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Research Article

Characteristics of nutrients in the estuaries of Kanyakumari District-Tamilnadu-India

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Abstract

Water samples were collected in four major estuaries of Kanyakumari District to analyse the distribution of dissolved nutrients and it is said to be polluted. Water samples were analysed for physico-chemical parameters including pH, turbidity, electrical conductivity, total hardness, dissolved oxygen , BOD and anions were analysed like Ca, Mg, Fe, free ammonia, NO_3^-, SO_4^{2-}, PO_4^{2-}, F^- and Cl^- during the different seasons of monsoon period from August - January (2011-2012).The concentrations of most of the investigated parameters in the water sample from Manakudy(Station1), Rajakamangalam (Station2), Kadiyapattanam (Station 3), Thengapattanam (Station 4) estauries in Kanyakumari district were exceeded the permissible limit of WHO, CPHEEO water quality guidelines.

Keywords: Estauary, Nitrate, Dissolved Oxygen, WHO, CPHEEO

1. Introduction

Rivers are the main inland water resources for domestic, industrial and irrigation purposes and often carry large municipal sewage, industrial waste water discharges and seasonal runoff from agricultural land to the coastal region. It is for this reason that the river water is mostly enriched in nutrients compared to other environments. The four major rivers that flow in Kanyakumari district are, Thambaraparani, Valliyar, Pazhayar and Paraliyar. Thambaraparani river confluences with Arabian Sea near Thangaipattanam estuary about 56 km west of Kanyakumari District. The Valliyar River collects the drainage from P.P. Channel and its branches ayacuts and confluences with Arabian Sea in Kadiyapattanam estuary. The Pazhayar River collects the drainage of Thovalai, Ananthanar and N.P. and confluences with Arabian sea in Manakudy estuary. The Paraliyar flows through the Mathur hanging trough which is the highest and longest aqueduct in Asia and confluences with Arabian sea in Rajakkamangalam estuary. Usually in the near shore water and estauries exhibit considerable seasonal variations depending on the local conditions of rainfall, tidal incursions, quantum of fresh H_2O inflow, affecting the nutrient cycle of different coastal environments [1]. Hence the present study is designed to investigate the changes of physico-chemical parameters and the nutrients in the above mentioned estuaries.

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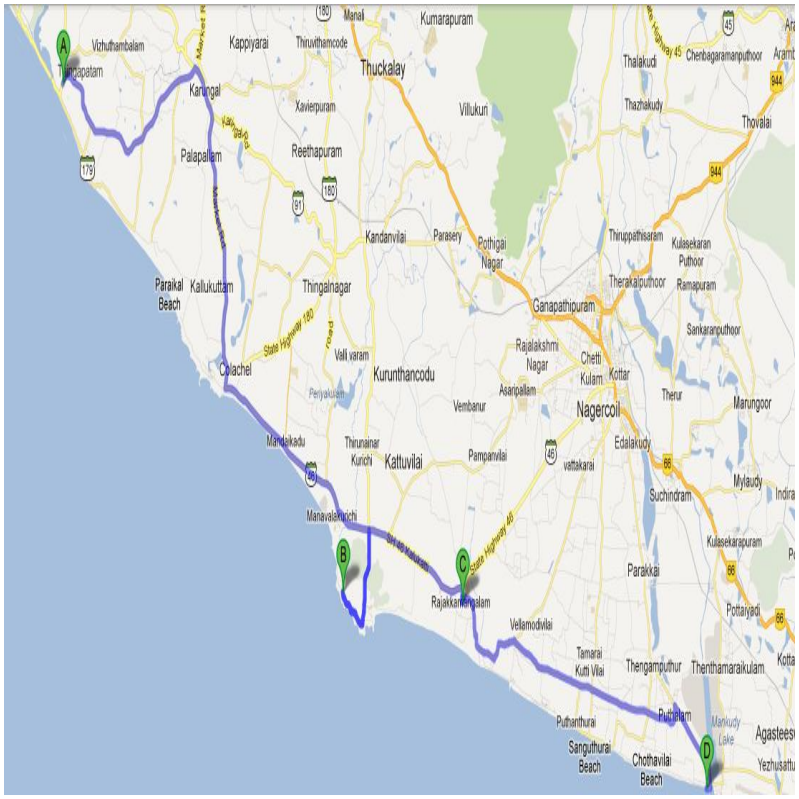

