Assessment of Hydrobiological Parameters in Manakudy Estuary, South West Coast of India

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Abstract

In the present study area, the hydrobiological parameters were subjected to temporary variations. High atmospheric temperature, salinity impacts would have also increased the oxygen concentration in water. Indiscriminate use of fertilizers by the aquculturists might have contaminated the water with rich nutrients such as nitrates and phosphates which stimulate the growth of aquatic plants algae.

Keywords: Manakudy estuary, Rainfall, Temperature, Salinity, CO_2, Nitrate, Total Phosphorus.

Introduction

The hydrobiology is important to known the relationship between the ecological conditions such as topography, water movement, salinity, O_2, temperature and nutrients. It also determining the composition of biota at different trophic levels and food webs[1]. India extents over 7,500 km in coastline with numerous biological ecosystems such as estuaries, lagoons, backwaters, mangroves, salt marshes etc. Estuaries act as a conversion zone between the two aquatic ecosystems namely freshwater and seawater which are highly productive ecosystems for sea food and nurturing of many valuable marine organisms.

The country supports the 1/6th, 1/50th and 1/25th world population, land and water resources[2]. Physical processes in estuaries namely the mixing, circulation and transport control the transfer of materials and hence studies on these processes help understanding the exchange of materials in the estuaries. The physical and chemical characteristics have been studied by many workers in estuary environment[3]. Estuaries are effective ecosystem subject to changeable environmental conditions like tidal amplitudes and salinity. Industries and respositories for many effluents were the sites of estuaries. At a degree of pollution organisms able to survive with variable salinity, long periods of immersion and emersion. An estuary is a partially enclosed coastal body connection with the open seawater. The characterization of nutrients (PO_4, NO_2, NO_3 and NH_3) in the marine environments, especially in seawater and estuaries, which depends on rainfall, fresh water inflow, tidal incursion and biological activities like phytoplankton uptake and recreation.

The mixing of ocean and fresh waters can cause shifts in the spatial and temporal availability of nitrogen and phosphorus. Hydrobiological and biogeo- chemical cycles mainly caused by increase in population[4]. Land use and climate with geology are the ultimate determinants of water quality which become modify the ecosystem[5]. The hydrobiological parameters were used to determine the composition of biological organisms. Many studies were made on the physical and chemical variations of Indian estuaries[6].

The overall aim of the present study is to obtain a general assessment of the relative load and type of pollutants and their effects in the estuary by coconut husk retting effluents, domestic sewage and agriculture wastes.

Materials and Methods

The present study was carried out over a period of one year May 2012-April 2013. Water samples were collected once in a month between 7 to 9 a.m. at Manakudy estuary. In total eighteen water samples were collected in 2 litre bottles of six stations represented three samples in a station of different depth and brought to the laboratory for the analysis of physical and chemical parameters.

Physico chemical analysis: The physical and chemical parameters such as rainfall, atmosphere temperature, salinity, Carbon-di-oxide, Nitrate, Total phosphorus was analysed. Rainfall data were obtained from Meteorological Department at Chennai. Salinity is measured by salinity refractometer. Atmosphere temperature by using kit multiparameter PCS Testr[TM] 35. Nitrate, Carbon-di-oxide was estimated by EDTA method[7]. Total phosphorus content of the estuarine water sample were estimated by stannous chloride method[7].

Results and Discussion

The result of variation in physical and chemical parameters were presented in the Figure-1-6. The maximum rainfall (371.00 mm) were recorded in the month of October and minimum rainfall (2.40 mm) was noted in April (Figure-1). Rainfall was totally absent during the month of May of the study year. During the present study, the bulk quantities of rainfall were received in the monsoon months of October due to northeast monsoon of the study year. It was also noted in Parangipettai and Cuddalore coast estuary[8].

Atmosphere temperature of the sampling stations ranged from 27.77˚C to 30.30˚C. The minimum temperature 27.77˚C was recorded in station 5 in the month of January and the maximum atmosphere temperature 30.30˚C in station 6 was recorded in the month of June 2012 (Figure-2). In the present study temperature showed that atmospheric variations play major role governing temperature and water exchange between the sea and the estuary is of less significance. Temperature brings the intensity of streams while mixing with water [9].

