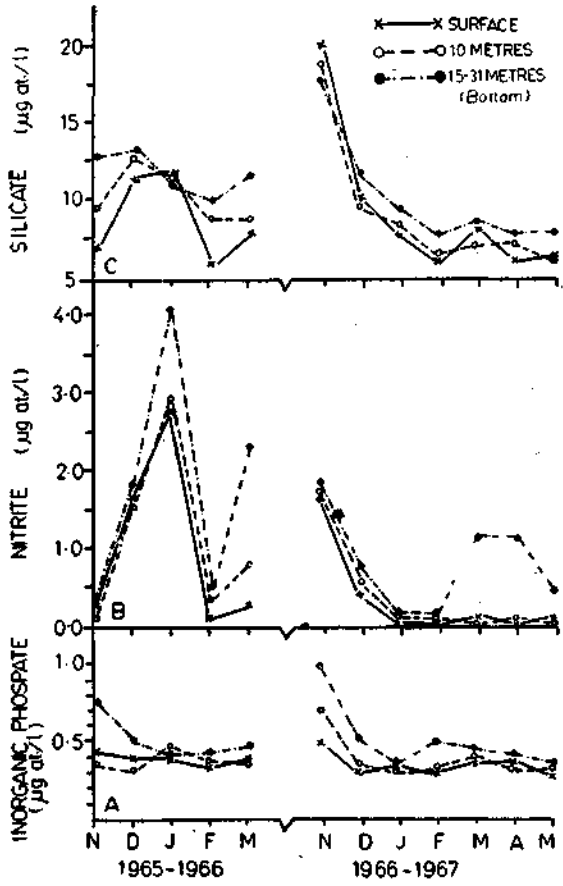

Fig. 4. Seasonal variation of A-inorganic phosphorus, B-nitrite and C-silicate in the inshore waters.

Discussion

The range in temperature values observed during the present study is found to differ from that given by Noble (1968). This may be due to differences in the localities of collections and also the period and the lack of data for the monsoon months during this study. The temperature showed its decline in the winter months, from November to January, and steadily increased in summer from March to May.

The trend in salinity was similar to that of temperature, the range of fluctuation being greater in 1966-67 than in the earlier year. This can be explained by the fact that at the beginning of the later period there were heavy

rains which brought the temperature and salinity to lower values increasing the range between the maximum and the minimum. The later season 1966-67 indicated richer dissolved oxygen content than the former, possibly on account of the favourable conditions like low temperature and salinity for higher photosynthesis. The sub-surface waters with higher photosynthesis indicated more super-saturation and higher dissolved oxygen content than the surface waters. Similarly, phosphates, nitrites and silicates showed increasing concentrations from surface to depths during this period.

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