Short Communications

Diurnal Variation in Net Phytoplankton & Nannoplankton Primary Production & Chlorophyll a in the Vellar Estuary

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Diurnal variation in net and nannoplankton primary production and chlorophyll a was studied in November 1975. A well marked salt wedge type system was observed during day time. Chl. a, primary production and assimilation ratio of nannoplankton were higher than those for netplankton. Mixing due to wind controlled the distribution of chl. a, nutrients and salinity during late evening and night hours. Light penetration was considered as the chief limiting factor in this study.

LARGE number of studies have been made on primary production rates. But very little information is available regarding diurnal variations in nannoplankton. Since monsoon months reveal some interesting characteristics in the Vellar estuary regarding their biological features, diurnal studies on nannoplankton production have been carried out in the tidal zone, which is the most productive one.

The study was carried out in November 1975 and the collections were started at 0600 hrs and continued up to 0600 hrs next day. The samplings were carried out at 3 hourly intervals. Estimations of primary production were made during day time. Surface samples were collected using a clean plastic bucket and the bottom water was collected using a horizontal water scoop. For the estimation of chlorophyll a and nutrients the methods described by Strickland and Parsons were followed. Light and dark bottle method using oxygen technique as described by Strickland and Parsons was used to estimate primary production. The details of the method were discussed in the previous papers.

Variations in salinity and light penetration are shown in Fig. 1. Temperature ranged between 20-5 and 25-1°C in surface water and between 19-6 and 24-0°C in bottom water. Surface water exhibited only very little variation in salinity during day time. Salinity increased slightly till 0900 hrs and then decreased slightly by 1500 hrs, followed by an abrupt increase to the maximum value at 2400 hrs. Finally it showed a decreasing trend till 0600 hrs next day. The range of variation in salinity was between 2 and 20-15%. Bottom waters also exhibited a similar pattern except for a steep decrease between 1200 and 1800 hrs.

Concentration of nutrients (except nitrite) in surface water was high between 0600 and 1800 hrs. Between 2 and 20-15%0' Bottom waters also exhibited a similar pattern except for a steep decrease between 1200 and 1800 hrs. This decrease was observed at 0600 hrs next day. Except at 2100 hrs chl. a concentration of nannoplankton was always higher than that of netplankton (Fig. 1e).

In surface water, unlike that of nannoplankton netplankton productivity fluctuated considerably. Productivity was nil during 0600-0900 hrs, but it gradually increased as the day advanced and attained a peak value of 44·77 mg C/m3/hr between 1200 and 1500 hrs (Fig. 1f). This was followed by a gradual decrease and levelling off towards 1500 hrs which remained constant till 0600 hrs next day. Except at 2100 hrs chl. a concentration of nannoplankton was always higher than that of netplankton (Fig. 1e).

In the bottom water, very low rates of production were observed. Production values were nil during 0600-0900 hrs and 1500-1800 hrs. Nannoplankton production values (22·38 mg C/m3/hr) remained the same between 0900 and 1200 hrs and increased from 1200-1500 hrs. But netplankton values increased from 0900-1200 hrs to 1200-1500 hrs. This increase was similar to that observed for surface waters (Fig. 1f).

Nannoplankton assimilation ratios were higher even when netplankton production and chl. a were...
at their peak and exhibited less fluctuations. The variations are (Table 1) quite consistent with production rates.

In the present study a salt-wedge type of circulation, characteristic of monsoon seasons, was observed during day time. However, due to the prevailing wind velocity (48 km/hr) stratification of the water column was disturbed commencing from 1500 hrs and attaining a completely homogeneous condition at midnight (2400 hrs). This was obvious from the data on salinity, nutrients and chl. a (Figs. 1b-e). The nutrient rich, productive, low saline surface water mixed with the nutrient poor high saline bottom water due to wind action and this process began slowly from the 1800 hrs and more or less uniform concentrations of the above were observed at 2400 hrs (Figs. 1b-e) when the mixing was at its height. With the decrease in wind velocity after 0 hrs the monsoonal flood again dominated the surface water and reestablished the two-layer system with its own characteristics, on the next day at 0600 hrs.