Fig. 1: Map of Estauries in Kanyakumari district. showing study sites (st.1- Manakudy (D), st. 2-Rajakamangalam(c), st.3-Kadiyapattanam (B), (st.4-Thengapattanam (A)

2. Materials & Methods

Water samples were collected in the different seasons of monsoon period from Aug. 2011- Jan.2012. Surface water samples were collected in a clean plastic bucket. Preservation and transportation of the water samples to the laboratory were as per the standard methods [2]. The samples were analysed in 15 different parameters. PH was measured using a pH analyzer (WTW model multi 340) while conductivity was analysed by Mohr-Kundensen $AgNo_3$ titration method [2]. Turbidity was measured by Nephelometer using 0.02 NTU standards. Dissolved oxygen was fixed immediately after collection and then determined by winkler's method. Nutrients (NH_4^+, No_3^-, PO_4^{3-}, Fe) were determined by standard photometric method, using varian 50 bio U.V visible spectrophotometer [3]. Ions Ca^{2+}, Mg^{2+} and hardness were determined by the complexometric EDTA titration method using EBT as a indicator [4]. Samples for BOD were incubated in laboratory for five days at 20^0C [5]. Whatman 541 filter papers were used for the determination of total dissolved solids. The present study reports the seasonal pattern of the physico-chemical parameters at these four important estauries.

3. Results & Discussion

In this study analysis, water qualities in different seasons were carried out to determine the seasonal variation of physical and chemical characteristic of water. The results were listed in Table 1, and Figure - 1 and 2. The appearance of water sample and its odour are noted. Water colour during the north east monsoon period is brownish and algae odour due to the rainfall and sediments flow.

pH of the estaurine water was alkaline and fluctuated between 7.16 and 8.57. It was well within the limits (ICMR standard; 7-8.5). Maximum values were noted at station 3 during the north east monsoon period and minimum was recorded at station 2 during the post monsoon period. Electrical conductivity of estaurine was varied in the range 233 - 16986 mics/cm. The average conductivity was 5346 mic s/cm. The conductivity value was very high at station 1, during the monsoon & post monsoon period due to high salinity. This is because of wide variation in the discharge of river water. [6] Turbidity is mainly due to the dispersion of suspended particles. Turbidity values ranged

from 2-41 NTU. Maximum was recorded at station 3, during the post monsoon period and minimum was recorded at station 4 during Monsoon and north east monsoon periods.

Table 1: Physico-chemical analysis of water in different seasons

Seasons	Stations	Physical Parameters		
		Turbidity NT Units	Total Dissolved Solids[mg/lit]	Electrical Conductivity[micS/cm]
Monsoon [August, September]	1	4	10482	15881
	2	2	3273	4959
	3	1	247	374
	4	2	2918	4421
North East Monsoon [October, November]	1	13	722	1078
	2	17	2227	3324
	3	13	263	393
	4	2	6223	9430
Post Monsoon [December, January]	1	34	11013	16986
	2	32	1124	1703
	3	41	154	233
	4	35	3546	5373

