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SEASONAL VARIATIONS IN PHYSICO-CHEMICAL PARAMETERS IN PENNAIYAR ESTUARY, CUDDALORE -SOUTH EAST COAST OF INDIA

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ABSTRACT

A present study has been undertaken to report to the water quality parameters of Pennaiyar estuary compared the concentration of water quality parameters like temperature was ranging from 26.0 to 32.4°C, salinity values ranging from 23 to 34ppt, pH was ranging from 7.2 to 8.3, dissolved oxygen content was ranging from 3.36 to 5.36 mg/l, ammonia was ranging from 0.136 to 0.683µmol/l, nitrate was ranged from 7.39 to 8.29µmol/l, nitrite was ranging from 1.83 to 2.15µmol/l, total phosphorus was ranging from 0.046 to 1.553µmol/l, and silicate was ranging from 1.193 to 2.293µmol/.were studied from Pennaiyar estuary, Cuddalore, southeast coast of India from July 2013 to June 2014.Above the water level due to the ceaseless release of domestic manure and trade waste matter in the estuary. The duration of the estuary concentrations of nutrients and other water quality parameters potency have been controlled by the anthropogenic inputs from point and non-point sources.

KEYWORDS: Physico-chemical parameters, nutrients, monthly variation, Pennaiyar estuary.

INTRODUCTION

Physico-chemical parameter variables in the marine environment are subjected to extensive spatiotemporal variations. several reports are available on the physicochemical features of Indian estuaries (Murugan and Ayyakkannu, 1991; Govindasamy et al., 2000; Balasubramanian and Kannan, 2005; Paramasivam and Kannan, 2005; seasonal variation in

phytoplankton abundance have been studied in other regions of Indian coastal waters (Saravanakumar et al., 2008; Vengadesh Perumal et al., 2009).Influenced by a number of ecological parameters, including Temperature, Salinity, pH, Dissolved oxygen, Ammonia, Nitrite, Nitrate, Total phosphorus, and Silicate (Boltovskoy and Wright, 1976; Murray, 1991; Gooday and Rathburn, 1997; Gooday, 2003). Estuaries are areas of the most intensive exchange of matter and energy, between the continents and oceans and therefore represent very biologically dynamic environment.

Hence, the present study was carried out to get information on the hydrobiology of water from the Pennaiyar estuary during the study period of from July 2013 to June 2014. We investigated temperature, salinity, pH, dissolved oxygen, ammonia, nitrate nitrite, total phosphorus, and silicate concentration and physicochemical parameters value from the estuarine water samples in quality analysis of water from the CAS in marine biology laboratory Annamalai University at Parangipettai.

MATERIALS AND METHODS

The water samples were collected every month from the pennaiyar estuary, the physico-chemical parameters were analyzed by appropriate standardized procedure under field and laboratory condition. For the sake of interpreting the data, a calendar year was divided into 4 main seasons viz.

1) Post monsoon – (January – March)
2) Summer – (April – June)
3) Premonsoon – (July – September)
4) Monsoon – (October-December)

Environment temperature and surface water temperature were measured using a digital centigrade thermometer. Salinity was recorded used a hand Refractometers (ERMA, Japan) water pH -Negative logarithm of hydrogen ion concentration was has been recorded in the field itself using an ELICO Grip pH meter. Dissolved oxygen was estimated by modified Winkler's method. For the analysis of nutrients, surface of water samples were collected in clean polythene bottles and kept immediately in an icebox and transported to the laboratory. The water samples were than clean by a Millipore filtering system and analyzed for total phosphorus ammonia, nitrate, nitrite, and silicate by adopting standard procedure of, (Strickland and Parsons, 1972).

Pennaiyar estuary is situated at Cuddalore (Lat.11° 32' N Long.79° 56'E) south east coast of India. In the present study, monthly samplings were made during forenoon in a plastic container from July 2013 to June 2014. The physico-chemical parameters were estimated by adopting standard procedures. Water samples were collected from the sampling location using clean Polythene bottles and were transported to the laboratory by keeping them in a portable ice box. Concentration of water nutrients viz. ammonia (NH_4), total phosphorus (PO_4), nitrate (NO_3), nitrite (NO_2), and silicate (SiO_3), were determined by following the methods described by Strickland and Persons (1972). Physico-chemical parameters, analyses of Variance were calculated for monthly averages. Determine the difference in the physico-chemical parameters between the following seasons viz.

RESULTS

Temperature (°C)

The water temperature was ranging from 26.0 to 32.4°C. The season-wise variation of water temperature maximum was recorded during the summer (2014) and minimum was recorded during monsoon (2013) Table-1.

Salinity (ppt)

The water salinity was ranging from 23 to 34 ppt. The season-wise variation of salinity maximum was recorded during the summer (2014) and minimum was recorded during monsoon (2013).

pH (Hydrogen ion concentration)

The water pH was ranging from 7.2 to 8.3. The season-wise variation of pH maximum was recorded during the summer (2014) and minimum was recorded during post monsoon (2014).

