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RESEARCH ARTICLE

SEASONAL VARIATIONS IN HYDROLOGICAL PARAMETERS OF VETTAR ESTUARY, NAGAPATTINAM COASTAL AREA, TAMILNADU, INDIA

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ABSTRACT

The present investigation is an attempt to ascertain the nature of the environment at Nagapattinam, a Coastal Village of Tamil Nadu. For the present study three sampling stations were fixed viz., Vettar River, Vettar Estuary and Coastal waters (St-I, St-II and St-III). Such a trend were similar in all the three stations. Nutrients like PO₄, NO₃, NO₂ and SiO₂, Total hardness, Sulphate, Free ammonia, Total dissolved solids, Total alkalinity, Flouride and Total organic carbon also exhibited high values during the monsoon season and low values were recorded during the summer season. It is likely that the river water is enriched by the domestic sewage, agricultural wastes and industrial effluents

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INTRODUCTION

It is estimated that 40% of deaths around the world to be attributed in various environmental factors, especially organic and chemical pollutants. The indiscriminate mixing of effluents, sewage and their contaminants with the water bodies. Most human activities and needs are losely related to water. First, the need of drinking water, agriculture and industry were made by people builds their homes near river and coastal waters (Prabhahar *et al.*, 2011) In the present state of affairs, good quality water has become a scarce commodity and ecotoxicological investigations on aquatic ecosystems have emerged as an important part of the social life (Science Daily, 2008). Water quality monitoring is an important aspect of overall water quality management and water resources development. A well planned and executed water quality monitoring system is is required to predict the changes in the quality of any particular water bodies so that, curative or preventive measures can be taken to restore and maintain ecological balance in that water body (Farombi *et al.*, 2007). Therefore .water quality monitoring is a systematic processes of collecting, preserving and anlaysing water samples to identify qualitative as well as quantitative changes in the physico-chemical characteristics of water. Further, the results of the water quality monitoring exposes the environmental conditions prevailing in the vicinity and catchment area of the water body. According to Agah *et al.*, (2009), without the knowledge of water quality, it is difficult to understand the biological phenomenon taking place in the aquatic ecosystem, because the chemistry of water reveals much about the metabolism of the ecosystem and explains the general hydro-biological inter-relationship. Surface waters such as rivers, lakes and estuaries often serve as disposal systems for wastes coming from residential areas, industries, and manufacturing plants. (Ashraj, 2005) Elevated levels of organic wastes from

these sources cause increased oxygen demand due to the contaminants increase in biological decomposition. The consequence of increased degradative processes is the consumption of Dissolved Oxygen (DO) and production of ammonia from the decomposition of organic nitrogen compounds leading to impaired metabolism in fish and invertebrate communities (Ayoola and Kuton, 2009). The present investigation is aimed to estimate the various physico-chemical parameters of the Nagapattinam coastal area.

MATERIALS AND METHODS

Samples were preserved and analyzed by adopting the procedures outlined by standard methods for various parameters (APHA, 2000). Total Organic Carbon (POC) was estimated by the standard procedures described by (Parsons *et al.*, 1989). Nutrients (Inorganic nitrate, nitrite, Phosphate Reactive silicate, Total hardness, Sulphates, Free Ammonia, Total dissolved solids, Total alkalinity and Fluoride) were estimated by titration methods as described by (Parsons *et al.*, 1989).

RESULTS

Minimum value 1.0mg/l of inorganic nitrate was recorded during premonsoon season and the maximum value 1.93mg/l during monsoon season at Station 1. Minimum value 3.12mg/l of nitrate was recorded during premonsoon season and the maximum 9.3 mg/l during monsoon season at Station 2. Minimum 4.12mg/l value of nitrate was recorded during premonsoon season and the maximum 9.4mg/l was recorded during monsoon season at Station 3. Minimum 5.75mg/l and maximum 8.95mg/l values of inorganic nitrite were recorded at

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Table 1 Mean values of physico – Chemical and nutrients recorded in Vettar River at Station-I Nagapattinam during the Period for July 2011- June 2012

Parameters	Pre	Monsoon	Post-	Summer
Nitrate (mg/l)	0.92±0.00	1.4±0.13	1.52±0.15	1.38±0.02
Nitrite (mg/l)	8.18±0.11	8.57±0.11	7.47±0.13	6.18±0.17
Phosphate (mg/l)	3.76±0.34	2.73±0.46	2.16±0.15	1.8±0.02
Silicate (mg/l)	37.6±0.63	47.93±0.0	22.13±0.37	22.23±0.66
Total Hardness	7517±110	7733±300	4050±359	2167±100
Sulphate (mg/l)	642±313	899±853	631±156	613±39
Free Ammonia	0.2±0.01	0.7±0.01	0.36±0.003	2.23±0.003
Total dissolved	3006±179	3251±616	2855±76	1561±505
Total alkalinity	226±110	242±196	322±25	257±30
Fluoride (mg/l)	0.71±0.07	0.84±0.00	0.44±0.25	0.46±0.006
Total organic carbon (mg/l)	0.57±0.09	1.29±0.05	0.9±0.007	0.75±0.007

