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Seasonal variations in physico-chemical characteristics of Thengaithittu estuary, Puducherry, South East-Coast of India

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ABSTRACT

All the physico-chemical parameters such as temperature, turbidity, pH, salinity, dissolved oxygen, biological oxygen demand and nutrients like ammonia, silicate, nitrate, and nitrite were studied in two selected stations (mouth & mangrove area) Thengaithittu estuary, south-east coast of India for a period of three year (January 2009 – December 2011). Atmospheric temperature varied from 26 to 38.5^{o}C, water temperature 26^o C to 35.5^o C, turbidity ranges from 4 to 13 NTU, pH varied from 6.8 to 8.4, salinity value ranges from 12 to 32.5 ppt, dissolved oxygen 3.3 to 4.7 mg/l, BOD values of 0.2 to 3.8 mg/l. Concentrations of nutrients viz., ammonia ranges from 0.05 to 0.18µmol/l, reactive silicate varied from 25.5 to 99.0µmol/l, nitrate 0.41 to 6.92µmol/l and nitrite value ranges from 0.090 to 0.78 µmol/l were also shows variations independently throughout the study period.

Keywords: Physico-chemical characteristics, nutrients, thengaithittu estuary, puducherry mangroves.

INTRODUCTION

Estuaries are the meeting place of saltwater from the sea and freshwater from rivers, are dynamic environments characterized by large fluctuations in environmental conditions [1]. Estuaries and mangroves are highly potential for fishery development in the aquatic environment and are considered as the potential source for feeding, spawning and nursery ground for most of the fin fishes and shell fishes. They also act as a centre for natural seed collection of most of the commercially important fin fishes and shell fishes suitable for aquaculture [2].The rapid industrialization and aquaculture practices along the estuarine system and also in the mangrove areas have brought considerable decline in the water quality of brackish water and the estuaries.

Estuaries and mangrove swamps have long been regarded as convenient place for the disposal of sewage and wastewater due to the tendency of pollutants to be recycled within these naturally eutrophic systems [3,4]. Domestic sewage discharges in water bodies increase the concentrations of organic matter and nutrients that can affect the productivity of the system, increase particulate materials and reduce the amount of dissolved oxygen leading to excessive algal growth, increased metabolism and changes in community structure [5,6]. Mainly the productivity and faunal distribution in estuaries and mangroves depend on various physico-chemical factors such as temperature, pH, salinity, DO and nutrients such as ammonia, nitrate, nitrite and silicate. Several investigations have been carried out on the physico-chemical features of Indian estuaries and mangroves viz., Mulki estuary [7], Vellar estuary [8], Muthupet mangroves [9], Adimalathura estuary [10], Pichavaram mangroves [11], Pennar estuary [12], Uppanar estuary [13], Kodungallur-Azhikode estuary [14] and Thengapattanam estuary [15]. At present no work has been carried out in Thengaithittu estuary on physico-chemical characteristics. Hence, the present study deals with the spatial temporal variations in physico-chemical characteristics of Thengaithittu estuary, southeast coast of India.

MATERIALS AND METHODS

The study was carried out over a period of 3 years i.e. from January 2009 to December 2011 in two stations of Thengaithittu estuary, mouth area (station 1) and mangrove area (station 2). Throughout the study period, sampling of water was carried out on a monthly basis during the last week of every month. Sampling was done usually during the morning hours, between 7a.m.to 9.00a.m. Air temperature and Surface water temperature was measured using a mercury thermometer. Care was taken to obtain a constant reading and the temperature was recorded in Celsius scale. Turbidity was measured with Turbidometer and pH (Hydrogen ion concentration) was measured using digital pH meter (Elico PH-131 Digital pH meter). Salinity was estimated with the help of refractometer (ERMA, Hand Refractometer, Japan). Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) estimated by the standard procedures described by [16]. Nutrients (Inorganic nitrate, nitrate, reactive silicate, and free ammonia) were estimated by titration methods as described by [16]. Statistical analysis were performed for co-efficient of correlation (r) was worked out to find relationship between the various parameters using SPSS statistical (version 7.5 for windows XP, SPSS, Chicago, USA).

RESULTS AND DISCUSSION

Atmospheric and Water temperature

In the present study, Thengaithittu estuary water samples from mouth area and mangrove area Atmospheric temperature varied from 26 to 38.5^{o}C and Water temperature from 26^{o}C to 35.5^{o}C (Table 1 & 2) & (Figure 1 & 2). Minimum Atmospheric temperature in January (26^{o}C) was recorded in (st.1) and the maximum April (38.5^{o}C) was recorded in (st.2). The minimum water temperature in December (26^{o}C) was recorded in (st.1) and the maximum (35.5^{o}C) in May was recorded in both stations. Both atmospheric and water temperature shows a slight variations. [17] reported that temperature of natural inland waters in the tropics generally varies between 25°C to 35°C. Temperature controls the rate of metabolic and reproductive activities [18]. Temperature also influences the concentration of dissolved oxygen and many other physical and biological factors in the water bodies [19]. It also controls the reproduction, diversity, migration and behavioural characteristics of animals and plants. The range of temperature generally varies in different environments like terrestrial, fresh water and marine media. Higher temperature values recorded in the dry months are expected since heat from the sunlight increases temperature of surface water. Similarly the sudden drop in water temperature in the wet season months is attributable to heavy rainfall, strong land sea breeze and precipitation experienced during the period [20]. Statistical analysis shows a significant positive correlation exists between air and water temperature (r = 0.581) at st.1 and (r = 0.704) at st.2.