Differential pattern of diurnal variation in phytoplankton productivity in neritic and oceanic waters

<table>
<thead>
<tr>
<th>Time</th>
<th>Assi. ratio</th>
<th>Net: Nanno production ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0600-0900</td>
<td>--</td>
<td>18:58</td>
</tr>
<tr>
<td>0900-1200</td>
<td>11:89</td>
<td>19:28</td>
</tr>
<tr>
<td>1200-1500</td>
<td>16:58</td>
<td>18:65</td>
</tr>
<tr>
<td>1500-1800</td>
<td>12:43</td>
<td>18:27</td>
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</tbody>
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Table 1 - Variations in Net and Nannoplankton Assimilation Ratio and Net: Nannoplankton Production Ratio
have been reported\textsuperscript{12-14}. Malone\textsuperscript{8} reported diurnal variation in nannoplankton chl. a, productivity and assimilation ratio in the temperate and tropical neritic waters. The results of the present study were somewhat different from those reported by him, which may be due to the differential behaviour of the eutrophicated estuary regarding their physical, chemical and biological conditions.

Diurnal variations in net and nannoplankton production rates and assimilation ratios could be attributed to factors like variations in nutrient concentration and light. Diurnal variations due to variations in the availability of nutrients were reported in tropical and temperate inshore waters\textsuperscript{4,6,10}. The Vellar estuary is somewhat eutrophic\textsuperscript{14,16} and the nutrient concentrations were always high. This was observed in the present study also. Since enough nutrients were available for photosynthesis almost continuously, it would be unlikely that nutrients be one of the limiting factors, during the present study. The non-limiting nature of nutrients in the Vellar estuary was established by previous studies as well\textsuperscript{12,16}.

Due to considerable turbidity of water (Fig. 1a) and cloudiness, light could be considered as one of the limiting factors. During the early hours when the illumination was very low, productivity by nanoplanckters completely dominated and this might be attributed to their adaptation to low light intensity than the netplankters\textsuperscript{8,12,16}. As the day proceeded netphytoplankton productivity increased notably and equalised with the nannoplankton production. This increase was consistent with increase in light penetration. The fact that larger cells are decrease in production rates as well as assimilation ratio in the temperate and tropical waters could be due to restricted light penetration. The above finding is consistent with earlier observations\textsuperscript{9,12}.

The increase in netplankton in the present study also could be attributed to this phenomenon. This is true for the bottom waters also. The decrease in production rates as well as assimilation ratios in the late hours (1500-1800 hrs) may similarly be attributed to decreased light. The gradient in assimilation ratio in the late hours (1500-1800 hrs) may similarly be attributed to this phenomenon. This was observed in the present study also. Since enough nutrients were available for photosynthesis almost continuously, it would be unlikely that nutrients be one of the limiting factors, during the present study. The non-limiting nature of nutrients in the Vellar estuary was established by previous studies as well\textsuperscript{12,16}.

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References

Food & Feeding Habits of Nephtys oligobranchia
Southern (Annelida: Polychaeta)

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Detailed analysis of the gut contents of N. oligobranchia is strongly suggestive of its carnivorous diet. Comparison of the density of N. oligobranchia inhabiting the Vasishta Godavari Estuary on the east coast of India is made with that of other species of Nephtys inhabiting other comparable areas, as density of the populations of a species is generally related to its food and feeding habits. N. incisa, a sub-littoral species of Long Island Sound and Buzzards Bay, Massachusetts, which is reported to feed on detritus is considered more an exception than a rule to this family.

POLYCHAETES, which include carnivores, herbivores, filter feeders and parasites\textsuperscript{5,6} display quite an array of adaptations in the structure of proboscis depending on the nature of their food. Because of their abundance they play a significant role in the ecosystem. As such several workers have tried to understand the food and feeding habits of this group. Among them, Nephtyidae has engaged considerable attention because of its abundance and cosmopolitan nature of distribution.

Several species of Nephtys are carnivores\textsuperscript{3,4}. Sanders\textsuperscript{8} however, feels that it is a detritus feeder. This divergence of view has led to the present study of the food and feeding habits of Nephtys oligobranchia, one of the most dominant species in the area under investigation.

N. oligobranchia was collected on 26-12-1977 from the intertidal area of the Vasishta Godavari estuary on the east coast of India. Vasishta Godavari is one of the 3 major branches of the river Godavari opening into the Bay of Bengal at Anterveli (lat. 16°18′N, long. 81°42′E). Salinity in the estuary varies from less than 1% during the annual high floods (August and September) to about 35% during the drought period (April to June). Majority of the specimens were collected near Narsapur, about 9 km up the river from the confluence with the sea.

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