Station 1 during summer and monsoon seasons, respectively. Minimum 7.4 mg/l and maximum 12.6 mg/l values of nitrite were recorded at Station 2 during post monsoon and monsoon seasons, respectively. Minimum 3.21 and maximum 11.5 values of nitrite were recorded at Station 3 during post monsoon and monsoon seasons respectively. In general, during monsoon season there was enrichment of nitrite at all the stations. Station 1 registered minimum 1.60mg/l value of inorganic phosphate during summer season and the maximum 3.85mg/l during monsoon season. Station 2 registered minimum 1.1 mg/l value of inorganic phosphate during summer season and the maximum 8.0mg/l was noticed during monsoon - season. Station 3 registered minimum 1.2mg/l value of inorganic phosphate during summer season and the maximum 4.7 mg/l was registered during the monsoon season. In general, minimum and maximum values of inorganic phosphate were recorded during summer and monsoon seasons respectively at all the stations. Minimum 21.5 mg/l and maximum 48.4 mg/l values of reactive silicate were registered during summer and monsoon seasons respectively at Station 1. Minimum 10.05mg/l and maximum 39.66mg/l values of reactive silicate were registered during post monsoon and monsoon seasons respectively at Station2. inimum 27.mg/l and maximum 37.2 mg/l values of reactive silicate were registered during post monsoon and monsoon seasons respectively at Station 3.

Table 2 Mean values of physico – Chemical and nutrients recorded in Vettar River at Station-II Nagapattinam during the Period for July 2011- June 2012

Parameters	Pre Monsoon	Monsoon	Post-Monsoon	Summer
Nitrate (mg/l)	8.36±1.16	32.46±11.	28.33±5.40	23.8±0.19
Nitrite (mg/l)	14.76±13.0	19.03±0.0	15.94±9.50	9.83±1.26
Phosphate (mg/l)	8.45±1.14	16.78±0.2	14.32±12.34	7.73±2.27
Silicate (mg/l)	36.33±b5.8	35.56±7.2	17.45±9.90	10.86±1.37
Total Hardness (mg/l)	6602±442	6855±163	6660±981	57.57±124
Sulphate (mg/l)	938±256	1019±466	844±68	838.33±85
Free Ammonia (mg/l)	4.1±0.01	6.26±0.00	5.2±0.04	5.26±0.04
Total dissolved solids	33.13d±3.7	35.04±2.4	35.75±0.65	2541±0.77
Total alkalinity (mg/l)	260±7.0	310±26.3	257±37.0	157±72
Fluoride (mg/l)	0.53±0.0	0.73±0.00	0.69±0.004	0.54±0.007
Total organic carbon (mg/l)	0.85*0.007	1.45±0.12	1.25±0.038	0.76±0.08

In general, monsoon season, registered maximum values of reactive silicate at all the stations. Minimum 1862mg/l and maximum 5263mg/l values of Iron were registered during summer and monsoon seasons respectively at Station 1. Minimum 3870mg/l and maximum 5663mg/l values of Total Hardness were registered during post monsoon and monsoon

seasons, respectively at Station2. Minimum 7201mg/l and maximum 8603mg/l values of Total Hardness were registered during post monsoon and monsoon seasons respectively at Station 3. In general, monsoon season, registered maximum values of Total Hardness and Iron at all the stations. Mmimum 5.11mg/l, and maximum 924mg/l values of Iron were registered during summer and monsoon seasons respectively at Station 1. Minimum 805mg/l and maximum 962mg/l values of reactive Sulphates were registered during post monsoon and monsoon seasons respectively at Station2. Minimum 812mg/l and maximum 990mg/l values of Sulphates were registered during post monsoon and monsoon seasons, respectively at Station 3. In general, monsoon season, registered maximum values of Sulphates at all the stations. Free Ammonia a registered a minimum value 0.6 mg/l during monsoon seasons and the maximum 1.8 mg/l during summer season at Stationl. Minimum value 4.1mg/l during monsoon seasons and the maximum 6.8 mg/l during summer season, were observed at Station 2. Minimum values during monsoon season, and the maximum during summer season, were observed at Station3. In general, monsoon and summer seasons, registered minimum and maximum values of Free Ammonia at all the stations. Station 1 registered minimum 1435 mg/l value of inorganic Total Dissolved Solids during summer season, and the maximum 3320mg/l during monsoon season.

