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RESEARCH ARTICLE

STUDIES ON THE HYDROBIOLOGY OF AGNIAR ESTUARY, EAST COST TAMIL NADU, INDIA

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ABSTRACT

The study was carried out to assess the water quality parameters of the Agniyar estuary, Tamil Nadu, India from August 2015 to April 2016. The monthly variations showed minimum and maximum value water temperature (24.52 – 32.15˚C), turbidity (47.75 – 59.15 cm), pH (7.62 – 8.4 ppm), dissolved oxygen (3.35 to 6.19 mg/L), salinity (18.27 - 25.57 ppt), calcium (95.15 – 146.9 mg/L, nitrate (0.32 – 0.51 mg/L) and ammonia (0.13 – 0.24 mg/L) respectively.. The minimum and maximum values of above parameters were observed during the study period of August 2015 to April 2016 in the Agniyar estuary.

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INTRODUCTION

The estuarine environment is characterized by constant churning of freshwater from the river with marine water, which may be challenged by modifications in water quality. Aquatic animals living in such a challenged estuarine environment should be able to match appropriate changes with their physiological requirements. It is observed that estuarine environment is polluted by discharges of domestic sewage and industrial effluents besides other anthropogenic activities including agricultural runoff. These discharges bring considerable amount of pollutants that may cause undesirable changes in the water quality which ultimately cause pollution. Such pollution is a serious threat not only to the aquatic organisms but also to the downstream water users. Estuarine environmental study has accelerated during the past two decades since estuaries support a rich pelagic, benthic communities and serves as excellent nursery and feeding grounds for many commercially important fishes and shrimps (Ganapati, 1975).

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Estuaries, the main contributors of fisheries in India, suffer from severe damage which receive large amount of contaminants due to increased industrialization and urbanization along the coastal areas by continuous discharge of domestic sewage and industrial effluents. Overloading of the estuaries with contaminants for a longer period of time has resulted in the significant buildup of pollutants with a resulting impact on water properties (Padmini and Kavitha, 2003). Paramisivam and Kannan, (2005) reported that factors related to water quality such as temperature, pH, salinity, dissolved oxygen, total organic carbon and nutrients are particularly important for determining the biota and ecosystem functions in coastal waters. Hence, the present study was therefore undertaken with a view to provide much needed information on the water quality parameters in the Agniyar estuary and the coastal water of Muthupet, Tamilnadu, India.

MATERIALS AND METHODS

Water samples were collected from Agniyar estuary, Tamil Nadu and analysis for physicochemical characteristics. Samples were collected in one litre plastic bottles with tightly fitted lids. The sample were analysed every month from August 2015 to April 2016 between 7 and 10 A.M. at a regular interval of one month.

The physico-chemical parameters were estimated in the laboratory following the methods of APHA (1998). Temperature and pH were recorded on the site immediately after the collection of the samples. Mercury thermometer was used to measure temperature, Secchi disc and pH meter were used to measure turbidity and pH, respectively. Salinity of the pond water was estimated with the help of Salinometer. Dissolved oxygen was determined by Winkler's method. Calcium was determined by EDTA-Titrimetric method, nitrate was estimated by Brucine method and ammonia by Nesslerization method.

RESULTS

Physico–Chemical parameters of freshwater and treated sewage water culture ponds

In the present study, physico–chemical parameters of Agniyar estuary Thanjavur district. Tamilnadu, India was investigated from September 2015 to April 2016 (Table 1). The water temperature fluctuated from 24.52 to 32.15ºC in freshwater carp culture pond – I. It was found to be low (24.52ºC) in the month of December 2015 and high (32.15ºC) in April 2016 (Table 1 & Fig. 1). Turbidity of the freshwater carp culture pond in the culture pond depends on availability of either zooplankton or phytoplankton and suspended soiled particles. The transparency of the freshwater fish culture pond varied from 47.75 to 59.15 cm. It was found to be low (47.75 cm) in the month of December 2015 and high (59.15 cm) in January 2016 (Table 1& Fig. 2).