The minimum salinity 0.33ppt was recorded in station 6 during October and the maximum 24.67 ppt in station 1 during December (Figure-3). Salinity is the prime factor of the environmental changes by the freshwater inflow and the prevailing temperature of the estuarine and coastal waters. In the present study salinity becomes high in mouth bar. Salinity distribution is the major factor, which governs the invasion of marine and freshwater organisms into the estuary[10].

Carbon-di-oxide was reported as higher 0.71mg/l in station 5 during March and low 0.09mg/l in station 2 in July month (Figure-4). CO_2 is released during respiration by organisms. Its increased level may affect the pH of the water. Maximum CO_2 content was found in the polluted zone due to the disposal of wastages. Verma Pradeep et. al.[11] reported the same throughout the investigation.
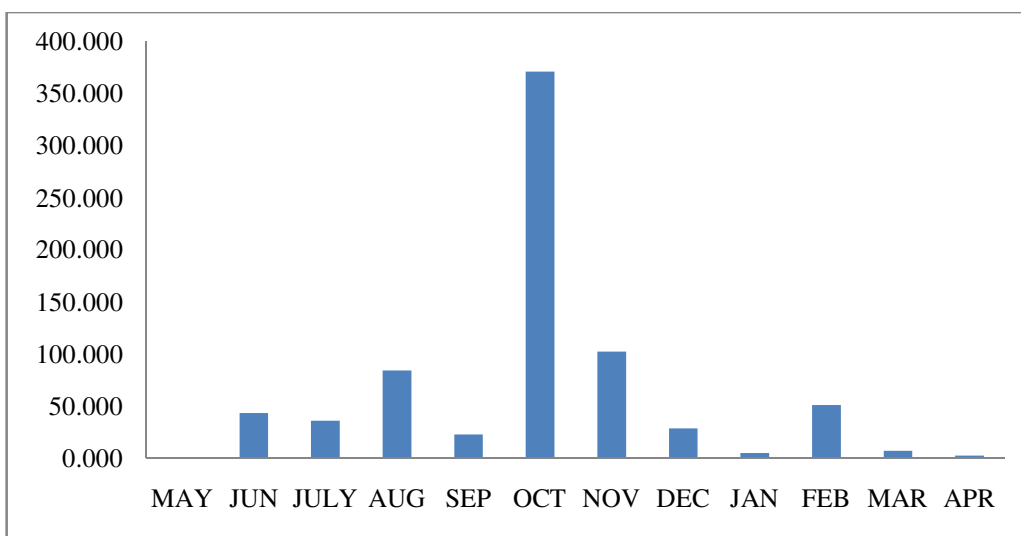

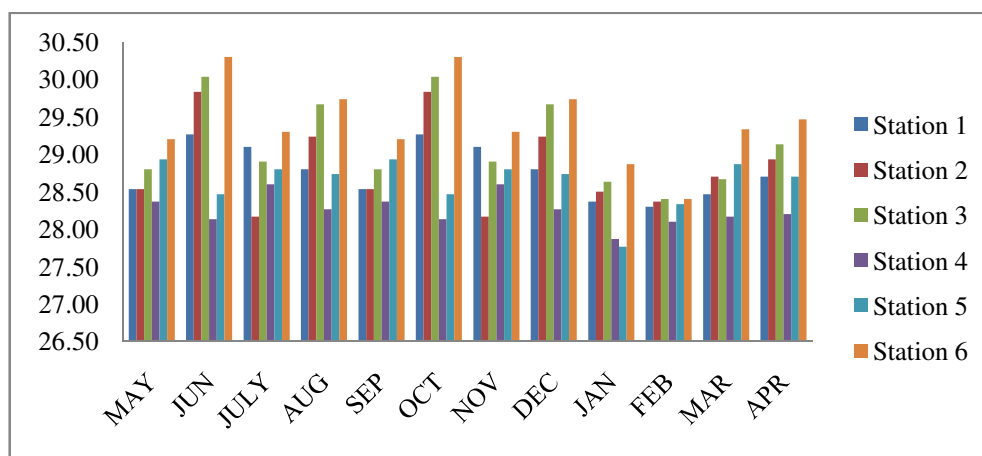
Figure-1
Monthly variation of Rainfall (mm)

