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Seasonal Changes in Physico-Chemical Characteristics of the Water of Gosthani Estuary in Visakhapatnam District-Andhra Pradesh, India

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Abstract:

The current study was carried out to find the seasonal changes in physico-chemical parameters in Gosthani estuary, East coast of Andhra Pradesh, India. The various parameters like temperature, pH and the nutrients (Chemical parameters) like carbonate, bicarbonate, nitrite-nitrogen, nitrate-nitrogen, phosphate and total phosphorus were measured over a period of six months i.e. from November-2014 to April-2015in both surface and bottom water samples. The overall analysis it was noticed that the fluctuations in physico-chemical parameters of water samples, the Gosthani estuary has been facing the problems of industrial wastes, municipal sewage and anthropogenic activities.

Key words: Estuary, pH, temperature, and anthropogenic activities.

INTRODUCTION

Estuaries are highly productive and excellent nursery and feeding grounds for many commercially important fishes and shrimps [1].Water is the universal solvent required for all the living beings. Without the knowledge of water quality, it is

difficult of understand the biological phenomenon fully, because the chemistry of water reveals much about the metabolism of the ecosystem and explains the general hydro-biological inter-relationship. The physico-chemical parameters of water and the dependence of all life process of these factors make it desirable to take water as an environment[2].

Estuarine water exhibit seasonal variations in its physic-chemical characteristics and nutrients content depending of physical and biological processes [3-11].There are very good reports available to describe seasonal variations of the physic-chemical characters in estuaries from Indian coast[6, 11, 12-22].

The nutrient contents in any coastal water determine its potential fertility[23], and therefore, it is important to gather information about their distribution and behavior in different coastal ecosystems require many inorganic substances, nitrogen, phosphorous and silicon are considered to be more important than the others, as they play key role in phytoplankton abundance, growth and metabolism[24, 25].

Hence the present study on to carry out to investigate on seasonal changes in physico-chemical characteristics of the Gosthani estuary.

MATERIAL AND METHODS

Monthly water samples were collected in the forenoon from the station (Gosthani estuary) during November 2014 to April 2015. Temperature, pH were measured using standard instruments viz., centigrade thermometer and Elico pH meter (Model, LC-120) respectively. The nutrients (Chemical parameters) carbonate, bicarbonate, nitrite-nitrogen, nitrate-nitrogen, phosphate and total phosphorus were estimated by adopting standard procedures [26].

RESULTS AND DISCUSSION

The result of physico-chemical parameters observed in different months from November 2014 to April 2015 of Gosthani estuary are represented in table.1 and 2

Table 1. Variations in physico-chemical parameters of Gosthani Estuary in Surface water during November 2014 to April 2015

Parameters	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15
Temperature	26.4±0.34	25.3±0.24	30.7±0.52	31.7±0.35	32.4±0.54	33.9±0.22
pH	7.3±0.04	7.2±0.03	7.7±0.07	7.8±0.02	8.0±0.05	8.2±0.01
Carbonate	7.6±0.24	1.2±0.11	5.7±0.17	13.5±0.33	5.2±0.27	11.7±0.19
Bicarbonate	60.7±0.52	84.7±0.39	110.2±0.44	107.4±0.27	127.5±0.15	117.6±0.28
Nitrite-nitrogen	35.4±0.11	33.7±0.17	14.8±0.55	9.2±0.47	11.9±0.21	35.0±0.36
Nitrate-Nitrogen	62.4±0.09	201.2±0.25	61.2±0.37	29.4±0.28	19.8±0.09	209.7±0.48
Phosphate	40.8±0.42	139.8±0.38	63.2±0.21	45.2±0.33	125.2±0.27	217.4±0.14
Total phosphorus	19.8±0.11	50.2±0.27	35.3±0.17	29.7±0.38	87.8±0.24	94.3±0.22

Table 2. Variations in physico-chemical parameters of Gosthani Estuary in bottom water during November 2014 to April 2015