Dissolved oxygen (mg/l)

The dissolved oxygen was ranging from 3.36 to 5.36 mg/l. The season-wise variation of dissolved oxygen maximum was recorded during the monsoon (2013) and minimum was recorded during summer (2014).

Table-1: Seasonal variations in physico-chemical parameters in pennaiyar estuary, during period of July 2013 to June 2014.

Parameter	July	`Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Max	Min	Ave
Temperature (oC)	28.5	28.0	29.1	26.4	26.0	27	29.5	29	30	31.2	32.4	31	32.4	26	29.035
Salinity‰ (ppt)	29	30	31	28	29	30	23	26	25	33	34	33	34	23	29.142
pH	7.4	7.0	7.2	7.8	7.9	8.0	7.2	7.0	7.2	8.0	8.3	8.2	8.3	7	7.607
Dissolved oxygen (mg/1)	4.36	4.86	5.12	5.34	5.36	5.16	5.23	4.56	4.65	3.36	3.38	4.23	5.36	3.36	4.595
Nitrite (µmol/l)	1.96.	1.98	1.90	2.15	2.10	2.13	1.98	1.95	1.99	1.89	1.83	1.88	2.15	1.83	1.98
Nitrate (µmol/l)	7.40	7.39	7.43	8.28	8.27	8.29	7.55	7.53	7.44	8.11	8.10	7.99	8.29	7.39	7.815
Ammonia(µmol/l)	0.442	0.334	0.556	0.681	0.683	0.680	0.522	0.322	0.633	0.137	0.136	0.138	0.683	0.136	0.438
Total phosphorus ((µmol/l)	1.551	1.449	1.334	1.552	1.553	1.550	0.550	1.442	1.339	0.047	0.046	0.049	0.046	1.553	1.004
Silicate (µmol/l)	2.234	2.212	2.243	2.289	2.291	2.293	2.234	2.117	1.198	1.195	1.194	1.193	2.293	1.193	1.869
Total value Sum (One year data)													93.522	71.462	83.485
Total Maximum value													34	26	29.142
Total Minimum value													0.046	0.136	0.438
Total Average value													11.597	8.872	10.278

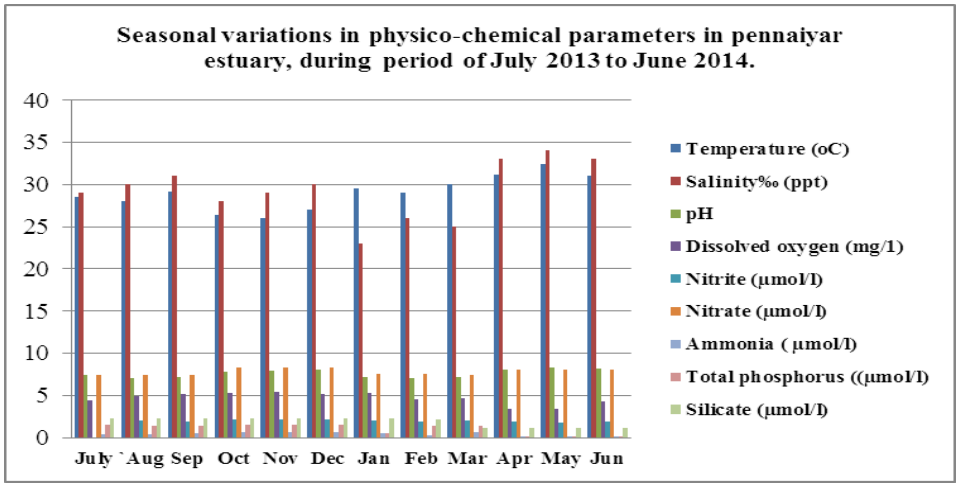

Fig: Seasonal variations in physico-chemical parameters during period of July 2013 to June 2014.

Ammonia (µmol/l)

The ammonia was ranging from 0.136 to 0.683µmol/l. The season-wise variation of ammonia maximum was recorded during the monsoon (2013) and minimum was recorded during summer (2014).

Nitrite (µmol/l)

The nitrite was ranging from 1.83 to 2.15µmol/l. The season-wise difference of nitrite maximum was recorded during the monsoon (2013) and minimum was recorded during pre monsoon (2013).

Nitrate (µmol/l)

The nitrate was ranged from 7.39 to 8.29µmol/l. The season-wise variation of nitrate maximum was recorded during the monsoon (2013) and minimum was recorded during summer (2014).

Total phosphorus (µmol/l)

The total phosphorus was ranging from 0.046 to 1.553µmol/l. The season-wise variation of total phosphorus maximum was recorded during the monsoon (2013) and minimum was recorded during summer (2014).

Silicate (µmol/l)

The silicate was ranging from 1.193 to 2.293µmol/l. The season-wise variation of silicate maximum was recorded during the monsoon (2013) and minimum was recorded during summer (2014).

