International Journal of Zoology and Applied Biosciences **ISSN: 2455-9571**
Volume 2, Issue 2, pp: 100-104, 2017
https://doi.org/10.5281/zenodo.1311702
http://www.ijzab.com
Research Article

PHYSIO-CHEMICAL STUDY OF VETTAR ESTUARY IN NAGAPATTINAM DISTRICT, TAMIL NADU, INDIA

***[1]S. Niraimathi, S. Angelina Glorita Parimala and [2]B. Shobana**

[1]Sir Issac Newton College of Arts & Science, Pappakovil- 611 001, Tamil Nadu, India.

[2]Department of Zoology, A.D.M. College For Women, Nagapattinam-611 001, Tamil Nadu, India,

Article History: Received 4th August 2016; Accepted 1st September 2016; Published 26th June 2017

ABSTRACT

The present study was designed to investigate the changes of physico-chemical parameters in Vettar estuary, Nagapattinam District, Tamil Nadu, India for the period of 6 months from January to June 2014. Water samples were collected from upper reaches (Station-I, River) and lower reaches (Station-II, Estuary) from Vettar for period of 6 months from January to June 2014. Various physico-chemical parameters of the water in were determined. In the present study, it has been observed that high temperature was noticed in the months of April to June at station-I and station- II in the Vettar estuary. Temperature, pH, dissolved oxygen, salinity, total dissolved solids, phosphorous, nitrite, ammonia and fluoride were varied in both stations in different months. In the present study revealed that all the physico-chemical parameters were more in the upper reaches than in the lower reaches, which may be due to the industrial effluents mixing up with estuary. Suitable remedial measures should be taken to prevent the mixing of domestic sewage and discharge of effluent into the river to maintain the quality of Vettar estuary.

Keywords: Physico-chemical parameters, Domestic sewage, Industrial effluents, Quality of water, Vettar estuary.

INTRODUCTION

Water is a resource that has many uses, including recreation, transportation, and hydroelectric power, domestic, industrial and commercial uses. Water also supports all forms of life and affects our health, lifestyle, and economic well being. Although more than three quarters of the earth's surface is made up of water, only 2.8 percent of the Earth's water is available for human consumption. At present, approximately one-third of the world's people live in countries with moderate to high water stress and the worldwide freshwater consumption raised six fold between the years 1900 and 1995 more than twice the rate of population growth. Thus, many parts of the world are facing water scarcity problem due to limitation of water resources coinciding with growing population. The total life of the world depends on water and hence the hydrological study is very much essential to understand the relationship between its different trophic levels and food webs. The environmental conditions such as water movement, salinity, oxygen, temperature and nutrients are determining the composition of its biota (Karande, 1991). Usually in the near shore waters and estuaries, they exhibit considerable seasonal variations depending on the local conditions of rainfall, tidal incursions, various abiotic and biotic processes, quantum of fresh water inflow affecting the nutrient cycle of different coastal environments (Choudhury and Panigraphy, 1991). In the present study, the Vettar estuary has been chosen since it receives the effluents from the port, soap factories and steel industrial complex. Hence, the present study was designed to investigate the changes of physico-chemical parameters and nutrients in Vettar estuary.

MATERIALS AND METHODS

The Vettar estuary is situated at Nagapattianm District, District, Tamil Nadu, India. This river flows between Nagapattinam district and Pondicherry district reaches the Vettar estuary. The estuary receives the municipal wastes and domestic sewage from near town's area. In addition to the wastes, the untreated effluents were released from industries and discharged in to the estuary.

Collection of water samples

Water samples were collected from upper reaches (Station-I, River) and lower reaches (Station-II, Estuary) from Vettar for period of 6 months from January to June 2014. In river and estuary, the samples were collected from

*Corresponding Author: Dr. S. Niraimathi, Principal, Sir Issac Newton College of Arts and Science, Pappakovil- 611 001, Tamil Nadu, India, Email: niraimathijeeva@yahoo.co.in

different areas and mixed in a single sterile polyethylene bottle. The water samples were taken by pumping in order to avoid contamination from the surface of river basin. The samples were stored in 4°C for further analysis.

