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CHLOROPHYLL AND PHOSPHATE IN BOMBAY HARBOUR BAY*

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ABSTRACT

Chlorophyll and phosphate are among the more important factors deciding the primary productivity level in the sea. In the present paper, the chlorophyll data of Krishnamoorthy and Viswanathan (1968) are discussed in relation to earlier chlorophyll and phosphate determinations in Bombay waters.

It is pointed out that biomass data based on chlorophyll determinations are essential for assessing bio.ogical uptake of elements from the sea.

INTRODUCTION

CHLOROPHYLL and phosphate are among the more important factors determining the primary productivity in the sea. In their studies in Bombay Harbour Bay, Krishnamoorthy and Viswanathan (1968) observed that total chlorophyll was positively associated with primary productivity (correlation coefficient, + 0.54). Earlier, chlorophyll 'a' and phosphate values had been reported by Gogate (1960) for Bay water from Station Light Ship.

In the present paper, chlorophyll 'a' and phosphate in Bombay Harbour Bay are discussed in relation to meteorological and hydrological variables such as wind force and dissolved oxygen content of sea water.

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METHODS AND RESULTS

Methods of seawater sampling and analysis are summarized in Table 1.

TABLE 1. *Methods of seawater sampling and analysis in Bombay Harbour Bay*

Reference :	Gogate (1960).	Krishnamoorthy (1966).
Sampling Site :	Light Ship.	Cirus Jetty.
Chlorophyll :	Richards & Thompson (1952).	SCOR-UNESCO (1964).
Phosphate :	Harvey (1957).	
Diss. Oxygen :	Harvey (1957).	Strickland and Parsons (1965).
Wind Force :	India Met. Dept., Bombay.	India Met. Dept., Bombay.

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Table 2 contains data on chlorophyll ' a ', dissolved oxygen and wind force at station Cirus Jetty. Corresponding data (together with phosphate values) for Station Light Ship are given in Table 3.

TABLE 2. *Chlorophyll, Oxygen and Wind force at station CIRUS Jetty, Bombay* (*Krishnamoorthy*, 1966)

Date 1965	Chlorophyll 'a' mg/m³	Dissolved oxygen ml/l	Wind force* km/hr
30-3	3.05	5.8	20.3
21-4 ..	1.51	2.9	17.0
28-4 ..	6.31	3.8	17.0
7-5	0.63	4.4	17.2
18-5 ..	2.43	3.4	17.2
25-5 ..	2.70	3.2	13.8
19-10 ..	2.84	4.7	10.5
10-11 ..	3.96	3.7	13.5
19-11 ..	7.18	4.0	9.8
24-11 ..	9.00	3.7	12.7
2-12 ..	11.98	4.2	12.9

* Ten-days' average (Data from India Meteorological Centre, Bombay-5).

TABLE 3. *Chlorophyll, Phosphate, Oxygen and Wind force at station Light ship, Bombay* (*Gogate*, 1960)

Date 1959	Chlorophyll 'a' mg/m³	Inorganic* phosphate µg at P/l	Dissolved* oxygen ml/l	Wind force** km/hr
14-1 ..	0.48	0.78	4.3	8.2
29-1 ..	2.58	1.01	4.2	10.6
11-2 ..	1.60	0.67	4.5	10.1
19-2 ..	1.01	0.59	4.4	10.1
26-2 ..	1.12	0.94	4.4	10.5
12-3 ..	1.17	0.71	4.5	10.7
21-3 ..	0.19	0.59	4.5	10.3
3-4 ..	1.50	0.57	4.2	10.2
15-4 ..	0.48	0.64	3.9	9.0
1-5 ..	0.00	0.25	3.8	9.6
16-5 ..	0.74	0.42	4.0	10.0
6-10 ..	3.37	0.55	3.4	8.7
20-10 ..	2.29	0.26	4.1	12.2
27-10 ..	0.97	0.28	3.3	7.5
3-11 ..	0.54	0.26	3.0	7.1
10-11 ..	2.13	0.28	2.5	7.1
17-11 ..	1.56	0.61	2.8	7.6
24-11 ..	0.47	0.57	3.8	9.0
8-12 ..	0.45	0.61	4.0	8.7
15-12 ..	0.25	0.44	4.1	8.2
23-12 ..	0.56	0.38	2.2	8.5
29-12 ..	0.55	0.76	4.1	8.5

* Integral Mean Concentration for depths 0-15 m.

