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Hydrological Assessment of Water Quality Parameters in Two Different Estuarine Habitats

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Abstract: ***People mostly depend on water for agricultural and domestic purposes. But with rapid growing population and urbanization, different activities like unplanned building and encroachment, clearing of riparian vegetation along the river banks, disposal of waste materials in river and unwise mining of construction materials from the rivers are commonly observed in rivers. Estuaries constitute a major interface between land and the ocean and have been regarded as one of the most important aquatic system. 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. The study was estimated the result of eight water samples, quality from the two different estuarine habitats of Muthupet and Muttukadu estuarine of South East coast of Tamilnadu State. There were eight water quality parameters samples are collected and analyzed, the result were significantly arrived positive effects of this parameters except few parameters. The results arrived from the statistical analysis of Regression and Pearson's correlation two tailed respectively.***

Keywords: Water quality parameter, Estuarine, hydrology, South East Cost, Tamilnadu

1. Introduction

Water is one of the most valuable natural resources on earth, and is essential for every living organism. Human history is tied directly or indirectly to fresh water source such as lakes, rivers and estuaries. Human beings as well as other terrestrial and adequate life forms are sensitive to changes in the quality of the fresh water supply. Changes in properties such as total dissolved solid, pH and dissolved oxygen in particular affect the mortality of aquatic life. The characteristics of both natural weathering process and anthropogenic activities can have a significant impact on water quality. Rain fall tends to dissolve and carry away minerals and contaminants found in the soil and the atmosphere. (Lawrence. B.2010). Clean, safe and adequate freshwater is one of the most importance to human existence and the survival of all living components in the ecosystem. Water quality issues are complex and diverse, deserving urgent global attention and action. The decline in water quality has become a global issue of concern because of its inherent ability to cause major alternations to the hydrological cycle. The past decades has seen remarkable impact of man on the environment due to unprecedented increase in population and rapid rate of urbanization as well as the intensification and expansion in agricultural practices. This has led to progressive and continual degradation of resources especially water.

People mostly depend on water for agricultural and domestic purposes. But with rapid growing population and urbanization, different activities like unplanned building and encroachment, clearing of riparian vegetation along the river banks, disposal of waste materials in river and unwise mining of construction materials from the rivers are commonly observed in rivers. Human as well as natural phenomena are responsible for bringing disturbances in the river system (Gyawali *et. al*., 2011).

The quality of any body of surface or ground water is a function of either both natural influences and human influences. Without human influences water quality would be determined by the weathering of bedrock minerals, by the atmospheric processes of evapotranspiration and the deposition of dust and salt by wind, by the natural leaching of organic matter and nutrients from soil, by hydrological factors that lead to runoff, and by biological processes within the aquatic environment that can alter the physical and chemical composition of water.

Industrialization and urbanization of the coastal region often lead to decrease in coastal resource and destruction of natural defense structures. (Zhao X *et. al.*, 2011). Eutrophication is of great environmental distress, leading to complicity in the aquatic environment, causing problems such as formation of algal blooms which results reduction in oxygen levels, leads to mortality of aquatic fauna and flora and eventually loss of biodiversity (Yadav A., *et. al*., 2007)

Estuaries constitute a major interface between land and the ocean and have been regarded as one of the most important aquatic system. The progressing of large industries in nearby areas has become a threat to the health of estuarine and coastal water environment.

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 et al., 2004). 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

2. Methodology

Study area

Location of sample Collection: The water samples were collected from Muthupettai and Muttukadu estuary parts of Thiruvarur and Chengalpattu Districts of Tamil Nadu, India. The present study was carried out during the study period (2019 - 2020), where the samples of water collected fortnightly; the data were pooled seasonally to understand the seasonal effect. The three distinct seasons were pre - monsoon, monsoon and post - monsoon periods. The samples were collected from five different points of each site and were mixed together to prepare an integrated sample. The water temperature and pH were analyzed immediately on the spot after collection, whereas the analyses of salinity, dissolved oxygen, total hardness, total alkalinity, electrical conductivity, and biological oxygen demand (BOD) were done triplicate in the laboratory as per the standard methods.

Measurement of temperature

This was carried out in - situ at the site of sample collection using a mobile thermometer. This was done by dipping the thermometer into the sample and recording the stable reading

pH

The pH was determined using ELICO - LI 127 pH meter. The pH of water sample was directly determined with the electrode while pH of the sediment sample was determined by preparing (1: 5, sediment: water) suspension in distilled water. The contents were stirred well and allowed to settle and supernatant was used to check pH.