The temperature of the water in both places was recorded using a standard mercury centigrade thermometer. The pH of water has been recorded in the field itself using an Elico pH meter (model-LI-120). Salinity was estimated with the help of refrectometer model E-2. Total dissolved solids were estimated by evaporate the samples upto dryness by using an evaporating dish in suitable size and weight. On a water bath, a filtered sample was taken in the evaporating dish was noted after cooling in dessicator. The TDS was calculated and expressed in mg/1. Dissolved oxygen was estimated by modified Winkler's method (Strickland and Parsons, 1972). Calcium was estimated directly by employing EDTA titrimetric method using murixidei and erichrome black-T as indicators. Nutrients like, total phosphorus, nitrite, ammonia were estimated by adopting the methods described by Strickland and Parsons (1972).

RESULTS

Temperature: The temperature in the upper reaches was varied from 30.2 to 36.6ºC. Minimum was recorded during January and maximum during the month of June. It varied in lower reaches from 35.6 to 39.2º C. Minimum was recorded during March and maximum during the month of June (Table 1 and 2).

pH: pH at upper reaches varied from 7.2 to 7.9. Minimum was recorded during the month of February and maximum during the month of May. At lower reaches, pH varied from 6.0 to 7.9. Minimum was recorded during the month of February and maximum during the month of June (Table 1 and 2).

Dissolved oxygen: Dissolved oxygen in upper region was varied from 4.2 to 5.3 mg/l. Minimum level was recorded in the month of May and maximum during the month of March. In lower reaches, it varied from 4.1 to 5.0 mg/l. Minimum was recorded during the month of May and the maximum during the month of March (Table 1 and 2).

Salinity: The salinity in the upper reaches was minimum (12.3 ppt) during the month of January and maximum (16.2 ppt) during the month of June. The salinity in the lower reaches was varied from 26.2 to 28.3. Minimum was recorded during the month of January and the maximum during the month of June (Table 1 and 2).

Total dissolved solids: The total dissolved solids in the upper reaches were varied from 350 to 500 mg/1. Minimum was recorded during the month of January and maximum during the months of April and May. The total dissolved solids in the lower reaches were varied from 850 to 950 mg/1. Minimum was recorded during the months of January and February and the maximum during the month of May (Table 1 and 2).

Calcium: The calcium in the upper reaches was varied 40.2 to 43.0 mg/1. Minimum was recorded during the months of January and the maximum during the month of June. The calcium in the lower reaches was varied from 94.2 to 97.4 mg/1. Minimum was recorded during the month of May and the maximum during the month of June (Table 1 and 2).

Total phosphorus: The total phosphorus in the upper reaches was minimum (1.00 ppm) in the month of March and maximum (1.96 ppm) in the month of January. The total phosphorus in the lower reaches was Minimum (1.72 ppm) in the months of January and June and maximum (1.93 ppm) in the month of March (Table 1 and 2).

Nitrite: The nitrite in the upper reaches was varied from 0.63 to 0.98 ppm. Minimum was recorded during the month of May and the maximum during the month of January. The nitrite in lower reaches was minimum in the month of April (1.73 ppm) and maximum in the month of March (2.06 ppm) (Table 1 and 2).

Ammonia: The total ammonia in the upper reaches was minimum (0.08 ppm) in the month of June and maximum (0.23 ppm) in the month of January. The ammonia in the lower reaches was minimum (0.12 ppm) in the month of May and maximum (0.32 ppm) in the months of January and March (Table 1 and 2)

Fluoride: The fluoride in the upper reaches was varied from 0.26 to 0.36 mg/dl. Minimum was recorded during the month of January and the maximum during the month of June. The Fluoride in lower reaches was minimum in the month of February (0.26 mg/dl) and maximum in the month of June (0.29 mg/dl) (Table 1 and 2).

Table 1. Physico-chemical parameters of the upper reaches (Station I) of Vettar estuary during January to June, 2014.

