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Primary Productivity of the Brackishwater Impoundments along Nethravathi estuary, Mangalore in Relation to Some Physico-chemical Parameters

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Primary productivity of brackishwater impoundments along Nethravathi estuary was studied for one year from Feb. 1998 to Jan. 1999. The primary productivity values varied from 1.78 to 13.47 mgC/m^3/h and it exhibited a bimodal pattern of distribution with primary peak in May followed by a secondary peak in September. Lower values were recorded during monsoon season (June-Aug). Chlorophyll-a values observed to range from 2.83 to 9.71 mg/m^3 with higher values recorded during monsoon season and lower values in the month of Dec/Jan. The seasonal trend of phaeopigment exhibited trimodal peak during March, November and July.

Key words: Primary productivity, brackishwater, estuary

In any aquatic body primary productivity gives information relating to the amount of energy available to support bioactivity of the system (Vollnwueider, 1969). Primary production indicates organic production at the base of a conceptual food chain. Though it is difficult to have an explicit definition some authors have attempted to define it generally as the rate of synthesis of organic matter by phytoplankton by the uptake of carbon, using solar radiation as a source of energy (Odum, 1971; UNESCO, 1973; Barnes and Mann, 1980 and Parsons *et al.*, 1984). Phytoplankton productivity is a major source of primary food energy for most of the brackishwater ecosystems. Lot of work has been carried out on primary organic production in coastal and estuarine environments (Pradeep & Gupta, 1986; Sivadasan and Joseph, 1995; Gowda, 1996 and Nayar *et al.*, 1999). However, as the study in brackishwater ponds having mangrove vegetation are meager. Hence the present work was aimed at investigating productivity status of brackishwater impoundments along Nethravathi estuary, Mangalore.

Materials and Methods

The study was carried out in the brackish water impoundment at the southern bank of river Nethravathi. The pond studied is a semi enclosed water body interlinked with another enclosed pond (Fig. 1.). The exchange of water takes place between semi enclosed pond and Nethravathi estuary through a narrow opening. Dense mangrove vegetation is present on the northern side of the pond. Four sampling stations were selected and samples were collected once a month for one year (Feb. 1998 to Jan. 1999) from each station. Temperature and pH of the water were recorded by using mercury glass thermometer and Systroni 323-pH meter respectively. Dissolved oxygen, salinity and nutrient concentrations viz., nitrate-nitrogen, phosphate-phosphorus and silicate-silicon were measured by using standard methods (Persons *et al.*, 1989). Chlorophyll-*a* and phaeopigments were estimated by acetone extraction method (Parsons *et. al.*, 1989). Primary production of water was estimated by using the ^{14}C technique (Steeman-Nielson, 1952).

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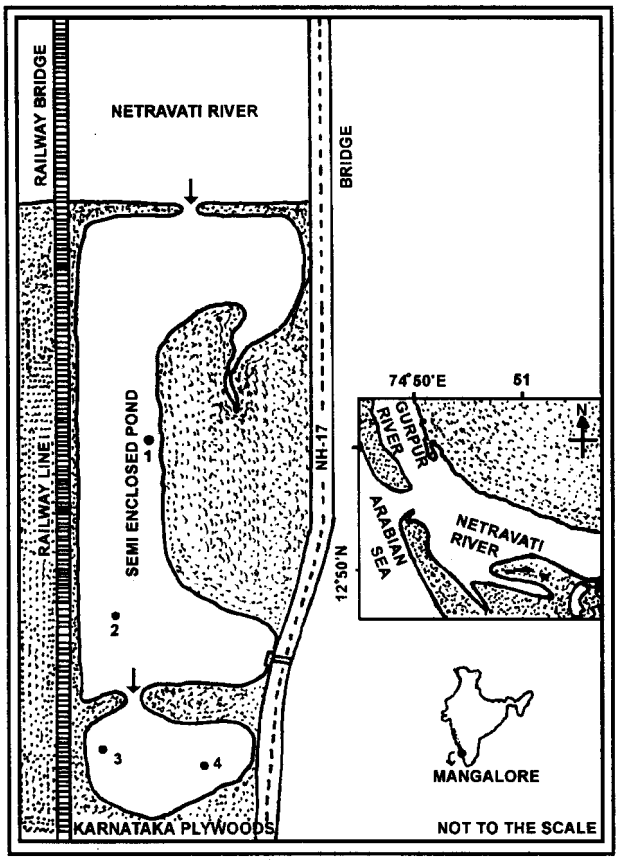

Fig. 1. Map showing different stations in the brackishwater pond of Nethravathi estuary.

Results and Discussion

Variation in the physico-chemical parameters of the water body are given in Table 1. Water temperature in the pond ranged from 26.7°C (Oct) to 37.22°C (May). pH value of water was slightly alkaline to neutral (6.93 to 7.55). The dissolved oxygen values fluctuated in the range of 3.75 to 4.55 mg/l. Salinity values ranged from 0.99×10^3 to 30.8×10^{-3}. Nitrate-nitrogen, phosphate-phosphorus and silicate-silicon fluctuated between 5.12 and 12.66, 0.52 and 3.89 and 52.84 and 123.4 µg-at/l.

