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ASSESSMENT OF PHYSICO-CHEMICAL CHARACTERISTICS OF THANGAITHITTU ESTUARY SOUTH EAST COAST IN PUDUCHERRY, INDIA

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ABSTRACT

The study was carried out to assess the water quality parameters of the Thengaithittu estuary in Puducherry, from January 2017 to December 2017. The results revealed that for most of the water parameters like temperature, turbidity, pH, salinity, dissolved Oxygen, calcium, nitrate and ammonia maximum and minimum values were recorded during the study period, respectively. Variations in the water quality parameters determine the distribution, abundance and diversity of all aquatic organisms in the Thengaithittu estuary.

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INTRODUCTION

Estuaries are highly productive dynamic systems which are always characterized by rich, varied and distinctive biological entities which can tolerate the unstable physico-chemical parameters of the environment. Estuaries supported a varied fauna of fish, shall fish and prawns. Brackish water system is generally composed of marine and fresh water fishes which are adapted to the water of varying salinies and truly resident which are present throughout the year. Salinity is the major

factor controlling the population distribution and abundance of fishes in an estuary. The major sources of brackish water fishes and fishery resources of the country are from the brackish water lakes and estuaries located in the east and west coasts of India.

The most productive environment is estuary and the estuarine environment is a complex blend of continuously changing habitats. Estuaries can produce a wide range in the values of physical and chemical parameters that will be recorded and frequent changes occur in these values both with tidal and meteorological events. In streams, rivers and lakes, water quality parameters are more likely to fluctuate within a well-defined range largely determined by rainfall and season and these values are often homogeneous throughout the water body (Bouillon *et al*., 2001).

Water is a vital role in agriculture, aquaculture, industries and almost all other human activities. Ensuring uninterrupted fresh water supply is a greater challenge and the world should manage to face during upcoming decades (Pankaj Malviya and Anjani Kumar Dwivedi, 2015). Mangrove and estuaries are the fertile ecosystem serving nursery and feeding ground to the many marine organisms. However the water quality parameters of the particular environment are prime factor which determining the breeding and spawning periodicity of the many marine shell and fin fishes. Water quality parameters showing seasonal variation and it are pertinent to say that the variations recorded during this study may be due to the environmental fluctuations in relation with season (Srilatha *et al*., 2012).

Surana Ranjana *et al*. (2013) were determined the important physico-chemical parameters of water of Tapi estuary at Dumas jetty. Turbidity, total dissolved solid, salinity, pH, dissolved oxygen, calcium and nutrients like nitrate were studied. The physico- chemical characteristics of water in mangrove ecosystem of Manakudy estuary, south west coast of India, revealed that the physico-chemical parameters like ambient temperature, water temperature, transparency, hydrogen ion concentration, salinity, dissolved oxygen and nutrients nitrate exhibited considerable seasonal and spatial variations (Arumugam *et al.*, 2014). Physico-chemical parameters such as temperature, turbidity, pH, salinity, dissolved oxygen and nutrients like ammonia and nitrate were studied in two selected stations (mouth & mangrove area) Thengaithittu estuary, south-east coast of India (Vijayakumar *et al*., (2014).). In the present study, eight physico-chemical parameters were observed from Thengaithittu estuary south east coast in Puducherry area, India for a period of January 2017 to December 2017.

MATERIALS AND METHODS

Water samples were collected from Thengaithittu estuary south east coast in Puducherry area, Tamil Nadu, India. 2 litre capacity of plastic cans for physico-chemical samples were used to collect surface water samples and kept immediately in an ice box and transported to the laboratory. The samples were analyzed every month during January 2017 to December 2017. 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, the nitrate was determined by the Brucine method and ammonia by Nesslerization method.

RESULTS

In the present investigation, the water temperature fluctuated from 23.97 to 32.25ºC in Thengaithittu estuary. It was found to be low (23.97ºC) in the month of November 2017 and high (32.25ºC) in May 2017 (Table 1 and Fig. 1). Turbidity of the estuarine water depends on availability of either zooplankton or phytoplankton and suspended soiled particles. The transparency of the estuary varied from 39.17 to 70.12 cm. It was found to be low (39.17cm) in the month of December 2017 and high (70.12 cm) in the month of May 2017 (Fig. 2). The pH of the estuarine water showed alkaline ranges throughout the study period. It varied from 8.15 to 8.82. It was found to be minimum (8.15) in September 2017 and maximum (8.82) in the month of May 2017 (Fig. 3). The salinity content ranged from 21.37 to 31.51 ppt. It was found to be high (31.51 ppt) in the month of May 2017 and low (21.37 ppt) was recorded in December 2017 (Fig. 4).