DISCUSSION

Information on various physico-chemical and biological process which controlling the prevailing environmental condition of the region, will eventually helps to evaluate the environmental changes. Surface water temperature is one of the important factors controlling the physiological activities of organism. The present water temperature varied was ranging from 26.0 ℃ to 32.4 ℃ during summer 2014), respectively at the stations, the higher surface water temperature recorded during summer season. The lower value of surface water temperature recorded during monsoon season might be possibly due to strong land sea breeze and precipitation (Ashok Prabu et al., 2008; Rajkumar et al., 2009). In the present study,

summer peaks and observed earlier by several workers in the west coast of India (Desai, 1992: Arthur, 2000).

The salinity is one of the important key factors which determine the composition of biological component in the estuarine environment. The fluctuations in salinity affect the biological characteristics of the environment water. The present study, the salinity value varied from 23 ppt (during monsoon 2013) to 34 ppt (during summer 2014). The salinity value was high during summer season and low during the monsoon season. Higher values during summer may be attributed to high degree of evaporation (Senthilkumar et al., 2002: Balasubramanian and Kannan, 2005; Sridhar et al., 2006; Asha and Diwakar, 2007). On the other hand during the monsoon season, rainfall and the consequent freshwater inflow from the land in turn would have moderately reduced the salinity.

The pH is the hydrogen ion varied from 7.2 (during post monsoon 2013) to 8.3 (during summer 2014), correspondingly at the stations. Hydrogen ion concentration (pH) in surface waters remained alkaline throughout the study period in the station with the maximum values occurring in the summer seasons and minimum values occurring in the post monsoon season. The present study, dissolved oxygen value varied from 3.36 (during summer 2014) to 5.36 (during monsoon 2013), were recorded in the stations. In the present study, higher dissolved oxygen concentration recorded during the monsoon season might be due to the cumulative effect of higher wind velocity coupled with heavy rainfall and the resultant freshwater mixing. The same trend was observed by Das et al. (1997) and Saravanakumar et al. (2007) attributed seasonal variation of dissolved oxygen mainly to freshwater influx and ferruginous impact of sediments. Relatively lower values found during summer could be mainly due to reduced agitation and turbulence of the coastal waters.

Nutrients are considered as one of the most important parameters in the marine environment influencing development, reproduction and metabolic behavior of biotic components. Distribution of nutrients is mainly based on season, tidal conditions and freshwater flow from land. The water nutrients like nitrite, nitrate, ammonia, total phosphorus and silicate varied significantly between seasons viz.

The present study, nitrite value varied from 1.83 (during monsoon 2013) to 2.15µmol/l (during pre monsoon 2014). The higher value of nitrite recorded during monsoon season may be due to various reasons including variation in phytoplankton release, decomposition of

ammonia and decrease of nitrate and by recycling of nitrogen and bacterial decomposition of planktonic detritus present in the environment (Asha and Diwakar, 2007) and also due to gentrification and air sea interaction exchange of chemicals (Rajasegar, 2003).The recorded low nitrite value during monsoon season may be due to high salinity (Saravanakumar et al., 2008).

Higher values of nitrate varied from7.39 µmol/l (during monsoon 2013) to 8.29 µmol/l (during monsoon 2013) and lower values of nitrate. The highest values of nitrate during monsoon season could be mainly due to the organic materials received from the catchment area during ebb tide. The present study, Ammonia value varied from 0.136 (during monsoon 2013) to 0.683 (during summer 2014), were recorded in the stations, another possible way of nitrate input could be through oxidation of ammonia form of nitrogen to nitrite formation (Rajasegar, 2003).

In the present study, the total phosphorus ranged from 0.046µmol/l (during monsoon 2013) to 1.553 µmol/l (summer 2014). High concentration of inorganic phosphate observed during monsoon season high is possibly due to intrusion of upwelling seawater, which increased the level of phosphate (Nair et al., 1984). Further, regeneration and release of total phosphorus from bottom mud into the water column by turbulence and mixing also contributed to the higher values during monsoon (Chandran and Ramamoorthy, 1984). The present study concluded that among the three stations were observed, the Pennaiyar is more disturbed area than the stations. The silicate varied from1.193 µmol/l (during monsoon 2013) to 2.293µmol/l (during summer seasons 2014) is the minimum was recorded. The silicate content was higher than that of the other nutrients and the recorded high monsoon values could be due to large influx of fresh water derived from land drainage carrying silicate leached out from rocks and also from the bottom (Govindasamy et al., 2000; Rajasegar, 2003). The observed low summer values could be attributed to uptake of silicates by phytoplankton for their biological activity (Ashok Prabu et al., 2008; Saravanakumar et al., 2008). All these nutrients were observed maximum during monsoon and minimum during summer season, indicating that the role of inflow the river water bringing high nutrients and deposit in to the estuarine.

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