Mahasagar

BULLETIN OF THE NATIONAL INSTITUTE OF OCEANOGRAPHY

VOLUME 7 1974 NUMBERS 1 & 2

SEASONAL VARIATIONS IN CHLOROPHYLL-*a* OF SOME TROPICAL ENVIRONMENTS

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ABSTRACT

Seasonal variations in phytoplankton pigment were studied for a period of one year from May 1973 to April 1974 in three environments, *viz* seagrass bed, coral reef waters and an estuary near Mandapam. Chlorophyll *a* values ranged from 0.893 to 9.49 μg/l in the waters of seagrass bed, in coral reef waters the range was from 0.177 to 0.695 μg/l. In estuary chlorophyll *a* varied from 0.962 to 8.762 μg/l. Among the three environments taken for study, the coral reef waters showed lower chlorophyll concentration than seagrass bed waters and estuary. A proper understanding of the role of the free phytoplankton and their association with corals and seaweeds in ascertaining their contribution to the production in selected environments has been stressed.

Variations in the phytoplankton content of tropical environments are of considerable interest in the study of food chains and these have been investigated in varied environments such as backwaters (Qasim and Reddy, 1967; Qasim and Gopinathan, 1969), reef waters (Jeffrey, 1968; Qasim and Sankaranarayanan, 1970) and in mangrove waters (Krishnamurthy, 1971; Sundararaj and Krishnamurthy, 1973). The present study deals with the seasonal variations of chlorophyll *a* concentration in some tropical environments such as seagrass bed, coral reef waters and an estuary near Mandapam.

Samples were collected at weekly intervals from all the three environments mentioned above and chlorophyll estimations were done according to Unesco (1966). In all cases replicate samples were taken and the mean are given in the results.

Seagrass Bed

The seagrass bed is located along the beaches of the Gulf of Mannar. The bed has a luxuriant growth and covers a distance of 3 km from Mandapam Jetty to Vedalai. It has an average width of 200 m from the shore into the sea and average depth over the bed is approximately 2 m.

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Cymodocea isoetifolia, *C. serrulata*, *Halophyla ovalis*, *H. stipulacea* and *Diplanthera uninervis* are the most common species found in this environment, among which *C. isoetifolia* is the most abundant species.

Coral reef

The reef in Palk Bay selected for this study lies almost parallel to the shore in an east-westerly direction. The reef is divided into two halves by navigational channel and the eastern half is Pamban Pass. The common corals found in this reef are species of *Favia*, *Porites*, *Acropora*, *Favites*, *Gonipora*, *Goniastrea* and *Pocillopora*.

Estuary

The Athankarai estuary is formed by the river Vaigai. It has its origin in the Western Ghats. The estuary is located at about 15km west of Mandapam (Fig. 1). There is no sand bar formation

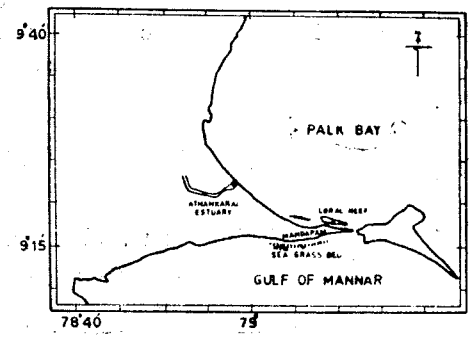

Fig 1. The location of different tropical environments around Mandapam.

at the mouth of the estuary and the sea remains in communication with the estuary throughout the year. The bottom sediment of the estuary is largely clayey and there are salt pans on its southern side. Several patches of oyster beds (dominant species in the bed is *Crassostrea madrasensis* Preston) are seen from the mouth up to 2–3 km into the upper reaches of the estuary. *Meretrix casta* also occurs abundantly along the banks of the estuary.

The variations in average monthly values of chlorophyll *a* are shown in Fig. 2. In the seagrass bed two peaks of chlorophyll *a* are evident : one in July (9.498 µg/l) and second in December (7.207 µg/l). Lowest value was recorded in September (0.893 µg/l).

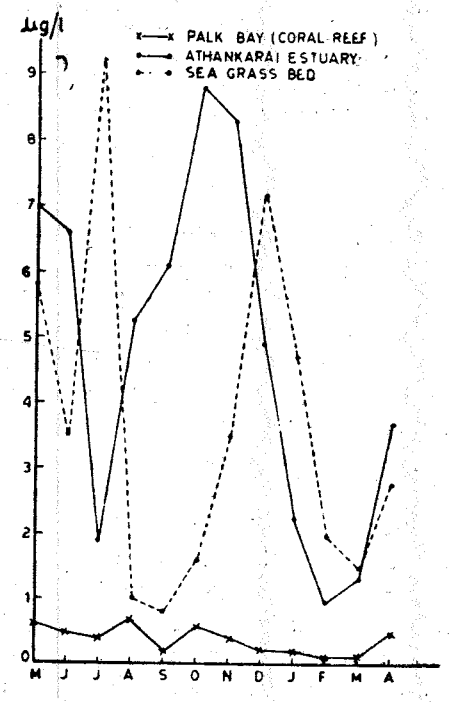

Fig 2. Mean monthly values of chlorophyll *a*.