Figure-2
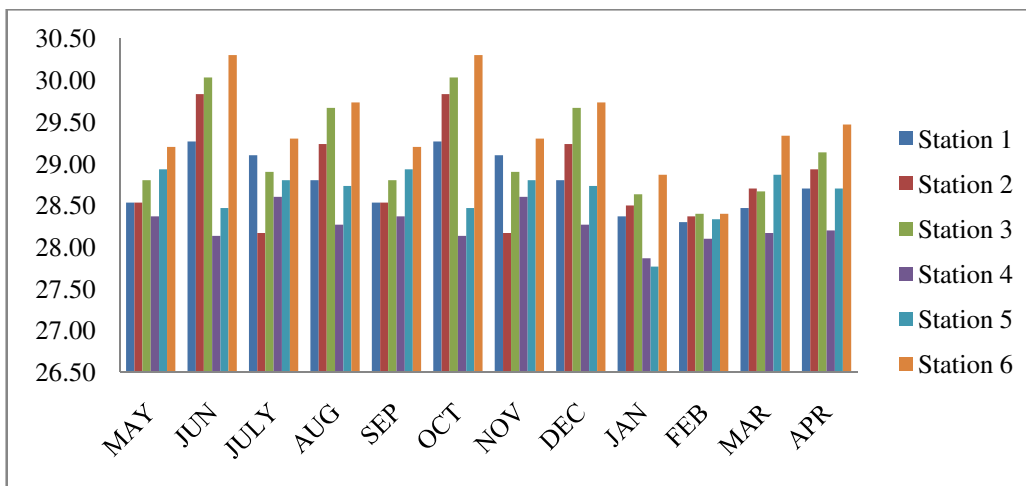**Monthly variation of Atmosphere temperature (^{0}C)**

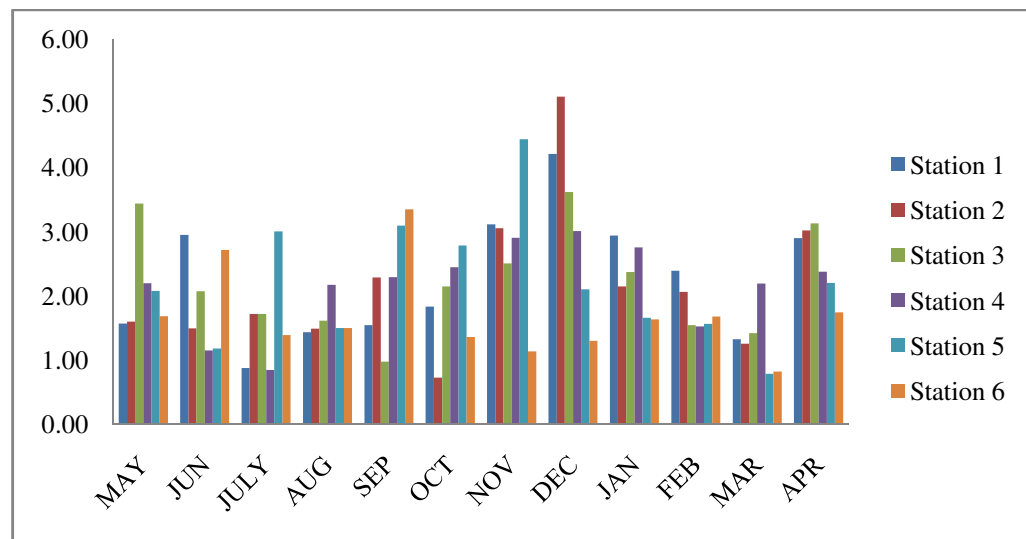**Figure-3**
Monthly variation of Salinity (ppm)

Figure-4
Monthly variation of Carbon-di-oxide (mg/l)

The higher nitrate level (3.19mg/l) was recorded in the month of July in station 4 and lower level (0.72mg/l) was recorded in September of station 5 (Figure-5). Higher values of nitrate recorded during monsoon season might be due to the influx of nitrogen rich flood water. Inorganic nitrogen is present in an aquatic biotope as oxidized nitrate, nitrite an intermediate state in the nitrogen cycle. Increasing amount of nitrate will leads to the high growth of aquatic plant, which may affected the estuary water environments leading to eutrophication. This causes sickness and death of marine organisms. The organic materials received from the fisheries leads to increase in nitrate level [12].