Seasons	Stations	Chemical parameters												
		PH	Hardness	Ca^{2+}	Mg^{2+}	Fe	NH_4	NO_3^-	Cl^-	F^-	SO_4^{2-}	Po_4^{2}-	DO	BOD
Monsoon [August, September]	1	7.57	610	640	1080	0.24	0.86	2	7200	0.4	74	1.6	0	15
	2	7.22	600	60	108	0.24	2.18	4	800	0.4	106	0.7	6.4	21
	3	8.16	30	8	2	0.47	0.46	2	20	0.4	4	0.40	7.3	12
	4	6.32	800	40	168	0.24	1.644	4	1350	0.2	171	0.40	6.7	18
North East Monsoon October, November]	1	7.54	2020	152	394	0.24	1.12	7	2800	0.4	429	0.80	1.4	32
	2	7.88	0	3120	136	0.24	1.46	9	2100	0.4	343	0.75	1.2	36
	3	8.57	40	8	5	0.12	1.08	4	44	0	7	0.90	1.3	28
	4	7.32	2120	112	442	0.12	0.92	7	3100	0.2	286	0.7	1.3	28
42Post Monsoon [December, January]	1	7.48	4600	720	672	3.06	0.88	10	6050	0.8	54	1.9	5.9	42
	2	7.16	640	60	118	0.12	0.23	9	1360	0.4	46	2.75	5.3	36
	3	8.55	88	24	7	0.35	0.23	4	40	0.2	19	0.80	6.1	42
	4	7.68	790	68	149	0	0.08	9	1505	0.2	46	2.3	6.2	32

Dissolved Oxygen (DO) levels varied from 1.2 - 7.3 mg/l. Maximum value was observed at station 3, in monsoon period and minimum was observed at station 2 in north east monsoon period. This low value is due to the addition of high organic contents in the fishing jetty leading to oxygen depletion. BOD was observed to be in the range from 12 - 42 mg/l. Maximum value was observed at station 2 during post monsoon period and low value was recorded at station 3 during monsoon period. The maximum values are due to the maximum biological affinity at elevated temperature [7] and reduced flow of reverine water. Due to the presence of high calcium and magnesium content observed at station 1 , during the north east monsoon period, the estaurine water exhibit high hardness. The minimum value of hardness was observed at station 3 during monsoon period. The nitrate (No_3^-) concentration ranged from 2 -10 mg/l. Maximum concentration was observed at station2 during post monsoon and minimum was observed at station 3 during monsoon period. This is due to domestic sewage, agricultural wash off, decaying plant, animal materials, fertilizers and other waste effluents containing nitrogenous compounds [8]. Such source of nitrate was also reported from Mahanadi estuary [9].

Ammonium concentration was observed in the range from 0.08 - 2.18 mg / l. The maximum was observed at station 2 during the monsoon period. The minimum was observed at station 4 during post monsoon period. This low value is due to the influence of industrial wastes. Chloride concentration was observed the range from 20-7200 mg/l. The maximum was observed at station 1 during the monsoon period. The minimum was noted at station 3 during the monsoon period. The WHO standard desirable limit of chloride was 200 mg /l and permissible limit 600 mg/l. The observed values are exceeded the desirable and permissible limit of WHO. High chloride content impacts taste and could cause corrosion [10]. Iron concentration was observed the range from 0– 3.06. The maximum value was observed in station1 during the post monsoon period. Minimum value was noted at station 4 during the post monsoon period. CPHEEO standard desirable limit of iron was 0.1 and the permissible limit was 1. But the maximum observed value exceeded the permissible limit