In the coral reef waters the chlorophyll *a* values showed an increasing trend from July–August, followed by a

sudden fall in September. From November to March there was a decrease and the values were almost constant.

In the estuary, higher values of chlorophyll *a* were recorded between August and December. Then there was a decrease in January and February. The maximum was recorded in October (8.762 μg/l) and the minimum in February (0.962 μg/l).

Phytoplankton samples showed that even though several species of diatoms occurred in both Gulf of Mannar and Palk Bay, the predominant species which formed the bulk in several months were: *Rhizosolenia alata* Brightwell, *R. imbricata* Brightwell, *R. stylicormis* *Thalassinema nitzschoides* Grunow, *Thalassiothrix frauenfeldii*, *Chaetoceros* sp., *Biddulphia* sp., *Astrionella japonica*, *Hemidiscus* sp., *Coscinodiscus* sp. *Ceratium* sp. and *Pleurosigma* sp. Diatoms were the most abundant group. *Trichodesmium erythraeum* were also noticed in the Gulf of Mannar during the summer months but these were relatively scarce in the Palk Bay. Almost all the phytoplankton which occurred in the Palk Bay were also observed in the Athankarai estuary.

Chlorophyll *a* values in coral reef waters recorded in the present study were found to be several times lower than those recorded for the waters of seagrass bed and the estuary. Earlier workers have also reported similar values. Jeffrey (1968) found a pigment value of 0.11–0.24 μg/l in August and 0.19 μg/l in September in the Clark reef. Qasim and Sankaranarayanan (1970) obtained the pigment values of 0.01–0.38 μg/l in November and December in Kavaratti Atoll. The pigment value obtained in the present study for August (0.69 μg/l) is higher than those of Jeffrey's but the value in September (0.17 μg/l) is similar. Likewise, the values for November and December (0.40–0.22 μg/l) are nearly similar to those obtained by Qasim and Sankaranarayanan (0.01–0.38 μg/l) in Kavaratti Atoll. Russel (1934) and Johnson (1954) have reported low phytoplankton concentration in Great Barrier Reef Lagoon and Bikini Lagoon respectively. These authors reported their values based only on a few months and hence a strict comparison of the values is not possible. Despite the low chlorophyll levels and phytoplankton content in the coral reef waters, their high productivity may probably be due to the presence of zooxanthellae in the polyps, boring filamentous algae inside the corals and attached algae. Thus it appears that the contribution by free phytoplankton concentration to the reef productivity is not appreciable and perhaps a combined study of the pigments of the free living phytoplankters, zooxanthellae, boring and attached algae and its comparison with flow respirometry studies will probably give a better understanding of the productivity of coral reef.

High pigment values in the waters of seagrass bed indicate that the waters are far more productive than those of the coral reef. However, the extent of contribution by free phytoplankton to the productivity of the waters of seagrass bed is yet to be ascertained.

Even though the Athankarai estuary appears to be very productive as other tro-

pical estuaries, the relatively higher pigment values observed in this study may probably be due to the detrital chlorophyll associated with stirred up sediments (Qasim and Reddy. 1967).

ACKNOWLEDGEMENTS

The author wishes to express his deep gratitude to Dr. S. Z. Qasim, Director, NIO for his guidance and valuable suggestions for improving the manuscript. Thanks are also due to Ministry of Education and Social Welfare, Government of India for awarding a Senior Research Scholarship during the tenure of which the work was carried out.

REFERENCES

Jeffrey, S. W., 1968. Photosynthetic pigments of phytoplankton of some coral reef waters. *Limnol. Oceanogr.*, **13**, (2) : 350.

Johnson, M. W., 1954. Plankton of the Northern Marshall Islands. *U. S. Geol. Survey Profess. Papers*, 260–E : 301–314.

Krishnamurthy, K., 1971. Phytoplankton pigments in PortoNovo waters. *Int. Revue. ges Hydrobiol.*, **56** (2) : 273.

Qasim, S. Z. and C. V. G. Reddy , 1967. The estimation of plant pigments of Cochin Backwaters during the monsoon months. *Bull. mar. Sci.*, **17** (1) : 95.

Qasim, S. Z. and C. K. Gopinathan, 1969. Tidal cycle and the environment at features of Cochin Backwaters. *Proc. Indian Acad. Sci* , *LXIX* (6): 336.

Qasim, S. Z. and V. N. Sankaranarayanan, 1970. Production of particulate organic matter by the reef on Kavaratti Atoll (Laccadives). *Limnol. Oceanogr.*, **15** (4) : 574.

Ruasel, F. S., 1934. The zooplankton III. A comparison of the abundance of zooplankton in the Barrier Reef Lagoon with that of some regions in northern European waters. *Great Barrier Reef Exped. Sci. Rept.*, **2** : 176-201.

Sundararaj, V. and K. Krishnamurthy, 1973. Photosynthetic pigments and primary production. *Curr. Sci.* **142** (6) : 185–189.

UNESCO, 1966. Determination of photosynthetic pigments in seawater. In *monographs on oceanographic methodology*—1.