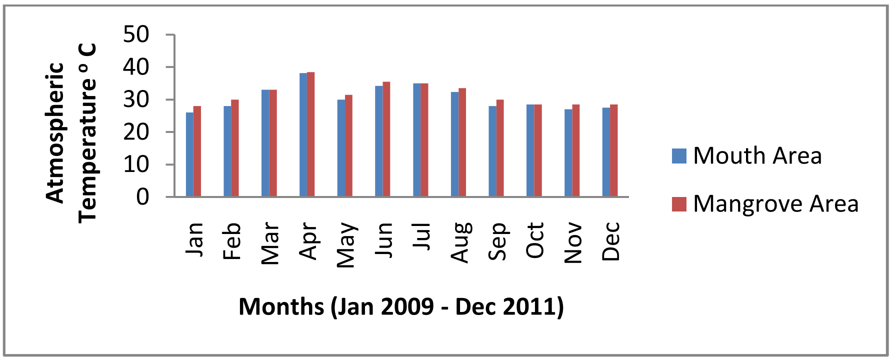

Fig 1: Average monthly variations of Atmospheric temperature in two stations

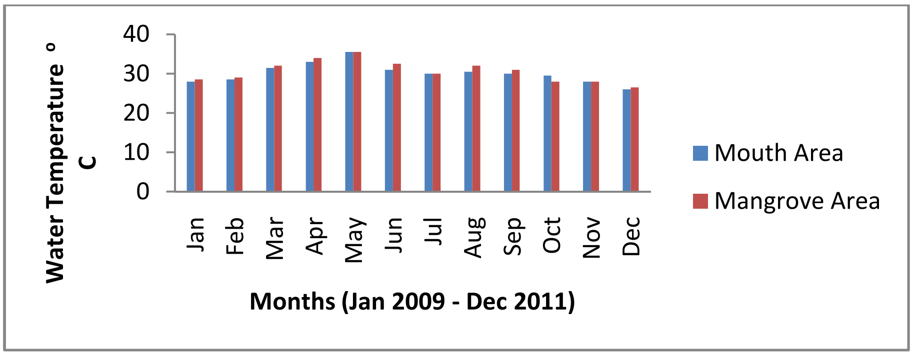

Fig 2: Average monthly variations of Water temperature in two stations

Turbidity

Water Turbidity values ranged from 4 to 13 NTU during the study period (Table 1 & 2) & (Figure 3). The maximum of 13 were recorded in month of October from Stations 1 (Mouth area). The minimum were 4 were recorded in month of February to April from Station 2 (Mangrove area). Higher values of turbidity during monsoon may be input of sediments from Ariyankuppam rivers mingled with rainfall and also the movement of water by tidal action in the mouth of estuary (st.1). The presence of salts in estuaries has the effect of reducing turbidity [21] as noticed during summer periods with low turbidity values in the present study. Similar results were also given by [22] in Bonny estuary and [23] in tropical estuarine ecosystems of Niger delta shows higher values in wet season and low in dry periods.

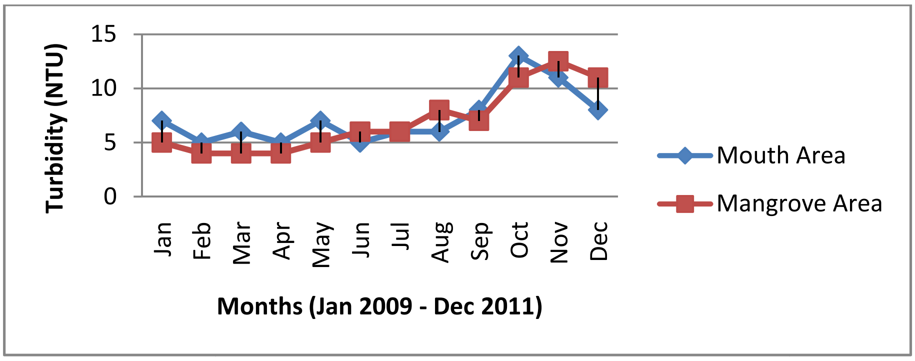

Fig 3: Average monthly variations of Turbidity in two stations

Increased turbidity will decrease light penetration, plant growth and oxygen production into the water. It also reduced breeding and survival of fish and other aquatic animals. Suspended particles absorb heat, which causes water temperature to increase and it holds less oxygen than cold water [24]. Turbidity shows negative correlation with atmospheric temperature (r = -0.559) and water temperature (r = -0.326) in st.1 and also in st.2 (r = -0.531) and (r = -0.624) with atmospheric and water temperature. This result clearly shows that turbidity was greatly influenced by monsoon periods and fresh water run-offs from adjacent water bodies.