Electrical Conductivity (EC)

Determination of soluble salts in the sediments. It is preferably to keep the sediment at the field condition and measured at the field condition and measured its conductivity, got true picture. For this purpose saturated sediment water extract was prepared. Sediment extract is first prepared by taking 20 gms sediment into clean 100 ml beaker, add 50 ml of conductivity water then suspension is stirred for 30 minutes and allowed the suspension was filtered by using ordinary filter paper. EC of the water samples and sediment suspension was measured by using ELICO EC - TDS meter (CM 183, Make - India) where electrode was directly dipped into the respective solutions for the direct display of result on a digital scale. It was reported in micro Siemens (µS). The clear supernatant used for p^H was also used for EC measurement.

Dissolved Oxygen (DO)

Dissolved oxygen content of the water samples was measured by using Winkler's method (modified aside method). The sample were collected in 300 ml bottle and DO fixed on site by using 1 ml each of Manganoussulphate and Alkalineiodide - azide. The precipitate formed, and then it dissolved in laboratory by using sulphuric acid and titrated with sodium thiosulphate using starch as an indicator. The end point of titration was blue to straw pale colour. V1=volume of BOD bottle, V2=volume of content titrated and V= volume of MnSO4 and Alkaline - iodide - azide. Chemical Oxygen Demand (COD)

COD determination was carried out with dichromate reflux method with the addition of 10 ml of 0.25 N potassium dichromate (K2Cr2O7) and 30 ml H2SO4+Ag2SO4 reagent in 20 ml diluted sample. The mixture was refluxed for 2h and was cooled to room temperature. The solution was then diluted to 150 ml by using distilled water and excess K2Cr2O7 remained was titrated with ferrous ammonium sulphate (FAS) using ferroin indicator. Where, A is the ml of FAS used for blank; B is the ml of FAS used for sample, N is the normality of FAS and 8 is milli equivalent weight of oxygen.

Biological Oxygen Demand

The dilution method was followed to determine the BOD after three days at 27 ^oC. For the same dilution water was prepared with the addition of nutrients namely phosphate buffer, magnesium sulphate, calcium chloride and ferric chloride. The diluted sample was transferred to BOD bottles of 300 ml capacity. After determining initial dissolved oxygen (DO), final DO was estimated from the bottles kept for incubation period for three days. Alkalinity of Water sample 100 ml of water sample was mixed with 2 - 3 drop of phenolphthalein. The development of pink colour to the solution indicated the presence of alkalinity and was then titrated with 0.02N 2SO4 till the colour disappears.

Salinity

Salinity (PSU) was determined by Mohr Knudsen argentometric titration method, using standard solution of silver nitrate (Merck) as an indicator to form silver halides, presence of excess silver ions lead to the formation of red silver chromate (the endpoint of titration).

Total Hardness of Water sample

The total hardness of the water samples was determined by EDTA titration method where 50 ml of well mixed sample was mixed with 1 - 2 ml buffer of pH 10 and a pinch of Eriochrome black - T indicator. The contents were then titrated with0.01M EDTA till wine red solution changes to blue. Where C=ml of EDTA for titration, D= mg of CaCO3equivalent to 1ml of EDTA.

3. Results and Discussion

Table 1: The result of water quality parameter significant effect of Regression analysis

Sl. No	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Temp	0.092	0.030	0.237	3.005	0.009
2	pH	0.194	0.059	0.230	3.305	0.005
3	Salinity	0.131	0.013	0.902	9.789	0.000
4	EC	0.003	0.001	0.155	1.913	0.075
5	DO	0.243	0.061	0.266	3.985	0.001
6	Alkalinity	6.660	0.000	0.031	.997	0.334
7	COD	0.067	0.056	0.072	1.184	0.255
8	BOD	0.071	.089	0.054	0.795	0.439

Table 2: The result of water quality parameter significant effect of Pearson Correlations two tailed analysis