The dissolved oxygen is important biological factor. The dissolved oxygen content in estuary ranged from 3.35 to 5.08 mg/L. It was found to be low (3.35 mg/L) in May 2017 and high (5.08 mg/L) in October 2017 (Fig. 5). Calcium content in the estuary fluctuated from 142.75 to 269.5 mg/L. It was found to be minimum (142.75 mg/L) in the month of November 2017 and maximum (269.5 mg/L) in April 2017 (Fig. 6). Nitrate content

was fluctuated from 0.44 to 0.75 mg/L. The minimum nitrate (0.44 mg/L) was observed in the month of December 2017 and maximum (0.75 mg/L) was noted in the month of May 2017 (Fig.

7). The ammonia content ranged from 0.14 to 0.32 mg/L. It was found to be low (0.14 mg/L) in the month of August 2017 and high (0.32 mg/L) in the month of May 2017 (Fig. 8).

Table 1: Physico-chemical characteristics of Thengaithittu estuary (January 2017 to December 2017).

Month and Year	Temp. (°C)	Turbidity (cm)	pH	Salinity (ppt)	Dissolved oxygen (mg/L)	Calcium (mg/L)	Nitrate (mg/L)	Ammonia (mg/L)
Jan-17	27.80 ± 0.27	42.32 ± 0.28	8.51 ± 0.08	23.58 ± 0.26	4.54 ± 0.21	154.78 ± 0.46	0.52 ± 0.07	0.20 ± 0.01
Feb-17	29.52 ± 0.20	50.77 ± 0.36	8.32 ± 0.09	25.42 ± 0.24	4.12 ± 0.07	165.47 ± 0.29	0.48 ± 0.02	0.23 ± 0.01
Mar-17	30.22 ± 1.57	60.25 ± 0.96	8.72 ± 0.08	26.85 ± 0.89	3.66 ± 0.34	182.25 ± 1.26	0.65 ± 0.03	0.28 ± 0.02
Apr-17	31.12 ± 1.76	63.5 ± 1.29	8.67 ± 0.12	28.47 ± 1.15	3.54 ± 0.19	269.5 ± 3.51	0.69 ± 0.02	0.25 ± 0.02
May-17	32.25 ± 0.96	70.12 ± 0.85	8.82 ± 0.18	31.51 ± 0.49	3.35 ± 0.36	232.75 ± 1.71	0.75 ± 0.03	0.32 ± 0.10
Jun-17	29.22 ± 0.63	50.37 ± 1.25	8.35 ± 0.06	29.35 ± 1.62	4.23 ± 0.26	202.12 ± 1.31	0.73 ± 0.03	0.27 ± 0.03
Jul-17	28.07 ± 0.79	41.5 ± 2.64	8.22 ± 0.09	26.84 ± 0.49	4.10 ± 0.88	151.25 ± 1.71	0.71 ± 0.02	0.25 ± 0.02
Aug-17	28.67 ± 0.69	59.62 ± 0.48	8.32 ± 0.12	30.05 ± 0.39	4.23 ± 0.22	149.25 ± 1.71	0.52 ± 0.03	0.14 ± 0.01
Sep-17	29.32 ± 0.57	63.12 ± 0.85	8.15 ± 0.16	28.15 ± 1.56	4.96 ± 0.05	154.75 ± 4.35	0.63 ± 0.05	0.16 ± 0.02
Oct-17	26.45 ± 0.88	50.32 ± 0.79	8.37 ± 0.12	29.67 ± 0.46	5.08 ± 0.51	128.5 ± 2.08	0.60 ± 0.03	0.17 ± 0.02
Nov-17	23.97 ± 1.41	43.75 ± 1.71	8.35 ± 0.10	24.92 ± 1.47	5.27 ± 0.25	142.75 ± 1.5	0.55 ± 0.05	0.19 ± 0.02
Dec-17	25.25 ± 0.64	39.17 ± 0.89	8.42 ± 0.08	21.37 ± 0.41	5.43 ± 0.32	145.25 ± 1.71	0.44 ± 0.05	0.18 ± 0.02