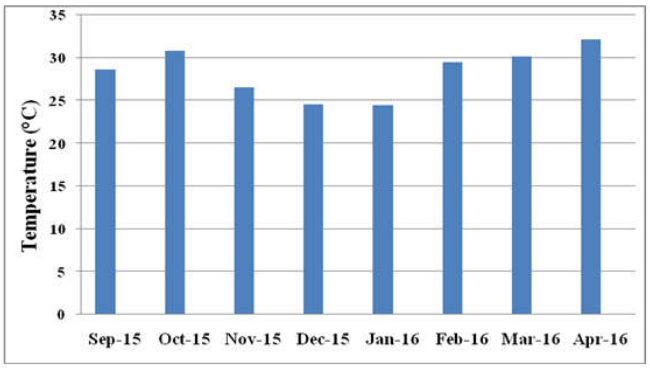

Fig. 1. Water temperature (^{0}C) of Agniyar estuary

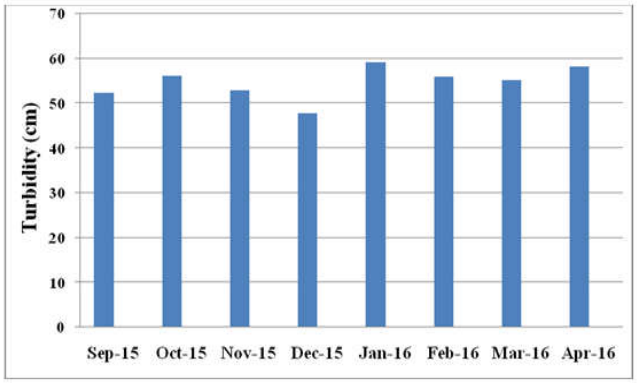

Fig. 2. Turbidity of the Agniyar estuary water samples

pH is another important biological parameter. The pH of the fish culture pond water showed alkaline ranges throughout the study period. It varied from 7.62 to 8.4. It was found to be minimum (7.62) in December 2015 and maximum (8.4) in the month of March 2016 (Table 1 & Fig. 3). The salinity ranges between 18.27 to 25.57. It was found to be low (18.27 ppt) in December 2015 and high (25.57 ppt) in April 2016 (Table 1 and Fig. 4). The dissolved oxygen is important biological factor. The freshwater fish culture of the dissolved oxygen content ranged from 3.35 to 6.19 mg/L. It was found to be low (3.35 mg/L) in April 2016 and high (6.19 mg/L) in December 2015 (Table 1 & Fig. 5).

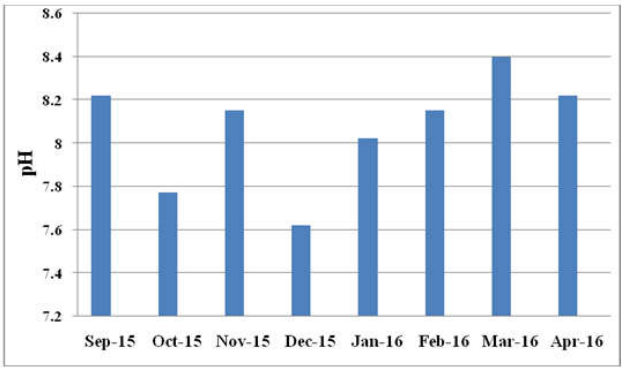

Fig. 3. pH of Agniyar estuary water samples

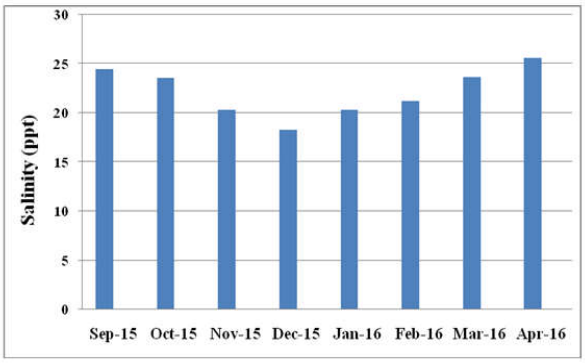

Fig. 4. Salinity (ppt) of Agniyar estuary water samples

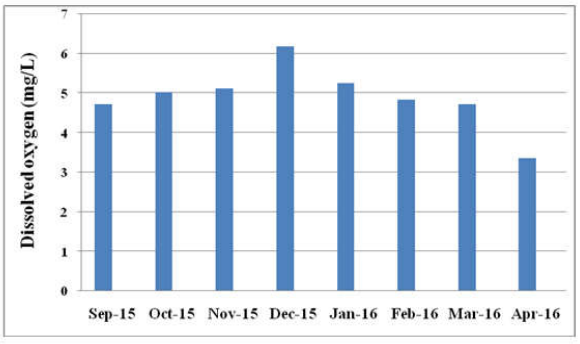

Fig. 5. Dissolved oxygen content (mg/L.) of Agniyar estuary water samples

The freshwater carp culture pond of the calcium ranged between 95.15 to 146.9 mg/L. The maximum calcium (146.9) was recorded in the month of December 2015 and minimum (95.15 mg/L) in December 2015 (Table 1 & Fig. 6). Nitrate content fluctuated from 0.32 to 0.51 mg/L.