** Ten-days' average (Data from India Meteorological Centre, Bombay-5).

The chlorophyll 'a' content of Bay water during the premonsoon and postmonsoon months varies from 0 to 12 μg/l with values tending to be higher at the Jetty Station which is nearer shore. In the coastal waters near Calicut, Subrahmanyan (1959) observed that an increase in wind force was usually followed by a phytoplankton bloom. Effect of wind on chlorophyll content of water has also been studied by steele (1956) in Fladen Ground and by Forsbergh (1964) in Gulf of Panama. Small (1965) has suggested the prediction of surface chlorophyll 'a' in shallow eutrophic aquatic environment on the basis of Effective Chlorophyll Displacement Index (EDI) and Displacement Vector (DV), both the Index and the Vector being dependent on velocity, duration and dimensional stability of wind prior to chlorophyll collection dates. Jayaraman *et al.* (1961) noted that wind velocity during monsoon months rather than rainfall had a greater influence on seawater charcteristics in Bombay Harbour Bay. In the present work, the correlation coefficient between wind and chlorophyll 'a' is + 0.22. It is not significant at the P=0.05 level (Croxton, 1959, for statistical methods of analysis).

Phosphate-phosphorus, as a measure of plant nutrients in the Bay, ranges from 0.25 to 1.01 μg at/l and is associated with chlorophyll 'a' by a correlation coefficient of + 0.18.

The dissolved oxygen content in Bay water ranges from 2.2 to 5.8 ml/l. There is no significant correlation between phosphate-phosphorus and dissolved oxygen.

Cushing's equivalents (1958) have been used to convert chlorophyll values to Biomass (dry Organic Substance and Phytoplankton Carbon), the respective averages being 105 μg/l and 52 μg/l.

In his summary of available biomass data, Polikarpov (1966) has reported phytoplankton biomasses ranging from tenths of gm/m^3 to gms/m^3. He has discussed the role of biomasses in the biological uptake of elements from the sea. Plant biomass data from Bombay Harbour Bay will help in similar calculations.

REFERENCES

CROXTON, D. F. 1959. *Statistical methods in biology and medicine.*

CUSHING, D. F. 1958. The estimation of carbon in phytoplankton. *Rapp. Proc.-Verb. Reunion Cons. Int. Explor. Mer.*, **144** : 32-35.

FORSBERGH, E. D. 1964. Some relationships of meteorological, hydrographic, and biological variables in the Gulf of Panama. Contribution No. 1645 from Scripps Institution of Oceanography.

GOGATE, S. S. 1960. *Some aspects of hydrobiology of Bombay waters.* M.Sc. Thesis, University of Bombay.

JAYARAMAN, R., R. VISWANATHAN AND S. S. GOGATE 1961. Characteristics of sea water near the Light House, Bombay. *J. mar. biol. Ass. India*, 3 : 1-5.

KRISHNAMOORTHY, T. M. 1966. *Radioactive isotopes as tracers in biochemical studies.* M.Sc. Thesis, University of Bombay.

———————— AND R. VISWANATHAN 1968. Primary productivity studies in Bombay Harbour Bay using C-14. *Ind. J. Exp. Biol.*, **6** : 115-116.

POLIKARPOV, G. G. 1966. *Radioecology of aquatic organisms.* Reinhold Book Division, New York.

RICHARDS, F. A. AND T. G. THOMPSON 1952. The estimation and characterization of plankton populations by pigment analysis. II. A spectrophotometric method for the estimation of plant pigmants. *J. Mar. Res.*, **11**.

SMALL. 1965. Chlorophyll and Wind in North Iowa Lake (*Deep-Sea Research*, Abstract).

SCOR-UNESCO Report of Working Group 17. Determination of photosynthetic pigments in sea-water, UNESCO, Paris.

STEELE, J. H. 1956. Plant production on the Fladen Ground. *J. Mar. Biol. Assn. U.K.*, **35** : 1-33.

STRICKOAND, J. D. H. AND T. R. PARSONS 1965. A manual of seawater analysis. *Bull. Fish. Res. Bd. Canada*, **125**.

SUBRAHMANYAN, R. 1959. Studies on the phytoplankton of the west coast of India. *Proc. Ind. Acad. Sci.*, **50B** : 113-252.