Each value is the mean ± S.D. of four observations.
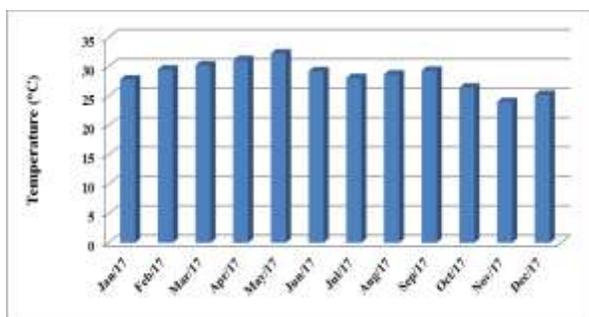
Fig. 1. Monthly variations of water temperature (⁰C) in the Thengaithittu estuary.
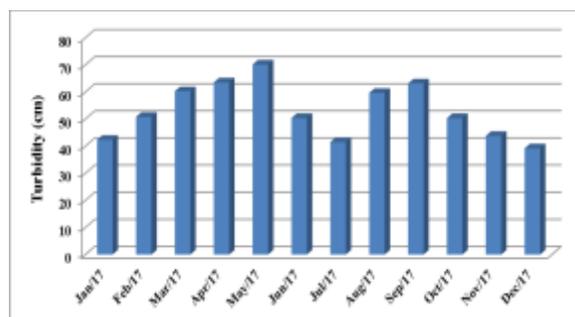
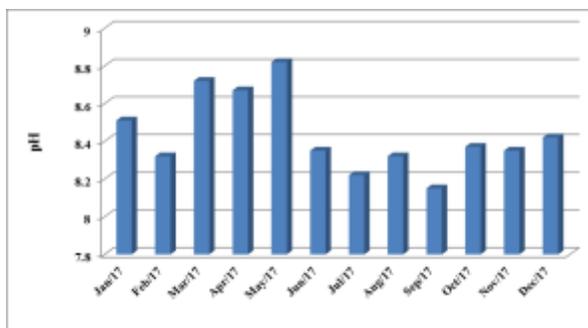**Fig. 2. Monthly variations of water turbidity (cm) in the Thengaithittu estuary.**

3

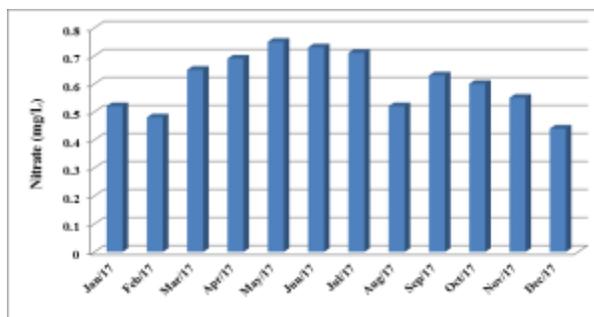**Fig. 3. Monthly variations of water pH in the Thangaithittu estuary.**

Fig. 4. Monthly variations of salinity (ppt) in the Thengaithittu estuary water samples.

Fig. 5. Monthly variations of dissolved oxygen (mg/L) in the Thengaithittu estuary water samples.

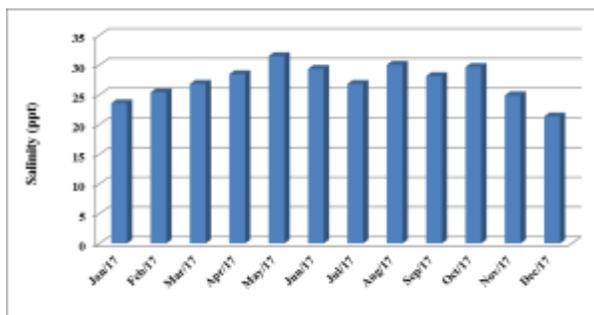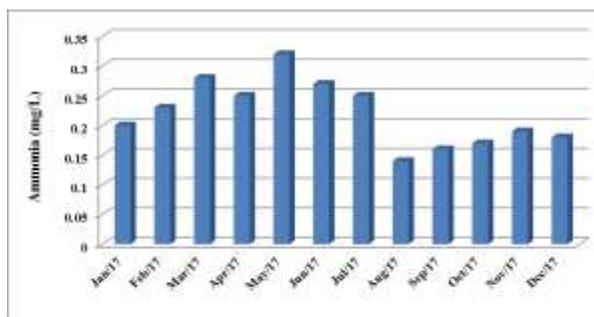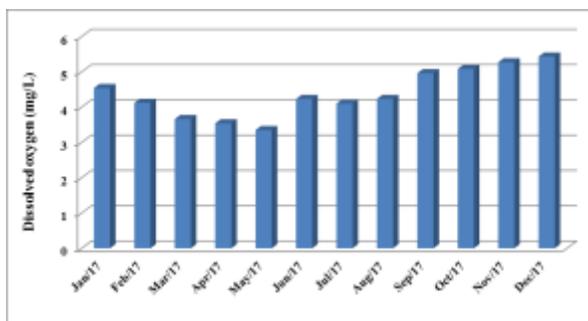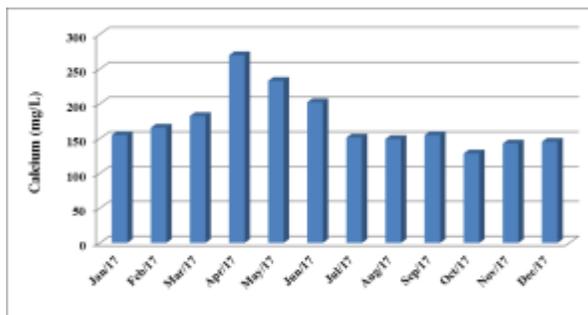**Fig. 6. Monthly variations of calcium (mg/L) in the Thengaithittu estuary water samples.**

