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POTENTIAL PRODUCTIVITY OF MICROBENTHIC ALGAE IN COCHIN ESTUARY

ABSTRACT

Potential productivity of the benthic microalgae in Cochin estuary and their productivity potential in terms of chlorophyll *a* were assessed. The studies concentrated at 5 representative stations for a period of one year recorded the average potential productivity of 57.81 mgC/m^2/hr. Based on the ratio of biomass and productivity, the annual potential production of benthic microalgae with an effective shallow area of 22.5 km^2 in the estuary is estimated to be 400,000 tonnes of carbon.

THE CONTRIBUTION of microbenthic algae often amounts for a large percentage of the total primary production in shallow regions (Jonsson, 1991). It may be even greater than that of phytoplankton (Hargrave *et al.*, 1983), in coastal and shallow waters the predominant primary producers being benthic microalgae (Raymont, 1980; Bott *et al.*, 1985), which play a major role in benthic environment as food resources for benthic invertebrates (Lamberti *et al.*, 1985;. Hansson, 1992; Sivadasan and Joseph, 1997). Their biomass is high (Marker, 1976 a; 1976 b; Yasuno *et al.*, 1985) and retain a part of the newly mineralised nutrients at the sediment surface (Cartlon and Wetzel, 1988). Hence it is essential to estimate the primary productivity of the benthic environment and assess potential fishery resources. Two main techniques for determining the benthic primary productivity, Oxygen technique and C^{14} technique (Shaffer and Cahoon, 1987) have been used. During the last decade the use of microelectrodes had made a major improvement in the oxygen exchange method because primary productivity can be measured with high spatial resolution (Revsbech and Jorgensen, 1986). In the present work the algae were separated from benthic environment and the productivity estimated.

In Cochin estuary, studies on organic production was initiated by Qasim *et al.*, (1969). They observed that the average gross production was 280 gC/m^2/yr. Later Nair *et al.*, (1975) estimated the primary production of the entire estuary and it was found to be 1,00,000 tonnes of carbon with an annual average ranging from 150 to 650 gC/m^2. The primary productivity of various size groups of planktonic algae in the estuary was studied. It was found that up to 73% of the total productivity was the contribution of plankton <60μ (Joseph, 1988). In India very little has been done on benthic microalgae except the photosynthetic pigments (Sivadasan and Joseph, 1995), distribution and role (Sivadasan and Joseph, 1997) and community structure (Sivadasan and Joseph, 1998) of benthic microalgae in Cochin estuary.

The authors are thankful to Prof. (Dr.) N.R. Menon, Director. School of Marine Sciences, for valuable suggestions and encouragement. The first author thanks CSIR for the award of fellowship.

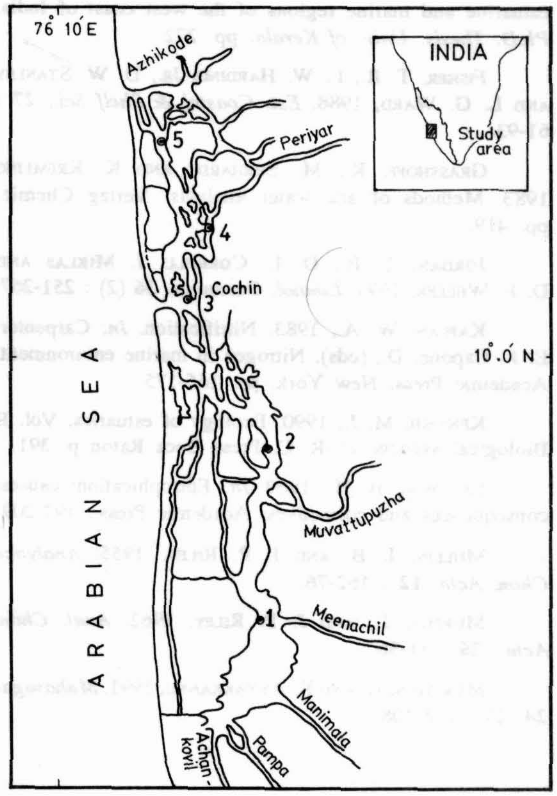

Fig. 1. *Cochin estuary, showing station location.*

MATERIAL AND METHODS

Monthly samplings were conducted at 5 stations in the estuary (fig. 1) viz. Thannirmukkam, Panavally, Bolghatty, Eloor and Cherai during June to May 1992. The replicate sediment samples collected from sediment surface (1cm to 17 cm) using a plastic tube of an area of 8cm^2 were transferred to petridishes for isolation of the flora and chlorophyll estimation.

The samples were diluted with millipore filtered estuarine water from the same station.