Parameters	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15
Temperature	25.9±0.39	22.9±0.27	28.7±0.11	30.8±0.64	31.7±0.21	32.7±0.19
pH	7.4±0.06	7.1±0.11	7.6±0.10	7.8±0.04	8.1±0.01	7.9±0.05
Carbonate	11.2±0.17	1.6±0.21	7.7±0.22	10.1±0.016	5.0±0.14	10.3±0.26
Bicarbonate	47.4±0.33	38.2±0.29	18.9±0.21	15.8±0.37	13.2±0.41	51.2±0.52
Nitrite-nitrogen	57.3±0.20	257.4±0.52	42.3±0.47	21.7±0.34	24.4±0.31	287.9±0.29
Nitrate-Nitrogen	147.2±0.07	110.7±0.09	64.7±0.17	43.4±0.21	153.4±0.08	530.2±0.07
Phosphate	57.4±0.44	50.4±0.41	51.4±0.42	34.2±0.37	82.7±0.24	168.2±0.21
Total phosphorus	60.9±0.18	87.3±0.23	112.4±0.13	107.4±0.41	127.6±0.28	125.4±0.34

Table 3. Two way ANOVA for difference in surface water samples during June 2014 to April-2015

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	73983.21	6	12330.54	7.350586	0.000152	2.508189
Columns	18858.87	4	4714.717	2.810578	0.048032	2.776289
Error	40259.77	24	1677.49			
Total	133101.8	34				

Table 4. Two way ANOVA for difference in bottom water samples during June 2014 to April-2015

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	132869.1	6	22144.85	3.244163	0.017686	2.508189
Columns	81703.26	4	20425.82	2.992329	0.03888	2.776289
Error	163825.4	24	6826.059			
Total	378397.8	34				

pH

In the present study pH values did not show significant variation. It ranged from 7.2 to 8.2 in surface waters and 7.1 to 8.1 in bottom waters. Highest and lowest monthly average values for both surface and bottom waters were recorded during 8.2 (April-2015) 7.2 (December-2014), 8.1 (March-2015), 7.1 (December-2014) respectively. Changes of pH within a very narrow limits was due to extensive buffering capacity of the seawater could be another factor for this marginal change [27].

Temperature:

The observed surface and bottom temperature values ranged from 25.30 to 33.90 0^C and 22.9 to 32.7 0^C. The Highest and lowest monthly average values for both surface and bottom waters were recorded during 33.9 (April-2015) 25.3 (December-2014), 32.7 (April-2015), 22.9 (December-2014) respectively. The present study results are following the trends in temperature values of previous workers [28, 29].

Carbonate and Bicarbonate:

The carbonate and Bicarbonate values ranged from 1.2 to 11.7 mg/L, 60.7 to 127.5 mg/L, 1.6 to 11.2 mg/L, 13.2 to 51.2 mg/L for surface and bottom water respectively. During the present study the lowest and highest monthly average values for carbonate and bicarbonate both surface and bottom waters were recorded during 1.2 mg/L (December-2014), 127.6 mg/L (March-2015). These results are in agreement with earlier worker [30].

Nitrite-Nitrogen:

Nitrite-Nitrogen values varied from 9.2 to 35.4 µg/L in surface water and 21.7 to 287.9 µg/L in bottom water. Nitrite is often released into the water as an extracellular product of the planktonic organisms [31, 32]. Thus, nitrite distribution depicts an irregular picture and wide variations in coastal milieu. In

the present study a relatively high concentration of nitrite-nitrogen during monsoon was due to heavy rainfall and river discharge [33, 34].

Nitrate-Nitrogen:

Nitrate-Nitrogen values varied from 19.8 to 209.7 µg/L in surface water and 43.4 to 53.2 µg/L in bottom water. Variations in nitrate and its reduced inorganic compounds are predominantly the results of biologically activated reactions. Quick assimilation by phytoplankton and enhancement by surface runoff results in large scale spatio-temporal variation of nitrate in the coastal milieu [35-37].

In the present study that low nitrate concentration was noticed in February and March probably due to its utilization by biological activity [38].The high concentration in Nitrate-Nitrogen during monsoon period was possibly due to heavy rainfall and land drainage and the observations of the present study results were in agreement with the previous workers reported elsewhere [39, 40].

Phosphate

Phosphate concentration values varied from 45.2 to 217.4µg/L in surface water and 34.2 to 168.2 µg/L in bottom water. Phosphate constitutes the most important inorganic nutrient that can limit the phytoplankton production in tropical coastal marine ecosystems[41]and thereby the overall ecological processes. The high concentration of phosphate observed in the bottom water was probably due to the liberation of this nutrient from bottom sediments [38].

Phosphorus:

Total phosphorus concentration values varied from 19.8 to 94.3 µg/L in surface water and 60.9 to 125.4 µg/L in bottom water. It is well known that the nutrient concentration of the bottom water very much depends on the regenerative capacity of the

bottom sediments [42] and there is regular exchange of phosphorus between the mud and overlapping water[43].

