

## DIURNAL VARIATIONS IN PHYTOPLANKTON PIGMENTS IN THE VELLAR ESTUARY

### ABSTRACT

Diurnal variations in phytoplankton pigments in the water on 3/4 September, 1969, at 3 stations in the Vellar estuary were investigated. The peak values of pigment content of the water were :

Chlorophyll <i>a</i>	..	19.00 $\mu\text{g/l}$
Chlorophyll <i>b</i>	..	16.00 $\mu\text{g/l}$
Chlorophyll <i>c</i>	..	35.80 $\mu\text{g/l}$
Carotenoids	..	5.34 MSP/m <sup>3</sup>

The yellow : green pigment ratio was generally between 2.50 to 3.50, and the range of variation was from 1.60 to 4.40 (with an occasional 7.50). The plankton settlement volume varied between 25 to 130 c<sup>3</sup>. The peak values in pigments usually occurred during morning and late evening hours.

THE variations in the pigment content of water are of ecological interest and have been investigated in recent years, among others, by Qasim and Reddy (1967), Qasim and Gopinathan (1969) in the Cochin Backwater, Shimada (1958) in the eastern Pacific, Yentsch and Ryther (1957) from Woods Hole and Yentsch and Scagel (1958) along the Washington Coast in the Pacific. The present account reports results of observations made on 3/4 September 1969 on the diurnal variations in the pigment content of water at 3 stations in the Vellar estuary at Porto Novo. The normal range of tidal fluctuation in the estuary is between 76 to 108 cm.

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The three stations (mouth of the Vellar river—Station 1 ; rivulet Killaiyar joining Vellar—Station 2 ; and opposite Biological Station in the estuary—Station 3) were visited in sequence continuously during the period of study. The surface samples of water were collected with a clean plastic bucket using the laboratory boat, ' Medusa '. The depths at the stations varied [Station 1 (2.5 metres) ; Station 2 (2 m) ; Station 3 (3.25 m)]. As soon as one survey covering the three stations was over, the next one was started, so as to provide almost a continuous picture of changes in the pigment content of water along this stretch of the estuary.

The samples were Millipore-filtered under vacuum using an Oxoid 0.50  $\mu$

porosity membrane filter paper, that was previously weighed. Usually one litre or more of water was filtered. As soon as the sample was filtered, the filter paper was allowed to 'dry' at room temperature and the damp-dry filter paper was weighed again and to find the seston content. The acetone extracts of Chlorophylls were immediately prepared, by soaking the damp-dry filter paper in 90% acetone. The recommended procedures as outlined in UNESCO Monograph (1966) and by Strickland and Parsons (1965) were followed for the estimation of chlorophylls. Replicates were run and Unicam SP-500 Spectrophotometer was used and equations recorded by Strickland and Parsons (1965) were used to calculate the concentration of chlorophylls and formula of Richards and Thompson (1952) was used for finding out the carotenoid concentrations. Salinity and temperature were measured using a NIO model conductivity bridge type Salinometer (Cox and Moorey, 1962). The salinometer was previously calibrated against a known standard of salinity.

The peak high water and low water during the period under study varied as given below. On 3rd September, high water was at 13 00 hrs and low water at 07 30 and 19 30 hrs. On 4th September, high water was at 14 25 hrs and 02 20 hrs and low water was at 08 15 hrs and 20 30 hrs. The estuary is thus influenced by semi-diurnal tides.

The concentration of pigments varied at different stations during the day. The results may be summed up as follows :—

		STATIONS		
		1	2	3
Chlorophyll <i>a</i> , $\mu\text{g}/\text{l}$	.. ..	3.40-19.00	0.10-7.80	0.10-13.70
mean	.. ..	9.28	3.68	7.08
Chlorophyll <i>b</i> , ,,	.. ..	8.00-16.00	0- 0.90	0-10.60
mean	.. ..	12.33	0.25	2.46
Chlorophyll <i>c</i> , ,,	.. ..	0-35.80	0-16.00	0.60-32.60
mean	.. ..	10.98	5.08	10.68
Carotenoids, MSP/ $\text{m}^3$	.. ..	0- 4.37	0- 5.34	0- 4.56
mean	.. ..	1.43	1.45	1.10
Plankton, $\text{c}^3$	.. ..	50- 160	25- 80	47- 130
(Settlement volume)				
mean	.. ..	105	53	80
Pigment ratio 430/665nm	.. ..	2.50-2.60*	2.50-3.60	1.60- 4.40
(Yellow : Green pigments)	.. ..			
mean	.. ..	2.60	2.95	3.02
		(*on one occasion 7.50)		
Seston, mg/l	.. ..	70-147	10-987	46- 194
mean	.. ..	104.25	320.25	126.78
Salinity, ‰	.. ..	24.10-33.20	23.20-27.50	20.40-24.50
mean	.. ..	27.58	25.50	21.98
Temperature, °C.	.. ..	26.20-28.50	26.90-29.30	26.60-29.10
mean	.. ..	27.45	28.13	27.67

Chlorophyll *a* had peaks at stations 1 and 2 at high tide almost simultaneously (10 10 and 10 50 hours), while at station 3, this was at low tide 15 15 hours. The chlorophyll *a* concentration fluctuated within wide limits from 0.10 to 19.00  $\mu\text{g}/\text{l}$ . Chlorophyll *b* concentration was highest at station 1. The time of occurrence of

the peak chlorophyll *b* values varied 13 45, 10 50 and 07 15 hours at stations 1, 2 and 3 respectively. The maximum values coincided with low tide.