Total phosphorus was maximum (2.18±0.44 mg/l) during the month of September in station 2 and minimum (0.42±0.19 mg/l) in April of station 1 (Figure-6). Total phosphorus content was found to be high may be due the impact of industrial effluents. Similar conditions were observed by Sundararaj V. and

Krishnamurthy K.[13] from Pitchavaram waters. The environmental changes of phosphate due to the processes like surface assimilation and buffering action of sediment[14].

Conclusion

The present information of physico-chemical properties of water samples from manakudy estuary shows relatively high content of salinity than the riverside. Salinity level is the main factor responsible for variation in the hydrobiology. The quality of water in the estuary is deteriorated by ret liquor of the retting industry adjacent to the estuary, domestic sewage and agricultural runoff alongr natural and artificial sources. The quality of water is not stable and it may be changed due to seasonal variations. Water nutrients shows variations among estuarine and riverine side because the accumulation of artificial and natural calamities. It is concluded that the necessessity of

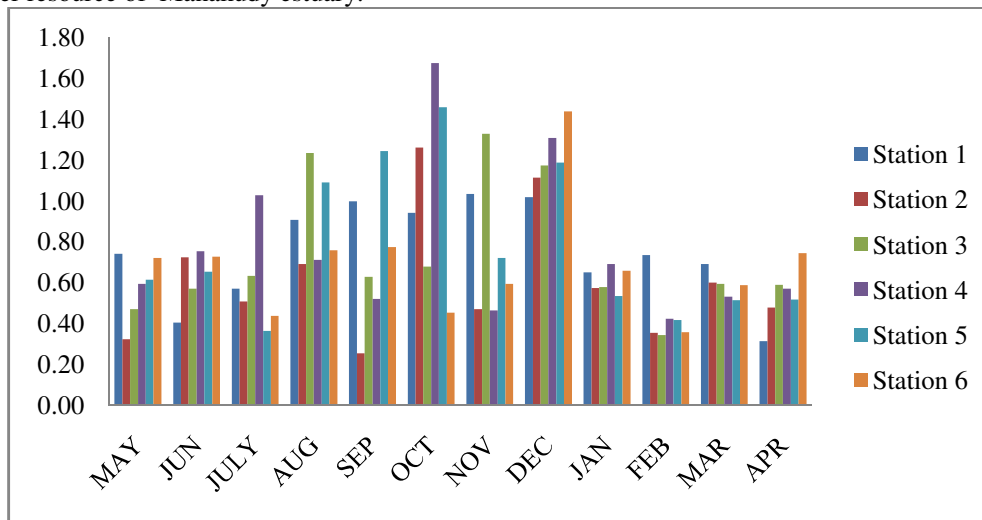monitoring the water resource of Manakudy estuary.
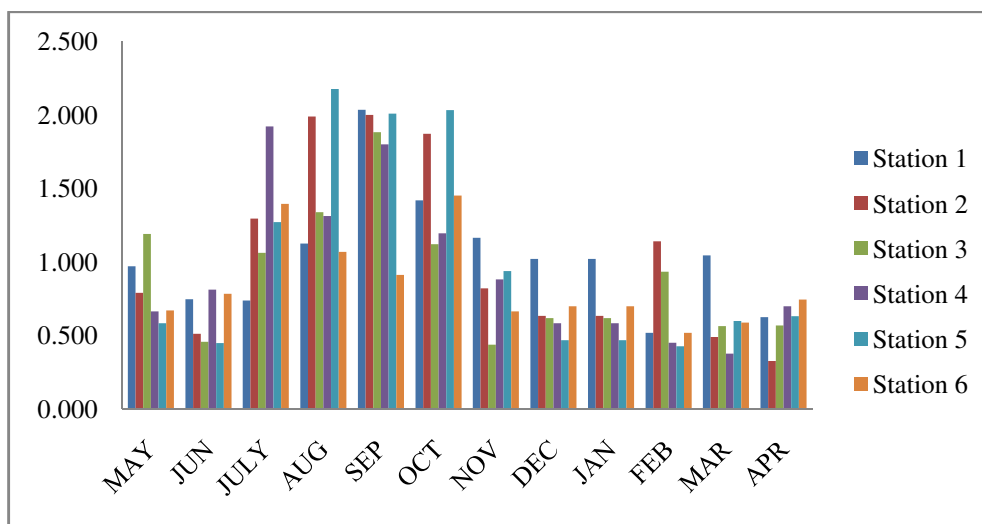