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REFERENCES

1. Ganapati, P.N. 1975. Estuarine pollution. Bull. Dept. Mar. Sci., Univ. Cochin:VI, I:1-9.
2. Gowinda, G., K.M. Rajesh and Mridula, 2009. Vertical distribution of polychaetes in brakish water pond Nehtravathi estuary, India. J. Envirom. Bio, 30: 1025-1029.
3. Subramanian, B and A. Mahadevan, 1999. Seasonal and diurnal variations of hydrobiological characters of coastal waters of Chennai (Madras) Bay of Bengal, Indian Journal of Marine Science, 28: 429-433.
4. Telesh, I.V. 2004. Plankton of the Baltic estuarine ecosystems with emphasis on Neva Estuary: a review of present knowledge and research perspectives. Marine Pollution Bulletin, 49: 206–219.
5. Shridhar, R., T. Thangaradjou, S. Senthil Kumar and L. Kannan, 2006. Water quality and phytoplankton characteristics in the Palk Bay, Southeast coast of India.Indian Journal of Environmental Biology, 27: 561-566.
6. Saravanakumar, A., M. Rajkumar, J. SeshSerebiah and G.A. Thivakaran, 2008. Seasonal variations in physico-chemical characteristics of water, sediment and soil texture in arid zone mangroves of Kachchh-Gujarat. Journal of Environmental Biology, 29:725-732.

7. Nirmal Kumar, J.I., B. George, R.N. Kumar, P.R. Sajish, S. Viyol, 2009.Assessment of spatial and temporal fluctuations in water quality of a tropical permanent estuarine system - Tapi, west coast of India.Journal of Applied Ecology and Environmental Research, 7(3): 267-276.

8. Soundarapandian, P., T. Premkumar and G.K. Dinakaran, 2009. Studies on the Physico-chemical Characteristic and Nutrients in the Uppanar Estuary of Cuddalore, South East Coast of India. Current Research Journal of Biological Science, 1(3), pp 102-105.

9. Babu, N.K., P.K. Omanaand M. Mohan, 2010. Water and sediment quality of Ashtamudi estuary, a Ramsar site, southwest coast of India a statistical appraisal.Environmental Monitoring and Assessment, 165: 307-319.

10. Sivadas S. Baban Ingole and Mandar Nanajkar, 2011.Temporal variability of macro fauna from a disturbed habitat in Zuari estuary, west coast of India.Environmental Monitoring and Assessment 173: 65–78.

11. BudharatnaBhaware, Miguel A. Rodríguez, Anil Kurhe, 2013. Study of seasonal variations in physico-chemical parameters and nutrients in water of Bhatye estuary, Ratnagiri central, West coast of India. International Journal of Environmental Sciences 3 (5): 1671-1677.

12. Rajasegar, M. 2003. Physico-chemical characteristics of the Vellar estuary in relation to shrimp farming.J. Environ. Biol,24: 95-101.

13. Balasubramanian, R. and L., Kannan, 2005. Physico-chemical characteristics of the coral reef Environs of the Gulf of Mannar Biosphere Reserve, India. International Journal of Ecology and Environmental Science, 31: 265-271.

14. Paramasivam, S. and L. Kannan, 2005.Physicochemical characteristics of Muthupettai mangrove environment, Southeast coast of India.Int. J. Ecol.Environ. Sci, 31: 273-278.

15. Rajaram, R., M. Srinivasan and M. Rajasegar, 2005.Seasonal distribution of physico- chemical parameters in effluent discharge area of Uppanar estuary, Cuddalore, South-east coast of India. J. Environ. Biol. 26:291-297.
16. Ajithkumar, T. T., T. Thangaradjou and L. Kannan, 2006.Physico-chemical and biological properties of the Muthupettai mangrove in Tamil Nadu.J.Mar. Biol. Ass. India, 48: 131-138.
17. Asha, P.S. and R. Diwakar, 2007. Hydrobiology of the inshore waters off Tuticorin in the Gulf.J. Mar.Biol. Ass. India,49: 7-11.
18. Gowda, G.K.M. Rajesh and R.M. Mridula, 2009.Vertical distribution of polychaetes in brackishwater pond ofNethravathi estuary.India.J. Environ. Biol, 30:1025-1029.
19. Vengadesh, P.N., M. Rajkumar, P. Perumal and K. ThillaiRajasekar, 2009. Seasonal variations of plankton diversity in the Kaduviyarestuary,Nagapattinam, southeast coast of India.J.Environ. Biol, 30:1035-1046.
20. Sankar, R., L. Ramkumar, M. Rajkumar, Jun Sun and G. Ananthan, 2010.Seasonal variations in physico-chemical parameters and heavy metals in water and sediments of Uppanar estuary, Nagapattinam, India.Journal of Environmental Biology, 31(5): 681-686.
21. Jagadeesan, L., M.,Manju, P., Perumaland P., Anantharaman, 2011. Temporal variation of water quality characteristics and their principal sources in Tropical Vellar Estuary South East Coast of India.Research Journal of Environmental Science, 5(8): 703-713.
22. Gadhia, M., R.Surana and E. Ansari, 2012.Seasonal Variations in Physico-chemicalCharacterstics of Tapi Estuary in Hazira Industrial Area.Our Nature, 10: 249-257.
23. Harvey, H.W. 1960. The chemistry and fertility of seawater.London: Cambridge University Press.