Water pH

Master variable in water is known as pH since many properties, processes and reaction are pH dependent. Because of buffering capacity in the sea water, generally the pH ranges from 7.8 to 8.3 in estuaries [25]. [26] reported that even though the pH of 5–9 is not directly harmfull to aquatic life, such changes can drastically make many common pollutants more toxic. Minimum (6.8) during monsoon in st. 2 and the maximum (8.4) in summer in st.1 values of pH were recorded in present investigation (Table 1 & 2) (Figure 4). pH values recorded in this study were well within the preferred pH of 6.5 to 9.0 recommended for optimal fish production [27]. The low pH observed during the monsoon season may also be due to the influence of rainwater, low temperature and organic matter decomposition given by [28]. Similar trends in pH have also been reported by [29] in Bonny River. The recorded high summer pH might be due to the influence of seawater penetration and high biological activity [30] and due to the occurrence of high photosynthetic activity [31,32]. Similar high and low values during dry and wet season were also given by [33] in New Calabar River. This is further evidenced by pH shows a strong positive correlation with atmospheric temperature in both stations ($p<0.05$, r = 0.659 and r = 0.722) and also with water temperature (r = 0.738 and r = 0.819). pH shows negative correlations with turbidity in both stations (r = -0.630 and r = -0.536).

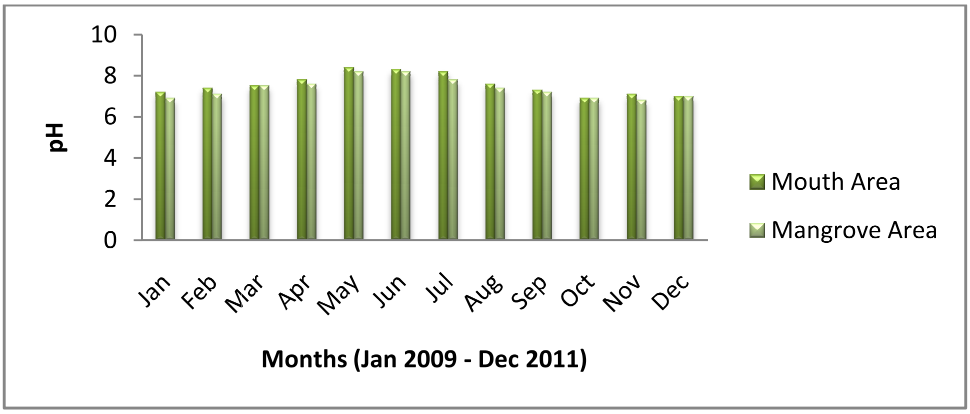

Fig 4: Average monthly variations of pH in two stations

Salinity

Salinity has been regarded as one of the most important variables influencing the utilization of organisms in estuaries [34].The salinity concentration was recorded minimum (12 ppt) in November (st.2) and the maximum (32.5 ppt) in July (st.1) (Table 1 & 2) (Figure 5). Salinity is reported to be the most fluctuating parameter with wide range of variations in the estuarine environment [35,36]. However salinity in turn is determined by a number of interacting factors includes local rainfall, river flow, ground water level, winds, currents etc. The salinity was found to be high during summer season and low during the monsoon season at both the stations. Higher values in summer in both stations could be attributed to the low amount of rainfall, higher rate of evaporation and also due to neritic water dominance [37,38,39]. During the monsoon season, the rainfall and the freshwater inflow from the land moderately reduced the salinity. Similar results were also given by [40] in estuaries of West Africa. There exists a significant positive correlation between salinity with atmospheric and water temperature in st.1(r = 0.671 and r = 0.456) and also in st.2 (r = 0.647 and r = 0.639) indicates that salinity were greatly influenced by temperature in these estuarine environment. Whereas salinity shows a strong negative correlation with turbidity (r = -0.924 and r = -0.884) and also shows strong positive correlation with pH (r = 0.714 and r = 0.647) in both stations.