		Temp	pH	Salinity	EC	DO	Alkalinity	COD	BOD
Temp	Pearson Correlation	1	0.353*	0.164	0.291*	0.130	- 0.556	0.470*	0.470*
	Sig. (2 - tailed)		0.014	0.266	0.045	0.377	0.000	0.001	0.001
pH	Pearson Correlation	0.353*	1	0.619**	0.391**	0.289*	0.408*	- 0.228	- 0.228
	Sig. (2 - tailed)	0.014		0.000	0.006	0.047	0.004	0.120	0.120
Salinity	Pearson Correlation	0.164	0.619**	1	0.357*	0.618**	- 0.122	0.149**	0.149**
	Sig. (2 - tailed)	0.266	0.000		0.013	0.000	0.410	00.313	0.313
EC	Pearson Correlation	0.291*	0.391**	0.357*	1	0.299*	0.123*	0.311**	0.311**
	Sig. (2 - tailed)	0.045	0.006	0.013		0.039	0.405	0.031	0.031
DO	Pearson Correlation	0.130	- 0.289*	0.618**	- 0.299*	1	- 0.171	0.002*	0.002*
	Sig. (2 - tailed)	0.377	0.047	0.000	0.039		0.246	0.987	0.987
Alkalinity	Pearson Correlation	0.007	0.101	- 0.186	- 0.280	0.064	- 0.119	- 0.022	- 0.022
	Sig. (2 - tailed)	0.960	0.495	0.205	0.054	0.666	0.420	0.883	0.883
COD	Pearson Correlation	- 0.556**	- 0.408**	- 0.122	0.123	- 0.171	1**	0.577**	0.577**
	Sig. (2 - tailed)	0.000	0.004	0.410	0.405	0.246		0.000	0.000
BOD	Pearson Correlation	- 0.470**	- 0.228	- 0.149	- 0.311*	0.002	0.577**	1	1
	Sig. (2 - tailed)	0.001	0.120	0.313	0.031	0.987	0.000		

The study was estimated the result of eight water samples, quality from the two different estuarian habitats. In this study regression table resulted as significance of r=0.005 and the Pearson correlation describes the results significant value of Pearson Correlation with Salinity, EC, DO Alkalinity as (0.61 (Salinity), 0.39 (EC), 0.28, Alkalinity (0, 40)) is respectively. The present study revealed the result of the range of pH values of the estuarine character were estimated as 6.42 to 8.8 and the mean values of pH of (7.83±0.12). In Muthupet estuary pH ranged from (8.76 to 9.87) indicating slight alkaline nature of water. pH varied with the seasons as lowest in monsoon described by the (Vasanthi. P and M. Sukumaran, 2017)

A result of mean temperature values ofthe site is (34.38±1.31^{0}C), which is significant effect with pH (0.353), EC (0.291), COD (0.470) And BOD (0.470) in the result of two tailed Pearson correlation analysis. Furthermore, the regression analysis resulted as significance of r=0.009 respectively. Wotton R. S. (1994) Described the temperature will be fluctuated about 10^o somewhere like rivers of higher order will be less prone to diel fluctuations, as will small streams during rainfall and spate.

In this study Salinity was significant effect of positively correlation with the other parameters like pH (0.619), EC (0.357), DO (0.615), COD (0.149) and BOD (0.149) with respectively. The other analysis of regression highly significance of (29.39±3.51) the regression value of r= 0.00 in the result. During this study the salinity was varied in seasonal by monsoons and monthly variation of due to heavy rain, and evaporating in summer. Vijayalakshmi et al., (1993) reported in Muthupettaithe salinity in the study sites could probably be due to mainly freshwater runoff entering the creek systems.

The total mean value of Electrical conductivity was revealed the result of (434.31±28.12) and the regression result is insignificant effect of EC with other parameters. However the Pearson correlation was significantly positive correlate other all seven parameters.

The value of dissolved oxygen is remarkable in determining the water quality criteria of an aquatic ecosystem. (Vasanthi. P and M. Sukumaran, 2017). The Dissolved Oxygen parameter was estimated as (3.76±0.55) the regression value of r = 0.00 in the result. Further the Pearson correlation resulted as few parameters like pH, EC and Alkalinity are effecting the negative correlations with Dissolved Oxygen. Other three parameters namely Salinity, COD and BOD except Temperature are passively significance with the Dissolved Oxygen.

The Alkalinity was estimated the result of (671.11±2387.84) and regression r value is not significant with comparatively like other parameters. In the result of Pearson correlation also not significant with other all parameters. The Alkalinity is adversely negative effect with other all parameters. Remaining two parameters of COD and BOD was estimated both almost similar kind result getting but the results are not significant effect like the same result of Alakalinity. Many Studies reported that the alkalinity of water is a measure of

weak acid present in it and of the positive ion balanced against them, further the total alkalinity is the total concentration of bases in water usually bicarbonates and carbonates may showing the variations (Ouyang et al., 2006, Singh et al., 2010).

4. Conclusions

The healthy estuarine eco systems are determined by the water regimes and hydrography of the own eco systems. The present study were be made up of the significant role on the estuarine eco systems as well as between the parameters proportionately correlated with one to other parameters also with ecosystems services.

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