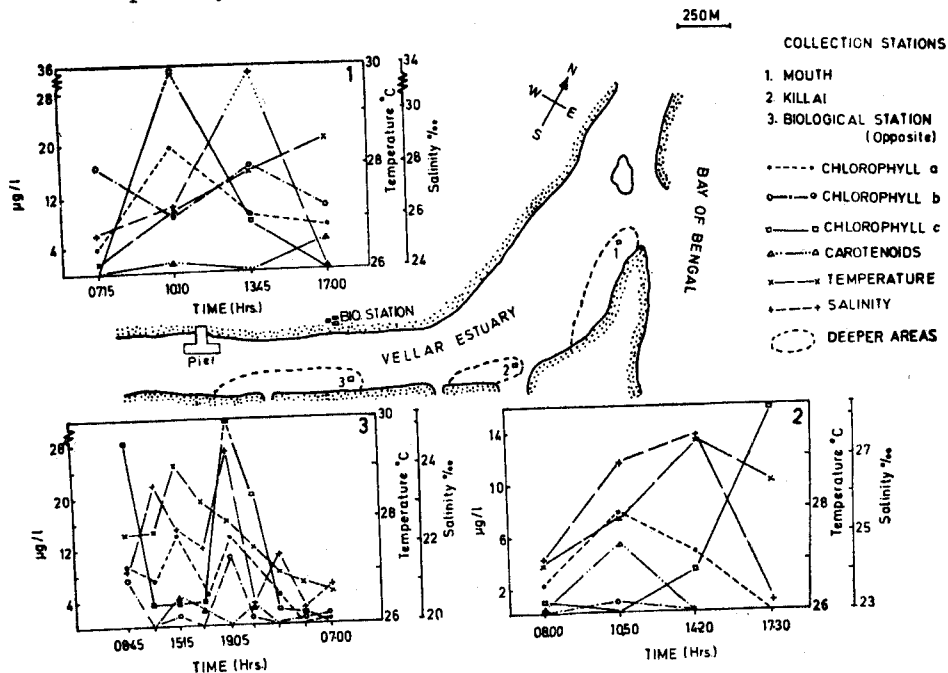


FIG. 1. Diurnal changes in the concentration of phytoplankton pigments in the vellar estuary

The peak values of chlorophyll *c* at stations 2 and 3 generally coincided with low tide and at station 1 with high tide.

The carotenoid values also showed wide fluctuation. The peak values usually occurred at low tide.

The yellow : green pigment ratio was around 2.60 at station 1 (with an occasional 7.50 recorded here), at station 2, around 2.95 and at station 3, around 3.02.

The phytoplankton community was more or less the same at the 3 stations. It comprised mostly of species belonging to *Thalassiosira*, *Thalassiothrix*, *Chaetoceros*, *Coscinodiscus*, *Rhizosolenia*, *Biddulphia* and *Melosira* among diatoms, and *Noctiluca*, *Pyrocystis*, *Peridinium*, and *Ceratium* among dinoflagellates. The plankton settlement volumes varied from 25 to 160 ml for a horizontal tow of 15 mts duration.

The wide variations in the pigment content of water have also been noticed by other workers (Qasim and Gopinathan, 1969 ; Qasim and Reddy, 1967 ; Yentsch and Ryther, 1957; Yentsch and Scagel, 1958). Yentsch and co-workers found highest chlorophyll *a* values during morning and before noon and lowest concentration during midday and early evening. Qasim and Gopinathan (1969) found the maximum values coinciding with low water.

In the present study also the peak values of pigments were found in the morning (10 10 and 10 50 hours at stations 1 and 2) and in the late evening (19 05 hours

at station 3). These observations compare favourably with the findings of other workers. At all stations during midday and evening, the pigment values showed a decreasing trend, which was again evident from midnight to 07 00 hours, the next day (Station 3). The pigment ratio was high during day while it fell at night. Cells with a high pigment ratio would mean more yellow than green pigments. It would appear that pigments near bottom begin to move upto surface at ebb tide, contributing thus to the peak values at low tide. In this process, the role of detrital chlorophyll being stirred up, has been brought to attention by Qasim and Gopinathan (1969).

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