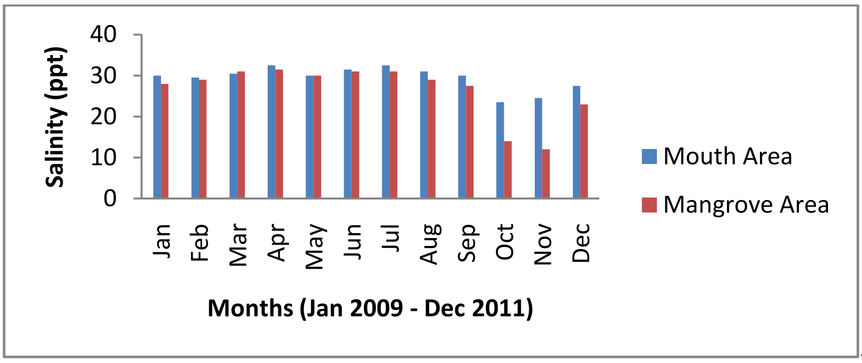

Fig 5: Average monthly variations of Salinity in two stations

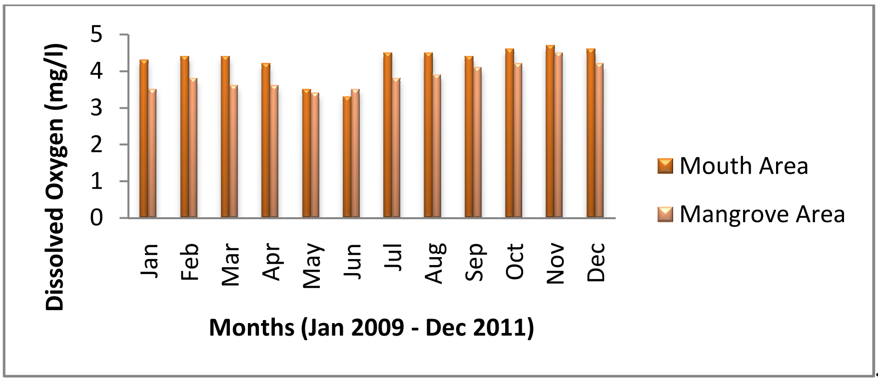

Fig 6: Average monthly variations of DO in two stations

Dissolved oxygen

Dissolved oxygen is an important constituent of water bodies and its concentration in water is an indicator of prevailing water quality and ability of water body to support a well-balanced aquatic life. Anthropogenic activities like runoff from roads, sewage, agricultural and domestic discharge and industrial pollution affect DO levels. At lower temperature and salinity, water can hold more oxygen [41]. In the present study the dissolved oxygen range was recorded minimum (3.3 mg/l) in (st.1) in summer periods and the maximum during monsoon (4.7 mg/l) in (st.1) (Table 1 & 2) (Figure 6). Dissolve Oxygen level along the estuary was within the recommended threshold levels (3.00 – 5.00 mg/l) which being able to support sensitive aquatic life. Many investigators have reported lower values of dissolved oxygen due to higher concentrations of toxic substances [19,18]. Higher values of dissolved oxygen in wet season then in dry season in this study coincides with the findings of [42] in river Oshun and [43] in Miniweja stream, they reported that dissolved oxygen is usually higher in wet seasons in tropics. A possible reason for this high values recorded during wet season is due to turbidity nature of water caused by North-East monsoon prevails in the study area (Oct-Dec) and also inflow from run-offs and decomposition of organic matter in water bodies. Dissolved oxygen shows negative correlation with atmospheric temperature in both stations (r = -0.323 and r = -0.520) and also with water temperatures (r = -0.646 and r = -0.689). It shows a strong positive correlation with turbidity (r = 0.879) and strong negative correlation with salinity (r = -0.829) in st.2. DO shows positive correlation with turbidity (r = 0.447) and a strong negative correlation with pH (r = -0.769) and negative correlation with salinity (r = -0.439) in st.1. This shows that main sources of dissolved oxygen in this estuary are rainfall and fresh water flow from adjacent river.

Table 1: Average physico-chemical parameters of Thengaithittu estuary (Jan 2009 – Dec 2011) Station 1 Mouth Area

Environmental Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Atmospheric Temperature °C	26	28	33	38.2	30	34.2	35	32.3	28	28.5	27	27.5
Water Temperature °C	28	28.5	31.5	33	35.5	31	30	30.5	30	29.5	28	26
Turbidity	7	5	6	5	7	5	6	6	8	13	11	8
pH	7.2	7.4	7.5	7.8	8.4	8.3	8.2	7.6	7.3	6.9	7.1	7.0
Salinity (ppt)	30	29.5	30.5	32.5	30	31.5	32.5	31	30	23.5	24.5	27.5
DO (mg/l)	4.3	4.4	4.4	4.2	3.5	3.3	4.5	4.5	4.4	4.6	4.7	4.6
BOD (mg/l)	3.8	1.6	1.1	2.9	1.6	1.1	1.0	0.8	0.9	1.0	0.8	0.9
Ammonia (µmol/l)	0.14	0.13	0.11	0.10	0.11	0.07	0.08	0.10	0.10	0.11	0.12	0.12
Silicate (µmol/l)	53	28.9	35.0	30.0	51	38.2	40.0	42.3	57.5	63	83.5	63.5
Nitrate (µmol/l)	2.81	0.91	0.56	0.41	0.43	0.59	0.68	1.20	2.50	6.50	5.42	4.81
Nitrite (µmol/l)	0.75	0.41	0.39	0.33	0.28	0.23	0.30	0.35	0.37	0.58	0.69	0.74