Table 3 Mean values of Physico-Chemical and nutrients recorded in Vettar river at Station-III Nagapattinam During the Period for July 2011 - June 2012

Parameters	Pre Monsoon	Monsoon	Post-Monsoon	Summer
Nitrate (mg/l)	5.54±0.26	16.51±0.12	11.02±0.64	8.59±0.12
Nitrite (mg/l)	13.10i0.45	17.30±0.94	5.15±3.22	9.73±0.30
Phosphate (mg/l)	0.86±0.005	0.93±0.009	0.2±0.007	0.17±0.004
Silicate (mg/l)	37.41±0.85	52.23±4.22	41.1±1.44	42.76±6.08
Total Hardness (mg/l)	7326±933	8300±400	7450±272	72.03±186.
Sulphate (mg/l)	842±430	981.6±146	877±313	734.6±837
Free Ammonia (mg/l)	4.5±0.11	6.06±0.002	3.09±0.004	1.74±0.32
Total dissolved solids	3604±396	3654±124	3549±148	3060±341
Total alkalinity (mg/l)	191±9.33	229.6±1.33	200.3±200	201.3±60
Fluoride (mg/l)	0.52±0.009	0.58±0.0	0.42±0.07	0.29i0.002
Total organic carbon (mg/l)	0.96±0.006	1.68±0.01	1.31±0.005	0.91±0.006

Station 2 registered minimum 3167mg/l value of inorganic phosphate during summer season and the maximum 3662mg/l was noticed during monsoon season. Station 3 registered mmimum 3307mg/l value of morganic phosphate during summer season, and the maximum 3802 was registered during the monsoon season. In general, minimum and maximum values of Total Dissolved Solids were recorded during summer and rlionsoon seasons respectively at all the stations. Station 1 registered minimum 214mg/l value of Total Alkalinity during summer season and the maximum 313mg/l during monsoon season. Station 2 registered minimum 132mg/l value of Total Alkalinity during summer season, and the maximum 316mg/l was noticed during monsoon season. Station 3 registered minimum 175mg/l value of Total Alkalinity during summer season, and the maximum 327mg/l was registered during the monsoon season's general, minimum and maximum values of Total Alkalinity were recorded during summer and monsoon seasons, respectively at all the stations. Fluoride a registered a minimum value 0.4mg/l during monsoon seasons and the maximum 0.94mg/l during summer season at Station 1.

Minimum value 0.7mg/l during monsoon seasons, and the maximum 0.85mg/l during summer season, were observed at Station 2. Minimum value 0.5 mg/l during monsoon season and the maximum 0.95mg/l during summer season, were observed at Station3. In general, monsoon and summer seasons registered minimum and maximum values of Fluoride at all the stations. TOC concentration was recorded minimum 0.33mg/l during premonsoon season and the maximum 1.68mg/l during monsoon season, at Station 1. TOC concentration was minimum 0.37mg/l during premonsoon season, and the maximum 1.84mg/l during monsoon season at Station 2. TOC concentration was minimum 0.81mg/l during premonsoon season and the maximum 1.88mg/l during monsoon season, at Station 3. In general, particulate organic carbon concentration was minimum during premonsoon and the maximum during monsoon season, respectively at all the stations. ANOVA between the environmental values where found the significant within the parameters are insignificant. The analyzed correlation coefficient values between the environmental parameters in the Nagapattinam coastal area during the period for July 2011 to June 2012, were significant.

DISCUSSION

The Physico-Chemical and nutrients similar results were observed by Azarbad *et al.*, (2010), the distribution and behavior of nutrients (PO₄, NO₂, NH₃ Total hardness, Sulphate and Total dissolved solids) in the coastal areas, particularly in the near shore waters and estuaries, would exhibit considerable seasonal variations depending upon their local input, rainfall, quantum of freshwater inflow, tidal incursion and some biological activities like uptake by phytoplankton and their productivity (Yacoub,2007). The present study was observed by Prabhahar *et al.*, (2011) have Phosphorus is a natural element found in rocks, soil and organic materials. Even though its concentration in clean waters is generally very low, phosphorus is used extensively in fertilizers and other chemicals. So it can be found in higher concentration in areas of agricultural and industrial activities. This trend is clearly visible in the polluted site of the present study also. (Teyal *et al.*, 2008) have also reported such eutrophication induced by organic pollution. The recorded highest monsoonal nitrate value could be mainly due to the organic materials received from the catchment area during ebb tide (Ashok Prabu *et al.*, 2008). Another possible way of nitrate input could be through oxidation of ammonia form of nitrogen to nitrite formation.

The recorded low values during non-monsoon period may be due to its utilization by phytoplankton as evidenced by high photosynthetic activity and the dominance of neritic seawater having a negligible amount of nitrate. Nitrite is a common pollutant in aquatic ecosystems (Malik *et al.*, 2010). According to Prabhahar *et al.*, (2012) high level of nitrite in water is a potential factor triggering stress in aquatic organisms. Elevated environmental nitrite has been reported to induce methaemoglobin formation, which could cause hypoxia in tissue, and impair the respiratory metabolism (Karthikeyan *et al.*, 2007). According to Fernandes *et al.* (2007), silicate content of water varies with salinity of water. They have reported high silicate content in low salinity area. Farombi *et al.* (2007) have reported that the may be coastal area in dinoflagellate bloom. The large portion of total organic carbon, Total dissolved solids, Total alkalinity and Fluoride in the coastal and estuarine

waters, might serve as an nutrients supplements for the phytoplankton.

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