The chlorophyll-*a* values observed to range from 2.83 to 9.71 mg/m^3 with higher values recorded during monsoon season (June-Aug) and lower values in the month of Dec. – Jan. and moderate values during March-May (Fig.2). Similar observations were made by Sivadasan and Joseph (1995) and they attributed the higher chlorophyll-*a* values of premonsoon season to the higher

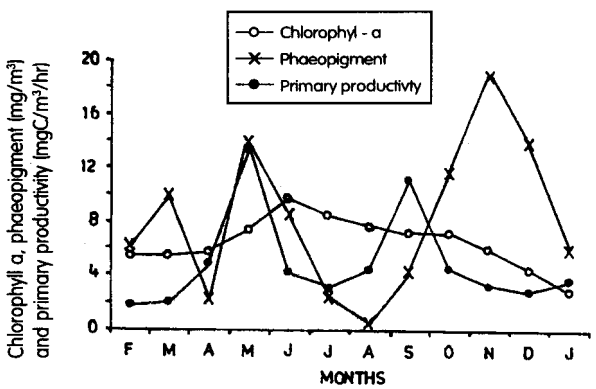

Fig. 2. Monthly variations of chlorophyll-a, phaeopigments and primary productivity in the brackishwater pond of Nethravathi estuary.

Table 1. Physico-chemical variables of brackishwater impoundment during 1998-99(monthwise values, mean values ± standard deviations of 4 samples)

Month	Water temperature (°C)	pH	Dissolved oxygen (ml/L)	Salinity ($X10^3$)	Nitrate-nitrogen (µg-at/L)	Phosphate-phosphorus (µg-at/L)	Silicate-silicon (µg-at/L)
Feb, 1998	34.35±0.38	7.48±0.21	4.51±0.36	24.84±1.83	5.71±0.84	1.13±0.36	70.94±15.96
March	35.85±0.54	7.55±0.21	3.79±0.24	26.19±1.22	7.23±0.18	0.75±0.10	62.79±11.65
April	36.63±0.31	7.35±0.13	4.55±0.37	29.72±0.82	6.96±1.26	0.52±0.13	61.36±7.89
May	37.22±0.29	6.98±0.04	3.76±0.17	30.8±0.69	8.77±0.41	0.9±0.15	52.84±3.83
June	32.07±0.43	7.10±0.16	4.02±0.07	18.64±0.68	10.93±1.38	1.17±0.26	84.24±2.55
July	31.67±0.57	6.93±0.04	3.95±0.47	8.85±2.16	11.87±1.87	1.79±0.12	82.46±4.16
August	30.4±0.34	6.98±0.12	3.75±0.21	0.99±0.34	12.66±1.51	2.22±0.22	79.78±9.45
September	28.82±0.37	7.01±0.18	4.55±0.17	1.68±0.22	8.86±0.92	2.91±0.24	81.31±1.73
October	26.7±0.41	6.95±0.07	4.34±0.15	2.10±0.29	6.96±0.92	2.76±0.23	113.2±2.02
November	30.3±0.22	6.95±0.21	4.42±0.23	4.75±0.24	6.56±1.28	3.9±1.71	123.4±5.83
December	29.0±0.61	7.41±0.06	4.22±0.20	12.61±0.56	6.36±1.28	1.13±0.28	85.93±3.19
Jan, 1999	28.7±0.08	7.42±0.10	3.87±0.17	18.69±0.76	5.12±1.01	0.88±0.20	66.09±6.71

phytoplankton standing crop. In the present study chlorophyll-*a* production was associated with higher nitrate – nitrogen and silicate – silicon and with lower salinity and phosphate – phosphorus concentration. The phaeopigment content was observed to vary from 0.54 to 19.04 mg/m^3. The seasonal trend of phaeopigment exhibited a trimodal distribution with primary peak during March followed by November and July. Discussing the relationship between chlorophyll-*a* and phaeopigments, Yentsch (1965) remarked that the prolonged condition tend to reduce the efficacy of chlorophyll-*a*. Higher phaeopigment concentration is attributed to increased production of detritus due to degradation of chlorophyll-*a* and inflow of matter from riverine runoff. Subramanian & Venugopalan (1980) and Verlencar & Qasim (1985) made similar observations in Vellar estuary and estuarine waters of Goa.

The primary productivity values varied from 1.78 to 13.47 mgC/m^3/h. In general, the primary productivity in the brackishwater ponds exhibited a bimodal pattern of distribution with primary peak in May followed by a secondary peak in September. Lower values were recorded during monsoon period (June – Sept.) and moderate production was recorded in postmonsoon season (Sept.–Feb.).

In comparison to our results, Patterson and Ayyakkannu (1991) recorded higher primary productivity values in Kollidam estuary and they reported salinity as prime factor in regulating the distribution of phytoplankton. Further the authors opined that summer period with high salinity stable condition promoted the growth of plytoplankton. The lower values during monsoon period was due to dilution of estuarine water by riverine flow or the reduction of salinity which could have affected the phytoplankton population (Pillai *et. al.*, 1975). The works of Pradeep (1980) and Nayar (1997) are in good agreement with the present study and they reported lower primary productivity during postmonsoon season in brackishwater ponds of Mulki estuary and Talapady lagoon respectively.

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