Table 1. Monthly variations of physico-chemical factors in water samples of Agniyar estuary

Month and Year	Temp. (°C)	Tur. (cm)	pH	Salinity (ppt)	DO (mg/L)	Calcium (mg/L)	Nitrate mg/L)	Ammonia (mg/L)
September 2015	28.6 ± 1.62	52.25 ± 1.26	8.22 ± 0.09	24.45 ± 1.26	4.71 ± 0.08	108.87 ± 1.31	0.42 ± 0.10	0.14 ± 0.005
October 2015	30.82 ± 0.38	56.12 ± 0.85	7.77 ± 0.12	23.52 ± 1.04	5.03 ± 0.13	111.62 ± 1.11	0.39 ± 0.08	0.13 ± 0.01
November 2015	26.52 ± 2.62	52.87 ± 1.31	8.15 ± 0.19	20.32 ± 0.80	5.11 ± 0.14	117.12 ± 1.03	0.37 ± 0.09	0.17 ± 0.02
December 2015	24.52 ± 3.35	47.75 ± 1.21	7.62 ± 0.19	18.27 ± 0.76	6.19 ± 0.16	95.15 ± 0.87	0.32 ± 0.08	0.21 ± 0.01
January 2016	24.62 ± 0.41	59.15 ± 2.18	8.02 ± 0.09	20.3 ± 0.21	5.25 ± 0.12	109.4 ± 0.77	0.42 ± 0.09	0.19 ± 0.01
February 2016	29.47 ± 1.31	55.97 ± 0.89	8.15 ± 0.13	21.17 ± 0.75	4.83 ± 0.11	125.17 ± 2.77	0.39 ± 0.08	0.22 ± 0.01
March 2016	30.17 ± 0.79	55.15 ± 0.75	8.4 ± 0.11	23.67 ± 1.12	4.71 ± 0.13	137.95 ± 2.74	0.43 ± 0.09	0.24 ± 0.01
April 2016	32.15 ± 0.48	58.27 ± 0.61	8.32 ± 0.09	25.57 ± 0.54	3.35 ± 0.17	146.9 ± 1.33	0.51 ± 0.07	0.22 ± 0.01

Each value is the mean ± S.D. of three estimations

It was found to be low (0.32 mg/L) in the month of December 2015 and high (0.51 mg/L) in April 2016 (Table 1 & Fig. 7).