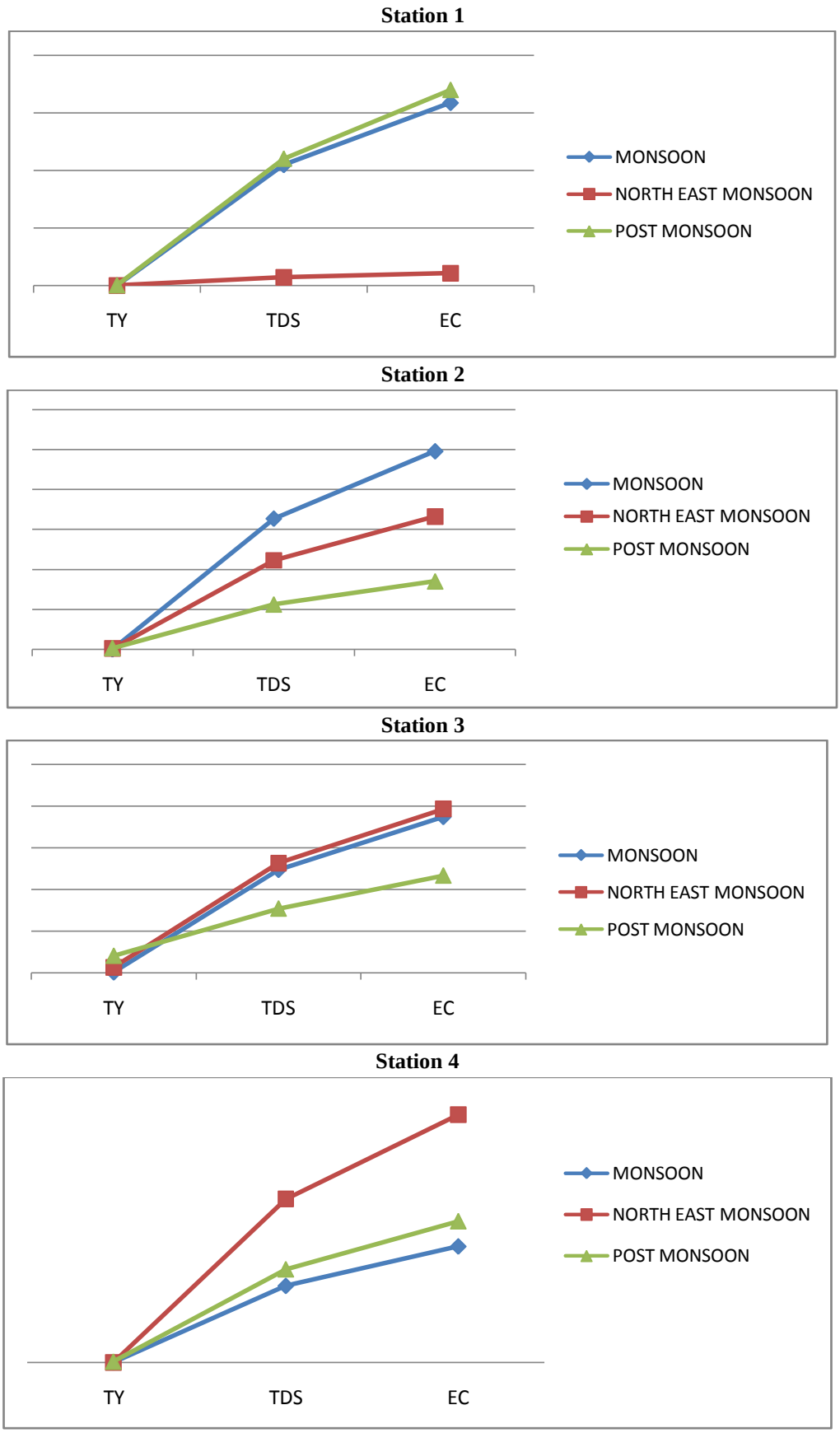

Figure 1: Distribution of physical nutrients at stations 1 to 4 of Kanyakumari estauries during August - January (2011-2012)