Fig.7. Monthly variations of nitrate (mg/L) in the Thengaithittu estuary water samples.

Fig.8. Monthly variations of ammonia (mg/L) in the Thengaithittu estuary water samples.

DISCUSSION

Temperature is one of the key factors scoring the water quality. The fresh water temperature was found to be low in the monsoon period and high in first year of summer and maximum range was recorded during summer season and minimum was recorded in the monsoon season. In an established system the water temperature controls the rate of all chemical reactions, and affects fish growth, reproduction and immunity. Drastic temperature changes can be fatal to fish and prawns. High temperature in summer and low temperature during monsoon season were noticed as it has been evidenced by some earlier investigator Prabhahar *et al*. (2000). 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 (Soundarapandian *et al*., 2009).

The excessive turbidity in water causes problems with water purification processes such as flocculation and filtration, which may increase treatment cost, elevated turbid water is often associated with the possibility of microbiological contamination as high turbidity makes it difficult to disinfect water properly (Malaviya and Rathore, 2007). Turbidity in water is caused by suspended

and colloidal matter such as clay, silts, finely divided organic and inorganic matter, plankton and other microscopic organism. Thommai Arockia Gaspar and Lakshman, (2014) reported that the monsoon time the level of turbidity is very high due to the estuary received rain water along with industrial waste and manmade waste. In summer, low level of turbidity was observed it may be due to the low level of inflow of fresh water. In general the pH values are alkaline in all stations and are close to the permissible limits. The pH changes may be due to the variation in photosynthetic activities of aquatic organisms which increases due to consumption of dissolved CO_2 process (Begum and Harikrishna, 2008). The value of pH remained in the range of 7.0 - 8.5 which was considered best for all fish species (Afzal *et al.,* 2008). The present study is a similar range was obtained lowest pH value was found during winter due to heavy rainfall and dilution effect by Shiddamallayya and Pratima, (2008).

The salinity was act as a prime factor (important environmental parameter) in the distributions of estuarine living organisms. A marked seasonal change in salinity was observed throughout the study period. Minimum salinity was recorded during monsoon and was slowly increased during post monsoon and attained maximum during summer seasons (Anand and Kumarasamy, 2013). Similarly salinity was low during monsoon and high during summer season in the Agniyar estuary (Sukumaran *et al*., 2013). Anand and Kumarasamy, (2013) noted that dissolved oxygen was varied between 3.5 and7.2 ml/L. Minimum dissolved oxygen was recorded during summer (June) and maximum in monsoon (December). Dissolved oxygen content was high during monsoon period in the study area could be due to the influx of fresh water during the monsoon, higher solubility and low salinity. The DO was found to be low in summer and high during monsoon season in the Agniyar estuary (Sukumaran *et al*., 2013).

The high concentration of calcium was observed during monsoon seasons may possibly be due to intrusion of seawater, which increased the level of calcium, the low calcium value during summer attributed to the limited flow of freshwater, high salinity and utilization of calcium by phytoplankton was reported by (Oswin and Rahman, 1997). Nitrates are the most oxidized forms of nitrogen and the end product of the aerobic decomposition of organic nitrogenous matter. The increasing nitrates level was due to the freshwater in flow, litter fall decomposition and terrestrial runoff during the monsoon season (Mathivanan *et al.,* 2008). The highest ammonia

concentration was recorded during the dry season (Kaniz Fatema *et al*., 2014), a result stemming from low precipitation. However, dilution of rainwater may be important in reducing the ammonium level in the estuary. A similar pattern of results was observed by Damotharan *et al.* (2010).

CONCLUSION

The present investigation, the various physico-chemical parameters water samples collected from Thengaithittu estuary of Puducherry. The data which showed that the physic-chemical 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 in the Thengaithittu estuary of Puducherry during the study period.