Figure-5
Monthly variation of Nitrate (mg/l)

Figure-6
Monthly variation of Total phosphorus (mg/l)

Acknowledgement

References

1. Karande A.A. (1991). Use of epifaunal communities in pollution monitoring. *J. Environ. Biol*, 191-200.

2. Kumar R., Singh R.D. and Sharma K.D. (2005). Water resources of India. *Current Science,* 89(5), 794-811.

3. Padmavathi G. and Goswami S.C. (1996). Zooplankton Composition in Vellar Estuary in Relation to Shrimp Farming. *Indian. J. Mar. Sci.*, 25, 268-273.

4. Schmidt S., Gonzalez J.L., Lecroart P., Tronczynski J., Billy I. and Jouanneau J.M. (2007), Bioturbation at the water-sediment inter-face of the Thau Lagoon: impact of shellfish farming. *Aquatic Living Ressources*, 20, 163–169.

5. Zolina O., Simmer C., Gulev S.K. and Kollet S. (2010). Changing structure of European precipitation: Longer wet periods leading to more abundant rainfall. *Geophys. Res. Lett*, 37, L06704, doi: 10.1029/ 2010GL042468.

6. Gadhia M., Surana R. and Ansari E. (2012). Seasonal variation in Physico-Chemical Characteristics of Tapi Estuary in Hazira Industrial Area. *Our Nature,* 10, 249-257.

7. American Public Health Association, American Water Works Association, and Water Pollution Control Federation (1985). Standard methods for the examination of water and wastewater. (16th ed.), Washington, D.C, American Public Health Association, 905.

8. Sundaramanickam A., Sivakumar T., Kumaran R., Ammaiappan V. and Velappan R. (2008). A Comparitive study of physic-chemical Investigation along Parangipettai and Cuddalore Coast. *Journal of Environmental Science and Technology*, 1(1), 1-10.

9. Reddi K.R., Jayaraju N., Suryakumar I. and Sreenivas K. (1993). Tidal fluctuations in relation to certain physic-chemical parameters in Swarnamukhi river estuary, east coast of India. *Indian J. Mar. Sci.*, 22, 232-234.

10. Nair K.K. and Tranter D.J. (1971). Zooplankton distribution along salinity gradient in the Cochin backwater before and after monsoon. *J. Mar. Biol. Ass. Indian*, 13, 203-225.

11. Verma Pradeep, Chandawat Deepika, Gupta Urvi and Solanki Hitesh. (2012). Water Quality Analysis of an Organically Polluted Lake by Investigating Different Physical and Chemical Parameters. *Int. J. Res. Chem. Environ*, 2, 105-111.

12. Prabhu A.V., Rajkumar M. and Perumal P. (2008). Seasonal variations in physico-chemical characteristics of Pichavaram mangroves, southeast coast of India. *Journal of Environmental Biology*, 29, 945-950.

13. Sundararaj V. and Krishnamurthy K. (1975). Nutrients and plankton: Backwater and Mangrove Environment N. Natarajan (ed*.). Recent Researches in Estuarine Biology*, Hindustan publishing Corporation (1) Delhi, 273-290.

14. Govindasamy C., Kannan L. and Azariah J. (2000). Seasonal variation in physic-chemical properties and primary production in the coastal water biotopes of Coromandel coast, India. *Indian J. Environ. Biol.*, 21, 1-7.