24. Raymont, J.E.G. 1980. Plankton and productivity in the oceans. In Phytoplankton(Vol. 1).Pergamon.
25. Grant, G.M. and E. Gross, E. 1996. Oceanography-a view of the Earth. USA: Prentice-Hall.
26. Strickland, J.D.H .and T.R. Parsons, 1972. A Practical Handbook of Sea Water Analysis, 2nd Edn., Bull. No: 167. Fisheries Research. Board, Canada, Ottawa,Onto. pp: 331.
27. Riley, J.P. and Chester, R. 1971. An introduction to marine chemistry. London: Academic.
28. Sangu, R.P.S., Shankar, V. and Sharma, S.K. 1987. Indian Journal of Ecology, 14: 278.
29. Qasim, S.Z. and C.K. Goponathan. 1969. Proc. Indaian Acad. Sci, 69:336.
30. UmayoruBhagan, V., V. Selvarajand P. Srirenganathan, 1996.Physico-chemical characteristics of the water of Manakudy Estuary in Kanyakumari District-Tamil Nadu (India).Asian journal of Chemistry. 8 (3): 547-552.
31. Santschi, P., P. Honener, G. Benoit and M.B. Brink, 1990. Chemical process at the sediment–water interface.Marine Chemistry, 30, 269–315. doi:10. 1016/0304-4203(90)90076-O.
32. Chandran, R. and K. Ramamurty, 1984. Hydrobiological studies in the gradient zone of Vellar estuary-I: Physico-chemical parameters. Mahasagar, 17: 69–77.
33. Balakrishnan, N., P.K. Abdul Azis, K. Darmaraj, M. Arunachalam, K. Krishnakumar and N.K. Balasubramaniam, 1983. Indian J. Marine Sci, 12:143.
34. Shoba, V. and P. Ignatius Miranda. 1987. Proc. Sem. Estuarine Management (Trivandrum), 307.
35. Qasim, S. Z. 1977. Biological productivity of the Indian Ocean. Indian Journal of Marine Sciences, *6*: 122–137.
36. De Souza, S. N. 1983. Study on the behaviour of nutrients in the Mandovi estuary during premonsoon. Estuarine, Coastal and Shelf Science, 16, 299–308. doi:10.1016/0272-7714(83)90147-6.

37. Zepp, R.G. 1997. Interactions of marine biogeochemical cycles and the photodegradation of dissolved organic carbon and dissolved organic nitrogen. In A. Gianguzza, E. Pelizzetti, & S. Sammarkano (Eds.), *Marine chemistry* (pp. 329–352). London: Kluwer.
38. Balakrishnan, N., P.K. Abdul Azis, K. Krishna Kumar, K. Darmaraj and M. Arunachalam. 1984. Indian J. Marine Sci, 13, 69.
39. Sreedharan, M. and K.Y.M. Salih, 1974. Indian. J. Mar. Science, 3, 125.
40. Thresiamma Mathew and N. Balakrishanan Nair, 1980. Indian J, Mar. Sciences, 9, 253.
41. Cole, C.V. and Sanford, R.L. 1989. Biological aspects of the Phosphorus cycle.In Proc. symp.on phosphorous requirements for sustainable agriculture in Asia and Oceania, 6–10 March. SCOPE/UNEP.
42. Reddy, C.V.G. and V.N. SankaraNarayana, 1972. Indian J. Mar. Sci., 1, 57.
43. Rochford, D.J. 1951. Aust, J. Mar. Fresh Water. Res, 201.