Parameters	Jan	Feb	Mar	Apr	May	June
Temperature	33.1	34.1	34.1	34.1	34.1	34.1
PH	7.1	7.4	7.1	7.1	7.1	7.1
Dissolved oxygen mg/dl	5.8	5.1	5.8	5.8	5.8	5.8
Salinity (ppt)	11.9	11.9	11.9	11.9	11.9	11.9
Total dissolved solids (mg/dl)	346	346	346	346	346	346
Calcium (mg/dl)	37.8	37.8	37.8	37.8	37.8	37.8
Phosphorous (ppm)	2	2	2	2	2	2
Nitrite (ppm)	0.67	0.67	0.67	0.67	0.67	0.67
Ammonia (ppm)	.21	.21	.21	.21	.21	.21
Fluoride (mg/dl)	0.27	0.29	0.26	0.28	0.29	0.29

Table 2. Physico-chemical parameters of the upper reaches (Station II) of Vettar estuary during January to June, 2014.

Parameters	Jan	Feb	Mar	Apr	May	June
Temperature	33.1	34.1	34.1	34.1	34.1	34.1
PH	7.1	7.4	7.1	7.1	7.1	7.1
Dissolved oxygen mg/dl	5.8	5.1	5.8	5.8	5.8	5.8
Salinity (ppt)	11.9	11.9	11.9	11.9	11.9	11.9
Total dissolved solids (mg/dl)	346	346	346	346	346	346
Calcium (mg/dl)	37.8	37.8	37.8	37.8	37.8	37.8
Phosphorous (ppm)	2	2	2	2	2	2
Nitrite (ppm)	0.67	0.67	0.67	0.67	0.67	0.67
Ammonia (ppm)	0.21	0.21	0.21	0.21	0.21	0.21
Fluroide (mg/dl)	0.26	0.26	0.27	0.27	0.28	0.29

DISCUSSION

The temperature variation is one of the factors in the coastal and estuarine system, which may influence the physico- chemical characteristics and also influence the distribution and abundance of flora and fauna. In the present study, it has been observed that high temperature was noticed in the months of April to June at station-I and station-II in the Vettar estuary. Lower temperature in the months of January to March was due to cloudy sky and rainfall brought down the temperature to the minimum (Kannan and Kannan, 1996). Similar observations have been reported by Thangaraj (1985), Gothandaraman (1993) and Seenivasan (1998) in Vellar estuary, Mani (1989), Vasantha (1989), Kaliyaperumal (1992) and Karuppusamy (1997) in Pichavaram mangroves water, Saraswati (1993) in Arasalar and Kannan and Kannan (1996) in Palk Bay. Ananthan (1994) has stated that the higher value of pH during summer was due to the uptake of CO_2 by photosynthesizing organisms. The low pH observed during the months of January to March may be due to the influence of fresh water influx, dilution of sea water, low temperature and organic matter decomposition as suggested by Ganesan (1992). Similar trend of pH in Vettar estuarine system was reported by Thangaraj (1985), Hemalatha (1996) and Seenivasan (1998) and Mathevan (1994) from Cuddalore Uppanar waters and Ananthan (1994) from Pondicherry coastal water. In the present study, it has been observed in lower reaches (station-II) that the pH showed grater variation due to irregular treatment of the industrial effluents and subsequently released into the estuary. Dissolved oxygen concentration varies according to many factors; the main factors are due to photosynthesis and respiration by plants and animals in water. It has been observed from the present study that the amounts of dissolved oxygen content during different months (January to June, 20014) have shown minimum quantity in lower reaches when compared to upper reaches. This is because of the oxygen is consumed more by the aquatic animals due to effluents stress. Salinity is one of the important factors which profoundly influence the abundance and distribution of the animals in estuarine environment. In the present study, the lower salinity was recorded during the months of January to March was due to heavy rainfall and large quantity of freshwater inflow. Similar trend in the salinity values were also observed from Vellar estuary (Hemalatha, 1996; Seenivasan, 1998), Pichavaram mangrove water (Mani, 1989; Kaliyaperumal, 1992), Cuddalore Uppanar water (Mathevan 1994), Pondicherry coast (Ananthan, 1994), Palk Bay (Kannan and Kannan, 1996) and coastal waters of Kalpakkam (Satpathy, 1996). In the present study, the salinity was higher in the months of April to June due to low rainfall, decreased fresh water inflow, land drainage and rise in temperature. In lower reaches, it has been observed that the salinity range was not usual because of the effluents release. In the present study, the total dissolved solids are comparatively more during the months of April to June in lower reaches. It is due to the industrial waste, animal waste, agricultural waste, etc. and also caused by evaporation and less rainfall. Verma *et al.* (1978) have observed that the large amount of dissolved solids may result in high osmotic pressure. The high amount of solids recorded in Station-II, could be attributed due to the effluent discharge as evidenced by Ushamary *et al.* (1998) in the Paravanar river. In the present study, the accumulation of calcium content was more in lower reaches. This may be due to more calcium contents in effluents discharged in that area. The calcium content was high in Arabian Sea and Mandovi and Zuari estuaries (Sen Gupta and Sugandhini, 1981), west coast of India (Sugandhini *et al.*, 1982) and Vellar estuary (Palanichamy and Balasubramanian, 1989). Total phosphorus content was found to be high during the months of April to June in lower reaches than upper reaches. This may be due the impact of industrial effluents. Similar conditions were observed by Sundararaj and Krishnamurthy (1975) from Pitchavaram waters and Rajasegar (1998) from Vellar estuary. Nitrite content was also found to be higher during the months of January to May in the lower reaches than the upper reaches and which could be attributed due to the influence of seasonal floods. The higher concentration of