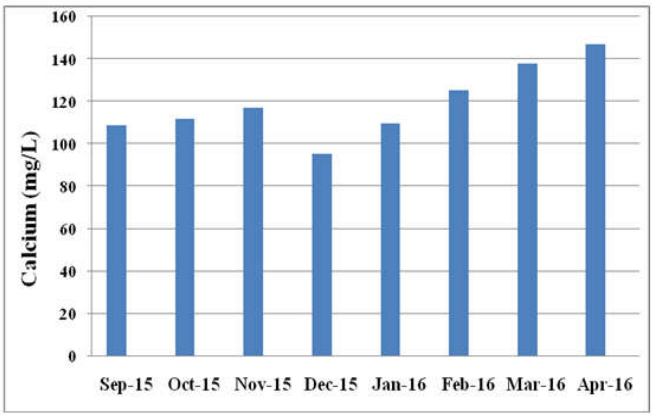

Fig. 6. Calcium content (mg/L.) of Agniyar estuary water samples

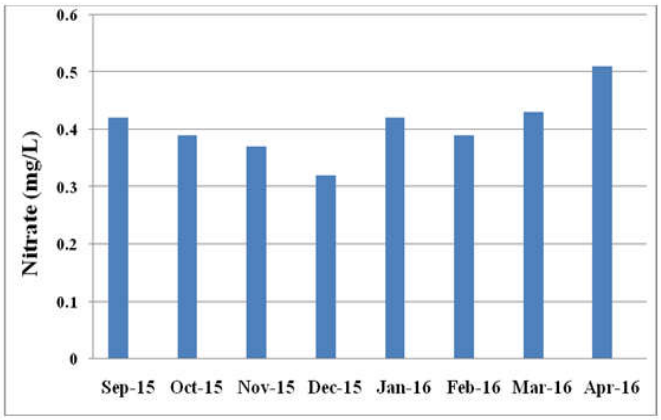

Fig. 7. Nitrate content (mg/L.) of Agniyar estuary water samples

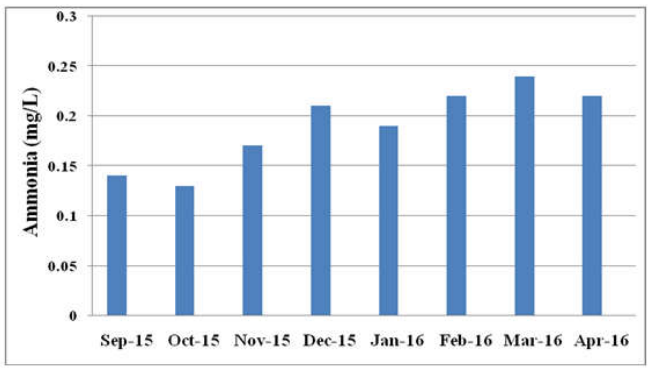

Fig. 8. Ammonia content (mg/L.) of Agniyar estuary water samples

Ammonia content of the freshwater fish culture pond fluctuated from 0.13 to 0.24 mg/L. It was found to be low (0.13 mg/L) in the month of October 2015 and high (0.24 mg/L) in March 2016 (Table 1 & Fig. 8).

DISCUSSION

The temperature of Agniyar estuary of Muthupet area were observed maximum April 2016 and minimum in December 2015. Generally water temperature correspond with air temperature indicating that the samples collected from shallow zones has a direct relevance with air temperature, shallow water reacts quickly with changes in atmospheric temperature (Rajkumar *et al*., 2011). Turbidity is a measure of water quality how much the material suspended in water decreases the passage of light through the water. In the present study, the maximum turbidity January 2016 and minimum in December 2015 was recorded during the study period. Similar trend was earlier reported by (Peterson, 2000). The high turbidity was recorded in rainy season when compared to summer season have also reported by (Jakher and Rawat, 2003). The minimum turbidity was recorded during May month and maximum was recorded in December month have reported by (Das *et al.,* 1997). Hydrogen ion concentration (pH) in Agniyar estuary was noted maximum in March 2016 and minimum in December 2015. Similar findings were recorded by Jankiraman *et al*., (2012) in Adyar estuary ranged from (7.06 to 7.86 ppm). Likewise in Uppanar estuary the pH value ranged from 7.6 to 7.72 ppm by Velsamy *et al*., (2013). The pH of the coastal seawater normally falls between 7.8 and 8.3 ppm and is controlled by the buffering action of bicarbonate (Martin 2007). Salinity is one of the important factors that influences the functional physiology and reproductive activity of the organisms. In the present study, salinity in the Agniyar estuary was observed maximum in April 2016 and minimum in December. The observed salinity variations in estuaries are due to the influx of freshwater. Generally, salinity acts as a limiting factor in the distribution of living organisms and its variation coursed by dilution and evaporation is most likely to influence the faunal distribution (Kamalkanth *et al*., 2012).

Dissolved oxygen content of Agniyar estuary showed minimum in April 2016 and maximum in December 2015. A similar observation was reported by Singh *et al.* (2004) the average dissolved oxygen concentration of Gomti River in Pipraghat region was 5.4 ppm. A possible explanation for the lower mean dissolved oxygen values when compared to coastal water could be the turbidity nature of the water, due to inflows

from run-offs and decomposition of organic matter in the water (Braide *et al.,* 2004). The calcium is essential for the growth of organisms and a nutrient that limits the primary productivity of the water body. Calcium plays a dynamic role in aquatic ecosystem, when present in low concentration is one of the most important nutrients. In the present study, maximum calcium content was noted April 2016 and minimum in December 2015.

The variation may be due to the various process line adsorptions and desorption of calcium and buffering action of sediment under varying environmental conditions (Rajasekar, 2003). The high value of calcium noticed during monsoon season and low value was recorded during summer (Sridhar *et al.,* 2006). In the present observation, maximum nitrate content was April 2016 and minimum in December 2015 during the study period. Studies show that excess utilization of fertilizer in agriculture and sewage discharge result in the increase of nitrogen and phosphorous in the estuary (Adeyemo, 2003). Similar trend was reported earlier by Sunitha Rao and Rama Sarma, 1995 in Gosthani estuary, east coast of India. In the present investigation, ammonia content of Agniyar estuary were recorded maximum in March 2016 and minimum in October 2015. Similar trend was recorded by Jankiraman *et al*., (2012). The total ammonia level more during the months of October to December and minimum level during the months of April to June have also reported by (Sridhar *et al.,* 2006).

Conclusion

The present investigation, the various physico-chemical parameters in the waters of the Agniyar estuary of Muthupet. The data which showed that the physicochemical properties of the estuarine zone were significantly vary when compared with study period. Thus, it can be concluded that the variations in the water quality parameters determine the distribution, abundance and diversity of all aquatic organisms in the Agniyar estuary of Muthupet during the study period.

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