

# Seasonal Variations in Hydrographical Parameters, Nutrient Content and Energy Content of the Suspended Particulate Matter in Netravathi - Gurpur Estuary

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An attempt has been made to study the energy content distribution in the suspended particulate matter of Netravathi-Gurpur estuary. Hydrological parameters and nutrient content exhibited seasonal variations. Suspended particulate matter gradually increased from January onwards till May at all the stations. The higher particulate matter concentration of 218 mg. l<sup>-1</sup> was reported in the month of December. The energy content of detrital matter was less during June to September in spite of greater concentration.

**Key words:** Netravathi-Gurpur estuary, hydrographical parameters, nutrients, energy content, seasonal variation, suspended matter

Estuary is one of the specialised coastal environments dependent on biotic and abiotic inputs, mainly from riverine inflow and oceanic influences (Laane, 1980; Runge & Ohman, 1982). In natural environment, suspended particulate matter is composed of a complex mixture of phytoplankton, detritus, bacteria and organic particles (Roman & Rublee, 1981) and its concentration varies with respect to size distribution, composition and nutritional potential (Riley, 1970; Roman & Rublee, 1981). The distribution of suspended particulate matter in an estuary results from the complex circulation pattern produced by the river current, tidal ingress and egress and mixing of riverine and marine environments (Sheldon *et al.*, 1967). Detrital particles generally form the major component of the suspended matter in the sea and play a vital role in the energy transformations. The present investigation on nutrient value and energy content of the suspended matter of Netravathi-Gurpur estuary was taken up because such information is meagre in Indian context.

## Materials and Methods

Netravathi-Gurpur estuarine complex situated at 12°15' N and 74°50' E is formed

by the simultaneous confluence of two rivers namely, the Nethravathi and Gurpur with the Arabian sea. River Netravathi, larger of the two, originates from the western ghats from east of Kudremukh and drains its waters into the Arabian sea and it has a catchment area of 1232 square miles (Anon, 1959) with a maximum water discharge of 7100 cm<sup>3</sup>.s<sup>-1</sup> (Anon, 1971).

In the present study, a total of six stations, two each at the estuarine limbs and one at the estuarine mouth and the other at offshore region were selected. Air and water temperature was measured by using a precise mercury-in-glass thermometer. Extinction coefficient was calculated by using secchi disc. Salinity and dissolved oxygen were estimated following standard methods (APHA, 1995). Nutrients like ammonia, nitrate, phosphate and silicate were analysed employing standard methods (Strickland & Parsons, 1972). Suspended particulate matter was determined by filtering a known volume of water through a glass fiber filter (GF/C, 0.45µ pore size). The caloric content of the material retained on the filter paper was estimated using a bomb calorimeter (Gallenkamp bombcalorimeter). The data

were subjected to statistical analysis (Snedecor & Cochran, (1968).

## Results and Discussion

Data on hydrographical parameters, suspended particulate matter and energy content during the period of study at the six stations are given in Tables 1 and 2. Air and water temperatures were maximum in March (31.36°C and 30.95°C respectively) and minimum during July (23.35°C and 21.05°C, respectively). Similar trend had been observed earlier by Reddy, 1982 and Sahu, 1981. Extinction coefficient is a measure of the turbidity and is known to depend to a great extent on the suspended material and to some extent on the cloud cover and sun's altitude. Relatively higher values of extinction coefficient were recorded during June (1.92), October (1.74) and May (1.68). The high values recorded can be attributed to the inflow of suspended matter to the estuary through the rivers. Similar phenomenon was reported by Reddy (1983), Reddy (1986) and Ramaraju *et al.* (1970). The distribution pattern of dissolved oxygen gives direct indication of the amount of organic carbon fixed. The higher dissolved oxygen in the study during monsoon (7.33 ml. l<sup>-1</sup>) could be due to the influx of fresh water and reduced

tidal influence (Vijayakumar *et al.*, 1999). Low values during pre-monsoon period (4.44 ml. l<sup>-1</sup>) might be attributed to utilization of oxygen for the decomposition of organic matter in terrigenous sediments. Salinity was high (32.13 ppt) during the pre-monsoon period and it was low during monsoon season (0 ppt). Similar trend had been reported by Ramamirtham & Jayaraman (1963) during studies in the Cochin estuary.

Nitrate-nitrogen values showed a bimodal oscillation, registering peaks during the months of September and August respectively. Sahu (1981) also had reported similar behaviour of nitrate in estuarine and near shore waters of Mangalore. The level of nitrate in the Zuary estuary was 0.16-8.35 µg.l<sup>-1</sup> and in the Netravathi-Gurpur estuary it varied from traces to 53.47 µg. l<sup>-1</sup> (DeSouza & Sengupta, 1986).

Nitrite - nitrogen concentration was found to vary from traces during the pre-monsoon period to 1.29 µg. l<sup>-1</sup> during the monsoon months. Similar variations in nitrite concentration were reported in the brackishwater ponds along the Netravathi estuary (Nagarajaiah & Gupta, 1983). The frequent variation of nitrite-nitrogen content with significant increase during the monsoon

Table 1. Seasonal fluctuation of hydrographical parameters and nutrient content in Netravathi-Gurpur estuary