nitrite and seasonal variation could be attributed due to the variation in phytoplankton, excretion and oxidation of ammonia and reduction of nitrite (Kannan and Kannan, 1996). The low contents of nitrites during the months of April to May was due to less freshwater input, higher salinity, higher pH and also uptake by phytoplankton. The same was recorded by Chandran (1982), Sivakumar (1992) and Shekar (1987) from Vellar estuary, Patterson Edwards and Ayyakannu (1991) from Kolhdarn estuary and Mathevan (1994) from Vettar estuary. Kannan and Kannan (1996) from Palk Bay from vettar estuary and Satpthy (1996). In the present investigation, ammonia was found to be high in lower reaches and this may be partly due to the death and subsequent decomposition of phytoplankton and also might be the excretion of ammonia by planktonic organisms (Segar and Hariharan, 1989; Ananthan, 1994; Rajasekar, 1998).

CONCLUSION

It has been observed from the present study that the high content of few chemical parameters in lower reaches which may be due to the industrial effluents mixing up with estuary. Regular monitoring of river and taking suitable remedial measures like collection of domestic sewage and sefting up the common treatment plant, before discharge of sewage into river system, it should be treatment. This will control pollution and prevent the depletion of the quality of river waters.

ACKNOWLEDGMENT

The authors express sincere thanks to the Principal and HOD of Zoology of A.D.M. College For Women for the facilities provided to carry out this research work.

REFERENCES

Ananthan, G., 1994. Plankton ecology and heavy metal studies in the marine environments of Pondicherry, India, Ph.D. Thesis, Annamalai University, India, pp. 125.

Chandran, R., 1982. Hydrobiological studies in the gradient of the Veller estuary. Ph.D. Thesis, Annamalai University, India. pp, 195.

Choudhury, S.B. and Panigrahy, R.C., 1991. Seasonal distribution and behavior of nutrients in the Greek and coastal waters of Gopalpur, East coast of India: Mahasagar-Bull. *Nati. Inst., Oeanogr.,* 24 (2), 91-88

Ganesan, M., 1992. Ecobiology of seaweed of the Gulf of Mannar with special reference to hydrography and heavy metals. Ph.D. Thesis Annamalai University, India. pp. 162.

Gothandaraman, N., 1993. Studies on micro Zooplankton, Ph.D.Thesis, Annamalai University, India, pp. 180.

Hemalatha, A., 1996. Studies on Benthos from a shrimp farm and in Vellar estuary, Paragipattai. M. Phill Thesis, Annamalai University, India, pp. 39.

Kaliyaperumal, C., 1992. Studies on the interrelationship between phytoplankton and zooplankton in the waterways of the Pitchavaram Mangroves (India). Ph.D. Thesis. Annamalai University, India, pp. 215.