Table 2: Average physico - chemical parameters of Thengaithittu estuary (Jan 2009-Dec 2011) Station 2 Mangrove Area

Environmental Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Atmospheric Temperature °C	28	30	33	38.5	31.5	35.5	35	33.5	30	28.5	28.5	28.5
Water Temperature °C	28.5	29	32	34	35.5	32.5	30	32	31	28.5	28	26.5
Turbidity (NTU)	5	4	4	4	5	6	6	8	7	11	12.5	11
pH	6.9	7.1	7.5	7.6	8.2	8.2	7.8	7.4	7.2	6.9	6.8	7.0
Salinity (ppt)	28	29	31	31.5	30	31	31	29	27.5	14	12	23
DO2 (mg/l)	3.5	3.8	3.6	3.6	3.4	3.5	3.8	3.9	4.1	4.2	4.5	4.2
BOD (mg/l)	0.9	0.5	1.2	3.5	0.8	0.9	1.0	1.1	1.5	1.0	2.0	0.2
Ammonia (µmol/l)	0.16	0.18	0.13	0.13	0.12	0.09	0.05	0.07	0.07	0.11	0.12	0.11
Silicate (µmol/l)	29.2	25.5	46.6	29.8	30.0	55.3	45.3	53.4	48.5	65.9	99.0	44.4
Nitrate (µmol/l)	4.51	2.51	0.58	0.51	0.52	0.58	0.71	1.91	3.25	5.81	6.92	4.58
Nitrite (µmol/l)	0.72	0.60	0.25	0.21	0.22	0.24	0.30	0.090	0.64	0.71	0.78	0.73

Table 3: Pearson correlation matrix for environmental parameters (Station 1 Mouth Area)

Parameters	Atm Temp	Water Temp	Turbidity	pH	Salinity	DO	BOD	Ammonia	Silicate	Nitrate	Nitrite
Atm Temp	1										
Water Temp	.581*	1									
Turbidity	-.559	-.326	1								
pH	.659*	.738**	-.630*	1							
Salinity	.671*	.456	-.924**	.714**	1						
DO	-.323	-.642*	.447	-.769**	-.439	1					
BOD	.024	.106	-.289	.019	.302	-.170	1				
Ammonia	-.727**	-.410	.275	-.661*	-.448	.430	.427	1			
Silicate	-.669*	-.431	.844**	-.542	-.796**	.356	-.269	.308	1		
Nitrate	-.648*	-.631*	.917**	-.799**	-.922**	.552	-.211	.396	.849**	1	
Nitrite	-.723**	-.757**	.589*	-.823**	-.676*	.582*	.206	.741**	.684**	.799**	1

** Correlation is significant at the 0.05 level (2- tailed)*
*** Correlation is significant at the 0.01 level (2- tailed)*

Table 4: Pearson correlation matrix for environmental parameters (Station 2 Mangrove Area)

Parameters	Atm Temp	Water Temp	Turbidity	pH	Salinity	DO	BOD	Ammonia	Silicate	Nitrate	Nitrite
Atm Temp	1										
Water Temp	.704*	1									
Turbidity	-.531	-.624*	1								
pH	.722**	.819**	-.536	1							
Salinity	.647*	.639*	-.884**	.674*	1						
DO	-.520	-.689*	.879**	-.701*	-.829**	1					
BOD	.530	.382	-.120	.031	.002	.010	1				
Ammonia	-.323	-.153	-.284	-.344	-.061	-.216	-.012	1			
Silicate	-.258	-.359	.798**	-.325	-.776**	.737**	.135	-.332	1		
Nitrate	-.819**	-.806**	.798**	-.866**	-.904**	.789**	-.113	.193	.590*	1	
Nitrite	-.846**	-.838**	.557*	-.818**	-.709**	.640*	-.220	.338	.310	.887**	1

** Correlation is significant at the 0.05 level (2- tailed)*
*** Correlation is significant at the 0.01 level (2- tailed)*

Biological Oxygen Demand

Biological oxygen demand (BOD) is an indication of the organic load and it is a pollution index especially for water bodies receiving organic effluent [44]. In the present investigation BOD values of estuary was reported high (3.8 mg/l) during January (st.1) and continue to May in both stations followed by minimum in (0.2 mg/l) December (st. 2) in monsoon seasons in both stations (Table 1 & 2) (Figure 7). [45] opined that water bodies with BOD concentrations between 1.0 and 2.0mg/l were considered clean, 3.0mg/l fairly clean, 5.0mg/l doubtful and 10.0mg/l was definitely bad and polluted. Unpolluted natural water bodies will have BOD values 5.0mg/l or less. Higher values of BOD in summer is due to high rate of evaporation, high temperature, clogging of the mouth and high nutrient concentration by source such as waste from fish godown and domestic waste from urban settlements. Similar results were also noted by [46,47]. Seasonal changes in BOD with low values during wet seasons (rainy) may be increased surface run-offs, soil erosions and effluents discharge into the receiving water bodies [48]. BOD shows positive correlation with temperature, dissolved oxygen in both stations. BOD shows negative correlation with turbidity in both the stations (r = -0.289 and r = -0.120) and positive correlation with pH and salinity in both stations (r = 0.019, r = 0.302, st.1 and r = 0.031, r = 0.002, st.2). This result clearly shows that BOD in estuaries is largely influenced by high temperature during summer periods.