Acknowledgements

References

Afzal M, Rub A, Akhtar N, Ahmad I, Khan MF, Qayyam M. (2008). Growth performance of big head carp Aristichthys nobilis (Richardson) in monoculture system with and without supplementary feeding. Pak. Vet. J, 28: 57-62.

Anand M, Kumarasamy P. (2013). Studies on the physico-chemical status of Kottakudi mangrove estuary, Thiruppullani, Ramanathapuram district, Tamil Nadu., Adv. Appl. Sci. Res., 4(6): 173 - 177.

APHA. (1998). Standard methods for the examination of water and waste water, 18th Edn. American Public Health Association, Washington DC. 1268.

Arumugam A, Sugirtha, Kumar P. (2014). Evaluation of physico-chemical parameters and nutrients in the mangrove ecosystem of Manakudy estuary, South west coast of India. Int. J. Latest Res. Sci. Technol, 3(6): 205 - 209.

Bouillon S, Frankignoulle M, Dehairs F, Verlimirov B, Eiler A, Etcheber H, Abril G, Borges AV. (2001). Inorganic and organic carbon biogeochemistry in the Gautami Godavari estuary (Andhra Pradesh, India) Global. Biogeochemical Cycles. 17(4)**:** 114.

Begum A, Harikrishna R. (2008). Study on the quality of water in some stream of Cauvery river. E.J. Chemistry, 5: 377–384.

Damotharan P, Perumal NV, Arumugam M, Vijayalakshmi S, Balasubramanian T. (2010). Seasonal variation of physico-chemical characteristics in point calimere coastal waters (South east coast of India). Mid. East J. Sci. Res., 6(4): 333–339.

Kaniz Fatema, Wan Maznah WO, Mansor Mat Isa. (2014). Spatial andtemporal variation of physico-chemical parameters in the Merbok estuary, Kedah, Malaysia, Tropical Life Sci. Res., 25(2): 1 - 19.

Malaviya P, Rathore VS. (2007). Seasonal variations in different physico chemical parameters of the effluents of century Pulb and Paper Mill, Lal Kuan, Uttarakhand. J. Environ. Biol. 28(2): 219 – 224.

Mathivanan V, Jeyachitra O, Selvisbhanayakam VP, Elanchezhiyan C. (2008). Environmental monitoring studies on river Cauvery at Thanjavur District, Tamilnadu in relation to pollution. J. Exp. Zool. 11(1): 225 – 230.

Oswin D, Rahman AA. (1997). Impact of aquaculture effluents on mangroves. In: proceedings of the national seminar on water quality issues in aquaculture systems (Eds: Santhanam, R., Ramadhas, V., and Gopalakrishnan, P. Fisheries College, Tuticorin. 15 – 22.

Pankaj Malviya, Anjani Kumar Dwivedi. (2015). Physico-chemical parameters of Narmada River Water. Int. J. Chem. Stud., 3(2): 1 - 4.

Prabhahar C. (2000). Coastal zone development and its ethical implications: A case study of Kadalur, A Coastal Village - Tamil Nadu, Unpublished Ph.D. Thesis, Department of Zoology, University of Madras.

Shiddamallayya N, Pratima M. (2008). Impact of domestic sewage on fresh water body. J. Environ. Biol., 29(3): 303 - 308.

Soundarapandian P, Premkumar T, Dinakaran GK. (2009). Studies on the physicochemical characteristic and nutrients in the Uppanar estuary of Cuddalore, South east coast of India. Cur. Res. J. Biol. Sci., 1(3): 102 - 105.

Srilatha G, Varadharajan D, Chamundeeswari K, Mayavu P. (2013). Study on physico-chemical parameters in different mangrove regions, South east coast of India, J. Environ. Anal. Toxicol. 3(5): 1 – 8.

Sukumaran M, Muthukumaravel K, Sivakami R. (2013). Seasonal variations in physico-chemical characteristics of Agniar estuary southeast coast of India, Asia Pacific J. Res., 2(8): 108 - 120.

Surana Ranjana, Gadhia Mohini, Ansari Ekhalak, (2013). Assessment of physico-chemical characterstics and pollution status of Tapi estuary at Dumas Jetty, Surat, Int. J. Innovative Res. Sci. Engineer. Technol., 2 (10): 5351 - 5357.

Thommai Arockia Gaspar D, Lakshman G. (2014). Water quality parameters of Thamirabarani estuary, Int. J. Adv. Res., 2 (4): 380 - 386.

Vijayakumar N, Shanmugavel G, Sakthivel D, Anandan, V. (2014). Seasonal variations in physico-chemical characteristics of Thengaithittu estuary, Puducherry, South East-Coast of India, Adv. Appl. Sci. Res., 5(5): 39 – 49.