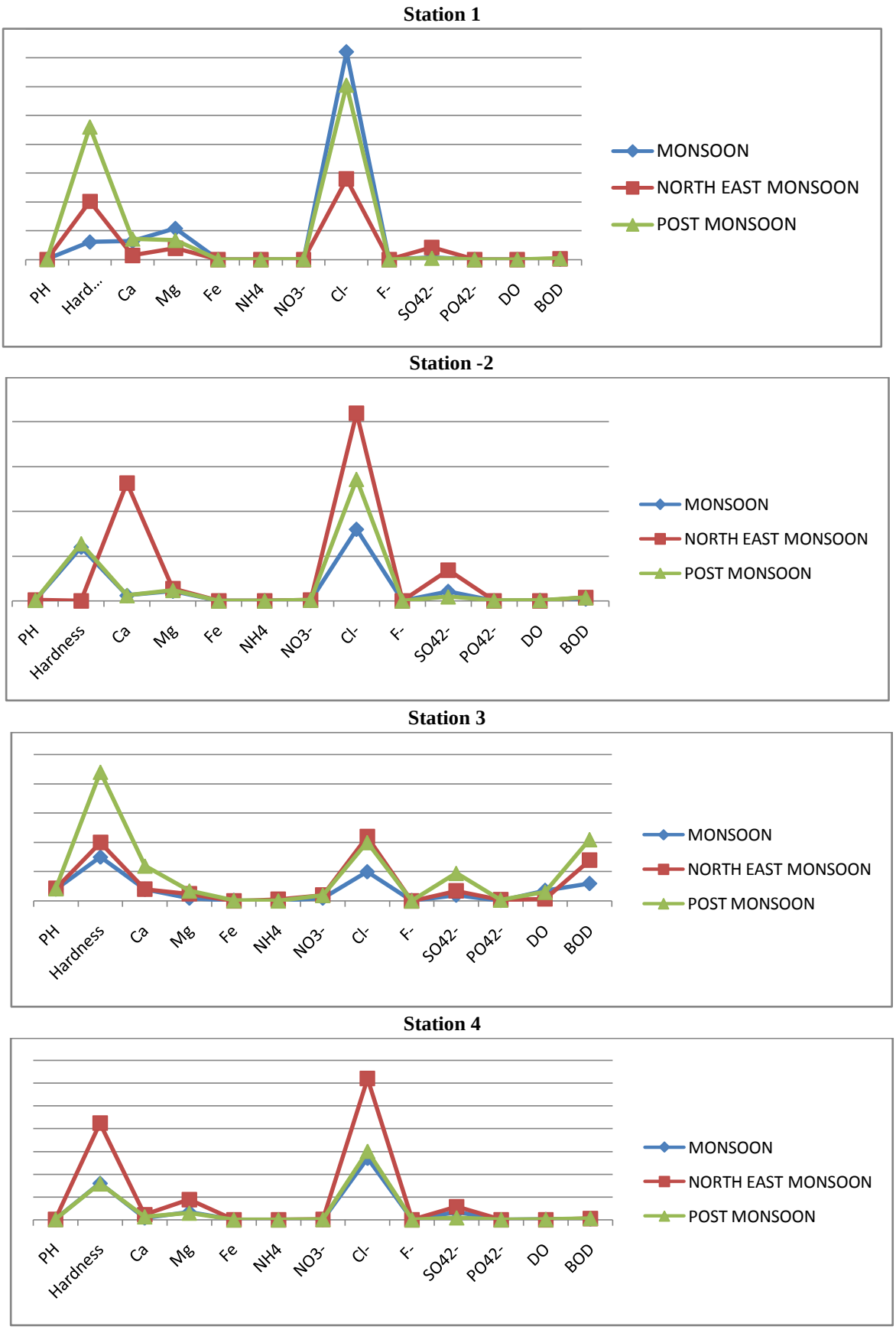

Figure 2: Distribution of nutrients at stations 1 to 4 of Kanyakumari estauries during August - January (2011-2012)

Fluoride and Sulphate levels were in the range of 0 - 0.8 mg/l and 4-429 mg/l respectively. Based on the CPHEEO standard fluoride desirable level should be 1 and the standard permissible limit 1.5 mg/l. WHO standard showed highest desirable limit of sulphate 200 mg /l and the maximum permissible limit should 400 mg/l.

4. Conclusion

Due to different environmental conditions and ecosystem, water quality standards vary significantly. The presence of trace metal contents in all the soil and crops, geographical location, pesticides, fungicides, fertilizers in the runoff water reached at the estuarine region has been polluted. The physico-chemical characteristics of estuarine water in the study area suggested that there was no harmful chemical contamination. But due to the exceeded value of chloride, iron, sulphate content may cause the corrosion which leads to the crackages in the bridges in the estuarine area. If proper measures are taken for the treatment of sewage before discharge and restrictions are put on various anthropogenic activities upstream, the estuary would remain healthy in the long run.

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