Parameter	1991			1992								
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.
Air temperature (°C)	28.69	28.20	28.32	26.54	29.08	31.36	30.81	29.63	29.16	23.35	24.21	24.43
Water temperature (°C)	29.73	28.36	27.78	26.68	29.55	30.95	29.85	28.83	30.18	21.05	21.83	22.18
Extinction coefficient	1.74	0.72	1.13	0.81	1.09	1.08	0.77	1.68	1.92	0	0	0
Dissolved oxygen (ml.l <sup>-1</sup> )	5.24	5.93	6.36	4.44	5.63	5.80	5.70	5.36	6.75	7.06	7.33	7.06
Salinity (ppt)	13.12	22.91	27.85	31.35	30.74	31.11	31.72	32.13	1.21	0.05	0.07	0
Nutrients (µg.l <sup>-1</sup> )												
Nitrite nitrogen	0.51	0.52	0.37	T*	0.34	0.27	0.67	0.12	0.15	1.29	1.22	0.78
Nitrate nitrogen	0.23	0.82	0.60	T	0.29	0.19	0.19	0.12	0.13	0.63	1.21	1.60
Phosphate phosphorous	0.52	1.30	0.68	0.43	0.16	0.13	0.47	0.61	1.56	1.70	0.84	0.95
Silicate silicon	75.42	51.03	14.0	5.08	7.63	8.40	61.87	7.78	8.16	111.13	103.43	77.21

\*T = traces

Table 2. Seasonal distribution of particulate matter (mg. l<sup>-1</sup>) in Netravathi - Gurpur estuary

Stations	1991			1992								
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.
1	0.027	0.011	0.007	0.02	0.031	0.047	0.040	0.071	0.082	0.103	0.158	0.081
2	0.076	0.021	0.013	0.034	0.021	0.027	0.038	0.085	0.096	0.127	0.111	0.109
3	0.043	0.014	0.009	0.036	0.033	0.022	0.042	0.044	0.109	0.112	0.218	0.123
4	0.039	0.031	0.01	0.023	0.02	0.015	0.029	0.085	0.087	0.207	0.133	0.089
5	0.063	0.023	0.028	0.024	0.014	0.027	0.027	0.058	0.148	0.161	0.121	0.096
6	0.081	0.087	0.009	0.027	0.029	0.030	0.042	0.033	0.074	0	0	0
Mean	0.054	0.0211	0.0126	0.0273	0.024	0.028	0.036	0.062	0.099	0.118	0.123	0.083

period in Mulki estuary was noticed by Reddy & Gupta (1985).

Phosphate content in the estuary was maximum during monsoon months (1.56 and 1.70  $\mu\text{g. l}^{-1}$ ). The higher levels of phosphates during the monsoon months is attributed to the terrigenous input and lower levels during pre- and post monsoon seasons is believed to be due to the utilization of phosphates by plankton (Pai & Reddy, 1986; Ramana *et al.*, 1989). Concentration of silicates also showed the same trend of high values during July-August and low values during January and March (Vijayakumar *et al.*, 1999). Data on the suspended particulate matter is presented in Table 2. Seasonal fluctuations in the levels of suspended particulate matter were not significantly different except during the South west monsoon months (June-Sept.). The data also suggested that suspended particulate matter gradually increased from March to August at all the stations. This observation is supported by the earlier study in the Netravathi-Gurpur estuary (Reddy *et al.*, 1979). At station 3, a higher particulate matter concentration of 0.218 mg. l<sup>-1</sup> was recorded in the month of August, while lower concentration of 0.009 mg. l<sup>-1</sup> was observed in the month of December. Comparable levels of suspended particulate matter have been reported in other estuarine systems also (Reddy, 1990; Reddy *et al.*, 1992).

Detritus in an estuary is formed through the process of decomposition of biological

material and it is an important link in energy transfer process in the aquatic environment. The detritus of the Netravathi-Gurpur estuary results from autochthonous materials such as phytoplankton, zooplankton and marginal vegetation and the material originating from the resuspension of sediments in the bottom layers. The energy content of the suspended particulate matter at the various experimental stations in Netravathi-Gurpur estuary is presented in Fig. 1. A higher energy content was found during pre-monsoon season while it was lower in monsoon season. This observation is in agreement with the earlier work (Krishnakumari *et al.*, 1978) in Zuari estuary, Goa. The pooled caloric values of the present study varied with minimum and maximum values of 0.938-11.1kJ. g<sup>-1</sup> dry matter. Energy content of particulate matter of Zuari river of Goa was in the range of 0.724 to 25.34 kJ.g<sup>-1</sup> dry weight (Krishnakumari *et al.*, 1989).

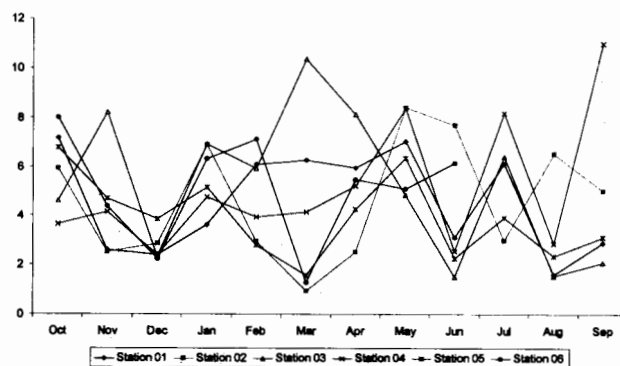


Fig. 1. Energy content (kJ.g<sup>-1</sup>) of suspended particulate matter at different stations of Nethravathi-Gurpur estuary.

The particulate material generally results from living (phyto - and zooplankton) and non living (detritus) components. Usually, detritus is largely estimated as the difference between the total suspended matter (TSM) and the living matter without separately taking into account the total bacteria and other microflora. Detritus is a predominant component of total suspended matter in both open ocean and estuary (Qasim & Ansari, 1981; Qasim *et al.*, 1978; Krishnakumari *et al.*, 1989). The attachment of bacteria, fungi and other microorganisms to the suspended matter has contributed to the fatty acid capacity of suspended organic matter (Schultz & Quinn, 1973). The microorganisms associated with suspended matter have a role in influencing nutritive value (Hanson & Weibe, 1977).

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