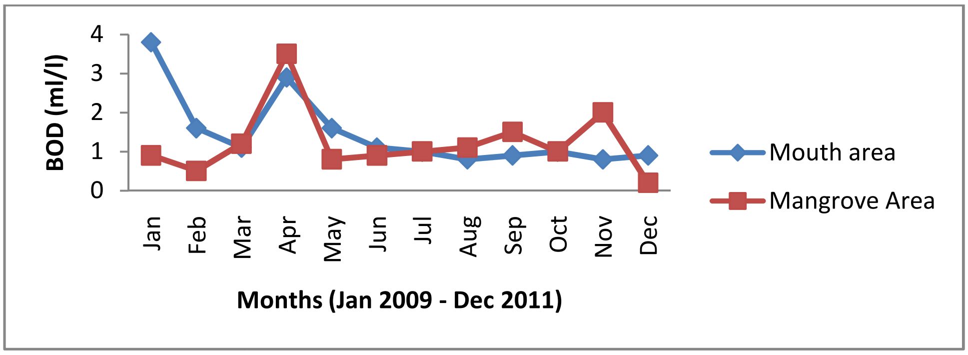

Fig 7: Average monthly variations of BOD in two stations

Ammonia

Ammonia is toxic to fish and aquatic organisms, even in very low concentrations. When level reaches 0.06 mg/L, fish can suffer gill damage. When levels reach 0.2 mg/L, sensitive fish like trout and salmon begin to die. Ammonia levels greater than approximately 0.1 mg/L usually indicate polluted waters [49]. The minimum (0.05 µmol/l) in July and maximum in February (0.18 µmol/l) values of ammonia were registered in (st.2) (Table 1 & 2) (Figure 8). It may be contributed by the natural materials such as proteins, peptides, nucleic acids, urea and the compounds in the form of azide, hydrazine, hydroxylamine, nitrate, nitrite, oxine and semicarbazone [50]. Decomposition from the organic matter in the sediments could also lead to increase in its concentration [51]. Even though the exact reason is not correctly known, it is interesting to note that in contrast to nitrate and nitrite, ammonia was more during post monsoon and monsoon periods. The relatively low concentration during summer and pre monsoon can be attributed to intense photosynthesis by algae, which removes ammonia in waters bodies [52]. In st.1, Ammonia shows positive correlation ($P<0.05$) with turbidity, DO, BOD and strong negative correlation with atmospheric temperature ($P<0.01$) and ($P<0.05$) with water temperature, pH and salinity in st. 1. and whereas ammonia shows negative correlation ($P<0.05$) with all parameters in st.2.