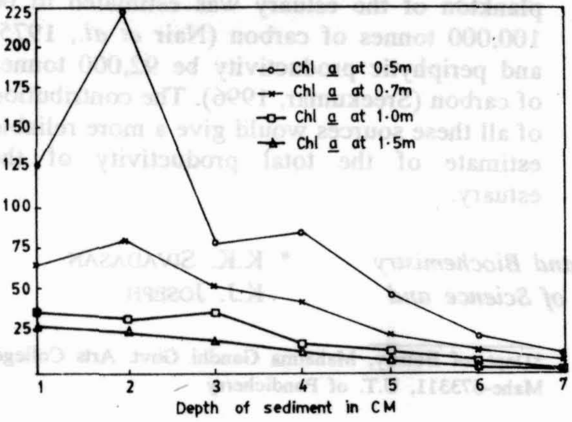

Fig. 2. *Depthwise distribution of Chl. a mg/m^2 from water level and sediment surface.*

The microalgae were isolated by allowing the algae to pass through 60 μ mesh size nylon cloth. The algae were transferred to a beaker, by repeated washing with filtered estuarine water. A known quantity of the isolated flora was fixed for biomass estimation. Biomass was estimated in terms of active chlorophyll *a* (APHA, 1992). The sediment after isolation of flora was fixed for biomass estimation. Once the total concentrtion of chlorophyll *a* is known the percentage of biomass of isolated algae can be estimated.

The primary production of the flora was estimated using Oxygen technique (Strickland and Parsons, 1977). From the ratio between the biomass and productivity the potential production of the estuary would be estimated.

RESULTS AND DISCUSSION

The concentration of active chlorophyll *a* varied with the depth of water column. It is inversely proportional to the depth and at the upper most 1 cm layer of 0.5 m depth, 0.75 m, 1.0 m and 1.5 m the values were 126.00, 69.08, 23.73 and 26.74 mg chlorophyll mg/m^2 respectively. At 7 cm depth of the sediment core the corresponding values for various depths mentioned were 27.00, 7.40, 7.62, 8.21 and 6.43 mg/m^2 respectively. On analyses of vertical distribution of the chlorophyll *a* it was found that shallow regions of 0.5 m and 0.75 m

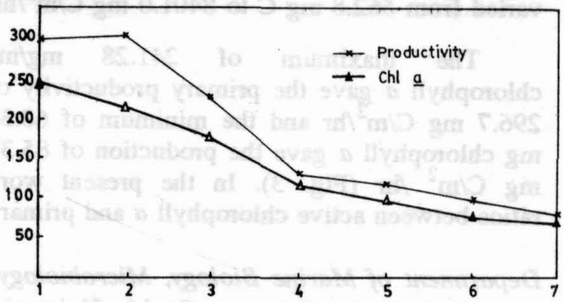

Fig. 3. *Variation of Chl. a mg/m^2 and productivity mg C.h^{-1}*

depth recorded the maximum at subsurface of the mud sample. (Fig. 2). Analyses of the vertical distribution of active chlorophyll *a* showed that it is inversely proportional to the depth of sediment core, the maximum concentration being varied with effective illumination which is influenced by a depth of the water column and texture of the substrata.

In very shallow areas that is within a depth of 0.5 m chlorophyll *a* was considerably high up to 17 cm of the core sample. When depth of the column was higher that is 0.75 m, 1 m and 1.5 m the concentration of active chlorophyll *a* was found to be negligible beyond 7 cm depth of the core.

The annual average value of chlorophyll *a* for every 1 cm thickness of the core upto 7 cm was analysed. When the depth is 0.5 m the maximum active chlorophyll *a* was 225.1 mg/m^2 which was at a depth of 2 cm of the core sample. At 0.75 m depth the maximum was only 34.38 mg/m^2 which was at the same depth. At 1m depth the highest value of active chlorophyll *a* (26.74 mg/m^2) was recorded at 1cm depth of the mud sample (Fig. 2). Thus the magnitude of active chlorophyll *a* was found to be inversely proportional to the depth of the water column.

The average value of biomass in terms of chlorophyll *a* being 46.25 mg/m^2. The total biomass in the estuary with an approximate effective shallow area of 22.5 km^2 is estimated to be 7300 kg. The productivity of the uppermost layer was found to be high where the production varied from 562.8 mg C to 8401.0 mg C/m^2/hr.

The maximum of 241.28 mg/m^2 chlorophyll *a* gave the primary productivity of 296.7 mg C/m^2/hr and the minimum of 68.34 mg chlorophyll *a* gave the production of 85.32 mg C/m^2 /hr (Fig. 3). In the present work ratios between active chlorophyll *a* and primary production was calculated to be 1:1.25. Based on the ratio derived and the total biomass in terms of chlorophyll *a* the annual potential production in the benthic environment of Cochin estuary with an approximate effective shallow area of 22.5 km^2 is estimated to be 400,000 tonnes of carbon. Primary production of plankton of the estuary was estimated to be 100,000 tonnes of carbon (Nair *et al.*, 1975) and periphytic productivity be 92,000 tonnes of carbon (Sreekumar, 1996). The contribution of all these sources would give a more reliable estimate of the total productivity of the estuary.

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