Kannan, R. and Kannan, L., 1996. Physico-chemical characteristics of sea weed beds of the Palk Bay, Southeast coast of India. *Ind. J. Mar. Sci.,* 25, 358-362.

Karande, A.A., 1991. Use of epifaunal communities in pollution monitoring. *J. Environ. Biol.,* 12, 191-200.

Karuppasamy, P.K., 1997. Studies on Zooplankton in the Pitchavaram Mangroves and laboratory culture of rotifer *Brachionus plicatilis*. M.Phil. Thesis, Annamalai University, India, pp. 85.

Mani, P., 1989. Phytoplankton ecology of mangrove ecosystem. Ph.D. Thesis, Annamalai University, India. pp. 72.

Mathevan, P.M., 1994. Hydrobiological investigation on the intertidal diatoms of the Cuddalore Uppanar estuary India. Ph.D. Thesis, Annamalai University, India, pp. 159.

Palanichamy, S. and Balasubramanian, T., 1989. Distribution of Calcium and magnesium in. the Vellar estuary. Mahasagar *Bull. Natl. Inst. Oceanogr.,* 22, 1-11.

Patterson Edward, J.K. and Ayyakannu, K., 1991. Studies on the ecology of plankton community of kollidam estuary, southeast coast of India. 1. Phytoplankton Mahasagar. *Bull. Natl. Inst. Oceanogr.,* 24(2), 89-97.

Rajasegar, M., 1998. Environmental inventory on Vellar estuary Southeast coast of India in relation to shrimp farming. Ph.D. Thesis, Annamalai University, India, pp. 95.

Saraswathi, R., 1993. Hydrobiology of two estuarine systems (Arasalar and Kaveri) of the southeast coast of India with special reference to plankton. Ph.D. Thesis, Annamalai University. India, pp. 267.

Satpathy, K.K., 1996. Seasonal distribution of nutrients in the waters of Kalpakkam, east coast of India. *Ind. J. Mar. Sci.,* 2, 221-224.

Seenivasan, R., 1998. Spectral reflectance properties of the Vellar estuarine environment, southeast coast of India, M.Phil. Thesis, Annamalai University. India, pp. 35.

Segar, K. and Hariharan, V., 1989. Seasonal distribution of nitrate, nitrite, ammonia and plankton in effluent discharge area of Mangalore, west coast of India. *Ind. J. Mar. Sci.,* 18, 170-173.

Sen Gupta, R. and Sugandhini, N., 1981. Studies on calcium, magnesium and sulphate in the Mandovia and Zuari river systems (Geo). *Ind. J. Mar. Sci*., 10, 24-34.

Sivakumar, V., 1982. An environmental inventory of the tidal zone of the Vellar estuary. Ph.D. Thesis, Annamalai University, India. pp: 78.

Strickland, J.D.H. and Parsons, T.R., 1972. A Practical Handbook of Sea Water Analysis, 2nd Edn., Bull. No: 167. Fisheries Research. Board, Canada, Ottawa, Onto, pp. 331.

Sugandhini, S.N. and Dias, C.M., 1982. On the distribution of fluoride, calcium and magnesium in the waters of the central west coast of India. *Mazhasagar Bull.Natl. Inst. Oceanogr.*, 15: 23-28.

Sundararaj, V. and Krishnanirthy, K., 1975. Nutrients and Plankton.In: Backwater and Mangrove Environment. N. Natarajan, (Ed.). Recent Researches in Estuarine Biology, pp. 273-390.

Thangaraj, G.S., 1985, Ecobiology of the marine zone of the Vellar estuary. Ph.D. Thesis, Annamalai University, India, pp. 194.

Ushamary, T.M. Nagarajan, S. and Swaminathan, M., 1988. A correlation study on Physico-chemical characteristics of carbonization waste water. *IJEP*, 18(9), 647-649.

Vasantha, K., 1989. Studies on hydrobiology and decomposition of macrophytes in Portonovo marine environment Southeast coast of India. Ph.D. Thesis, Annamalai University, India, pp. 252.

Verma, S.K., Tyagi, A.K. and Dalela, R.C., 1978. Physio-chemical and biological characteristics of Kedarabad drain. *Op. Cit.*, 20, 1-13.