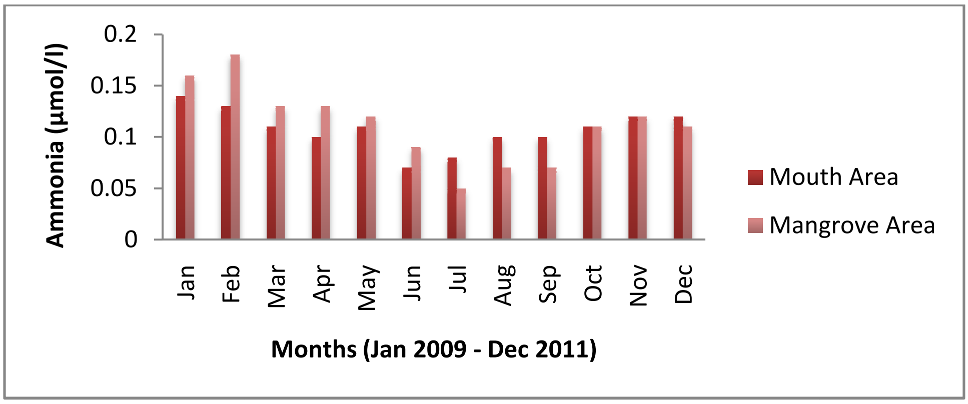

Fig 8: Average monthly variations of Ammonia in two stations

Silicate

In estuaries, silicate is one of the important factors which regulate phytoplankton distribution. During the present investigation minimum (25.5 µmol/l) in November (St.2) and maximum (99.0 µmol/l) in February (st.2) values of silicate were recorded (Table 1 & 2) (Figure 9). Dissolved silicate was derived from the chemical weathering of silicate containing minerals. Consequently, the ground water also tends to have high concentration of silicates. Silicate is not volatile, so there is a little of it in the atmosphere. Rainfall contains relatively little dissolved silicate. Therefore, surface water represents the major source of silicate concentration. This nutrient enriches the growth and distribution of aquatic plants and animals. According to [53] silicate content of water varies with salinity of water and higher silicate content were recorded in low salinity area. Inundation of the fringing mangrove vegetation at high tides yield decaying animals and plants debris into the estuary and these are the potential sources of nutrient enrichment [54]. The increased silicate and other nutrients content in the study area during the monsoon season may be due to flood influx from land drainage and tributary stream during the rainy season [55]. And also during this period silicate leached out from rocks and sediments as reported by [56]. Silicate shows a strong significant positive correlation with turbidity (P<0.01) in both stations. It also shows a strong positive correlation with DO (P<0.01) in st.2 and (P<0.05) in st.1. Silicate shows a strong negative correlation (P<0.01) with salinity in both study area. This shows that fresh water rich in DO would be the main source for silicate in these estuarine regions as the entry of silicate takes place by land drainage rich with weathered silicate material [57].

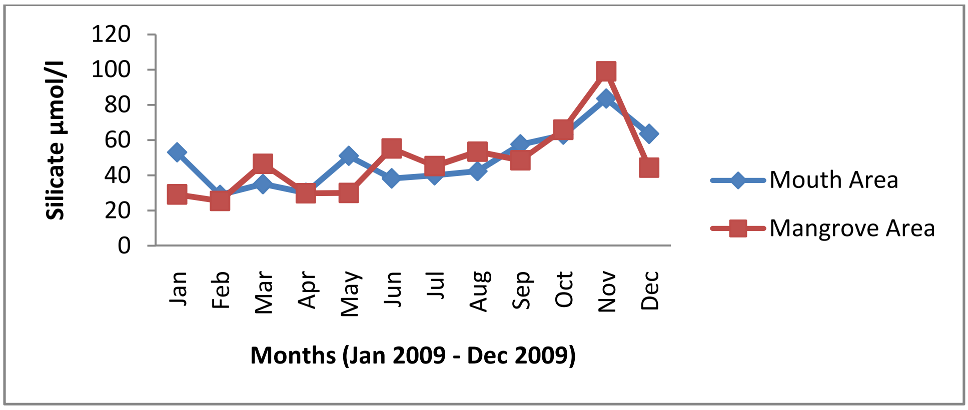

Fig 9: Monthly variations of Silicate in two stations

Nitrate

Nitrate content is excellent parameters to judge organic pollution and it represents the highest oxidized form of nitrogen and a vital nutrient for growth, reproduction and the survival of organisms. Nitrate level less than 0.5ml/l will not pollute the water bodies. Under normal conditions nitrate content in the water surface occurs in trace amounts but the value is enhanced by the inputs of other sources [58]. Nitrate concentration in the present study varied from 0.41 to 6.92 µmol/l of which higher value (6.92 µmol/l) was observed in November month (st.2) and the lower value (0.41 µmol/l) in April (st.1) (Table 1 & 2) (Figure 10). The presence of nitrates in the water samples is suggestive of some bacterial action and bacterial growth. These findings support to the observations of [59]. Monsoon season shows higher values and summer as low values in both stations of present study is in agreement with [60] they recorded similar trends in Gulf of Mannar. During monsoon due to more fresh water inflow and also the leaf litters fall of mangroves leads to decomposition will drastically increase the nitrate values during this periods [61]. [62] obtained negative correlation between nitrate and salinity is due to fresh water influx in accordance with our results. Nitrate is far less toxic than ammonia, with nitrite being the most toxic nitrogenous compound to fishes [63]. Nitrate shows a strong significant positive correlation with turbidity ($r = 0.917$ in st.1 and $r = 0.798$ in st.2) and with silicate ($r = 0.849$) in st.1. A strong negative correlation exists with salinity, pH (P<0.01) in both stations and with temperature (P<0.01) in station 2 and (P<0.05) station 1 respectively. This shows that fresh water influx from the adjacent river and rainy seasons are the main source of nitrate in this estuary which collaborated with results of our study.

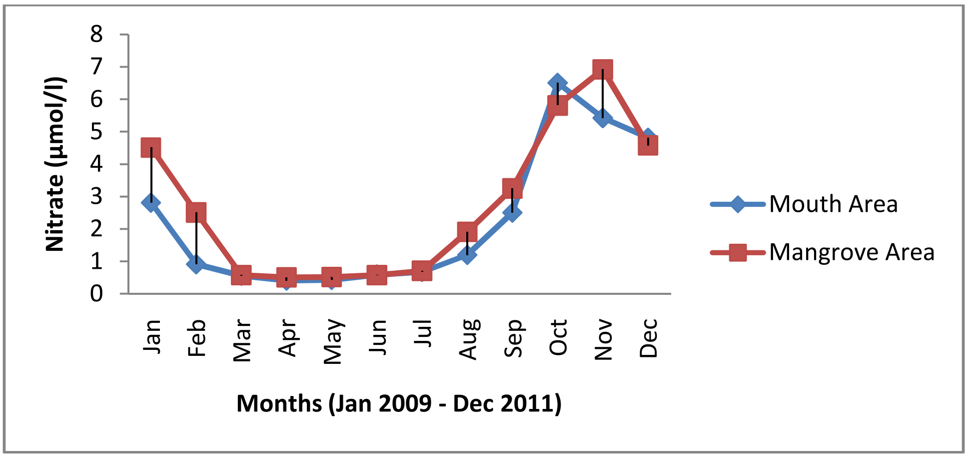

Fig 10: Average monthly variations of Nitrate in two stations

Nitrite
For nitrites the values were be in the range between 0.090 to 0.78 µmol/l, with higher value (0.78 µmol/l) was observed in November month (st.2) while the lower value (0.090 µmol/l) in August (st.2) (Table 1 & 2) (Figure 11). Nitrite is an intermediate stage in oxidation of nitrogen, both the oxidation of ammonia to nitrate as well as reduction of nitrate [64]. Toxicity of nitrite depends upon water chemistry. Nitrite levels above 0.1 mg/l in water bodies can be toxic [65]. It has long been known that the nitrite ions penetrate into fish through the chloride cells in their gills. In the blood of fish nitrites are closely related to haemoglobin structure resulting of reduction in transportation of the oxygen capacity of the blood [66]. Higher concentration of nitrite in the monsoon periods in both stations may be due to seasonal floods, variations of phytoplankton, excretion and oxidation of ammonia [67]. The low content of nitrites during the months of April to August was due to less freshwater input, higher salinity, higher pH and also uptake by phytoplankton. [68] from Vellar estuary and [69] from Kolhdarn estuary show similar trends in accordance with our results. Nitrite shows a strong negative correlations ($P<0.01$) with temperature, pH and ($P<0.05$) salinity in st.1. It also shows a strong positive correlation ($P<0.01$) with ammonia, silicate and nitrate in st.1. Whereas nitrite shows a strong negative correlation ($P<0.01$) with temperature, pH and salinity in st.2. It also shows a strong positive correlation with nitrate ($P<0.01$) in st.2.

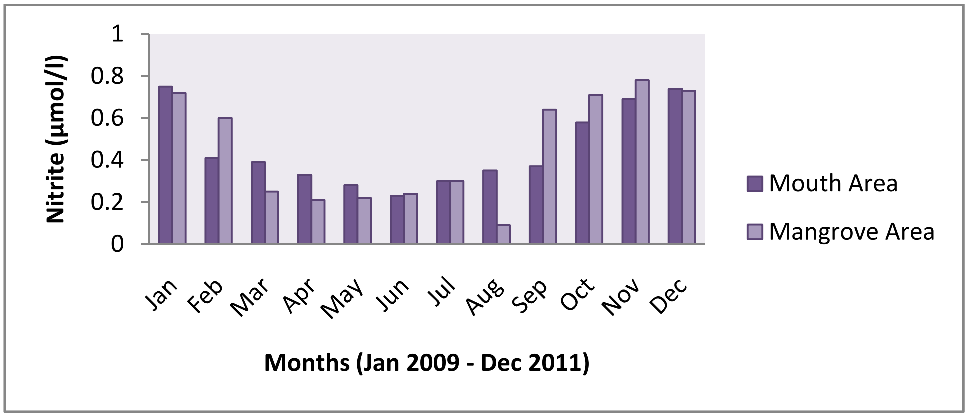

Fig 11: Average monthly variations of Nitrite in two stations

CONCLUSION

The various physico-chemical parameters in the Thengaithittu estuarine water showed wide seasonal fluctuations. In the monsoon season, the estuary was dominated with fresh water flow from Ariyankuppam river is a distributary of Sankaraparani river and land run off through adjacent small canals. While in the summer season the water showed predominantly saline characteristics. The concentration of various parameters was governed by river water flow, sea water intrusion, urban sewage, domestic waste through rivers, canal etc. The spatial distribution of pollutants was regulated by estuarine circulation, mixing and other physical process together with biological, sedimentological and chemical effects. Almost normal pH obtained by the entire sample clearly showed an effective mixing and self purification of contaminants received through several inlets. Concentration of nutrients in the estuary shows spatial variation. It is regulated by the fresh water flow and tidal mixing .Thus the increase of nutrients at station 1 and 2 are minimized by the strong flushing characteristics of the estuary by the removal of sand bar coupled with the saturation of estuarine water with oxygen content, establishing this estuary to have a higher capacity for self-purification. If proper measures are taken for the treatment of sewage before discharge and restrictions are enforced on various anthropogenic activities the health of this estuary can be maintained.

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