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RESEARCH ARTICLE

SEASONAL VARIATION AND INTERDEPENDENCE OF PH AND TURBIDITY OF THAMIRAPARANI (WEST) RIVER

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ABSTRACT

The turbidity and pH are two key factors in any aquatic ecosyatems. The present paper highlights the seasonal variations of turbidity and pH in Tamiraparani River (West) from June 2011 to May 2013. Twelve stations were selected for the study. The study reveals that high turbidity of 5.5 NTU was found in Station 9 (S_9) during the months June-Aug (2011 and 2012), Sept-Nov (2011and 2012) and Mar-May (2013), and low turbidity of 0.2 NTU was found in stations S1, S3, S4, S5 during Dec to Feb (2011, 2012) and Mar-May (2012).The pH was found to be acidic (below 7) in all the seasons. However, higher pH level was found during bothmonsoon seasons in all the station studied. The fluctuation in pH due to rain water influx is also discussed. The turbidity and pH was found to be significantly correlated (r=0.6780) in the 7th degree polynomial fit and the relationship established and discussed.

INTRODUCTION

The essential component for the survival of the world is water. Unfortunately, good and safe drinking water is becoming a rare commodity. Among different types of water bodies, river serves a significant role because of water supply for domestic, industrial, agricultural and power generation. Considerably the river water is also disposed of sewage and industrial waste and put under tremendous pressure due to human activities. The quality of river water is influenced by various natural factors such as rainfall, temperature and weathering of rocks and anthropogenic activities which alter the hydrochemistry of river water (Raj and Azeez, 2009). In addition to this, the survival of aquatic life is in danger due to the chemicals discharged into rivers. So the toxin within the water is a threat to aquatic life systems. As a result, the growing problem of degradation and human activities on river ecosystem has made it important to monitor water quality of rivers and to evaluate their state of pollution. Among the South Indian rivers "Thamiraparani" river is located in Southern most part of peninsula India and serves as the chief source of water for drinking and agricultural purposes of Kanyakumari District. Industrial pollutions over the water quality of the river has made concern to be strongly felt. Within the district of Kanyakumari, the West Thamiraparani river originate from the Mahenthragiri hills of the Western ghats with an elevation of 1,645.2 metres and passes by the Kodayar dam.

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It shares through a 60 km length and confluences with the Arabian Sea at the Thengapatanam estuary (7º53' N and 70º07'E). Due to urban development, large scale sand mining, mushrooming brick kilns, coir retting as well as automobile, domestic and industrial waste the river water is now gradually undergoing eco-degradation. The rubber sediments dissolved within the river water segments by the rubber estates is a threat to the domestic use of water to human being. However, there is no study available on the seasonal dynamics of turbidity of the Thamiraparani (West) river along the altitudinal gradient of 0-1000 ft. With this view in mind the present investigation was planned and carried out.

MATERIAL AND METHODS

Location of Study: The Thamiraparani (West) river which irrigates a major part of Kanyakumari District was selected for the present study. Water samples were collected from 12 different sites (Table 1). Water sample was collected in polythene bottles for 2 litres and carried to the laboratory, where physio-chemical parameters were analyzed as per standard methods (APHA, 2011). The parameters selected for analysis were pH and Turbidity for the two years June 2011 to May 2013 in four seasons each.

Statistical Analysis: Analysis of variance (ANOVA) comparing the difference among different stations was carried out using MINITAB software and the nonlinear relationship between turbidity and pH was carried out using

CURVEEXPERT software and the best mathematical model was determined using R^2 and SE values.

RESULTS AND DISCUSSION

Turbidity, nutrients and biological oxygen demand of river indicates the pollution level (Kamal *et al*., 2007). Moreover, it is recognized as a limiting factor in biological productivity due to hampering of light penetration in water body thereby affecting the growth of phytoplankton.

High turbidity levels during summer months results from low level of water, decaying vegetation and organic matter, while the post monsoon season high turbidity results from silt, clay and other suspended particles brought with the reservoir by surface run off (Kaushik and Saksena, 1999). High turbidity affects primary productivity. According to Pandey *et al.,* (1999) suspended particles cause turbidity and absorb considerable amount of nutrient elements like phosphate, nitrogen and potassium in their ionic form and make them unavailable for plankton production.

Table 1. Study location during the present investigation

S.No	Station No.	Locality	Latitude	Longitude	Altitude (ft above msl)
1.	S.1	Lower Kodayar	8°31'11.75"N	77°18'36.75"E	930
2.	S.2	Kuttiyar	8°30'03.27"N	77°18'11.59"E	347
3.	S.3	Mothiramalai	8°29'55.28"N	77°17'56.56"E	433
4.	S.4	Kadaiyalumoodu	8°24'42.77"N	77°16'51.55" E	211
5.	S.5	Kaliyal	8°23'57.03"N	77°15'31.47" E	194
6.	S.6	Tiruparapu	8°23'28.49"N	77°15'31.46"E	161
7.	S.7	Muvatumugom	8°20'35.73" N	77°15'04.98" E	68
8.	S.8	Gnaranvilai	8°19'10.75" N	77°13'26.47" E	63
9.	S.9	Kuzhithurai	8°18'33.42" N	77°12'31.11" E	58
10.	S.10	Ganapathiyankadavu	8°17'13.57"N	77°10'16.58" E	57
11.	S.11	Pallikal	8°16'17.63" N	77 °09'46.61" E	57
12.	S.12	Thengapattanam	8°14'24.65" N	77°10 '11.92" E	5

Table 2. Seasons during the period of investigation

Years	Months	Season
2011	June - August	South West Monsoon
2011	September –	North East Monsoon
2011-12	November	Winter
2012	December – February	Summer
2012	March - May	South West Monsoon
2012	June - August	North East Monsoon
2012-13	September –	Winter
2013	November	Summer
	December – February	
	March – May	

Table 3. One-Way Analysis of Variance comparing pH of different stations

Analysis of Variance

Source	DF	SS	MS	F**	P
Factor	11	4.3853	0.3987	5.42	0.000
Error	84	6.1737	0.0735		
Total	95	10.5591			

Level	N	Mean	StDev	Individual 95% CIs For Mean Based on Pooled StDev
S1	8	6.2125	0.2997	(-----*-----)
S2	8	6.1000	0.3854	(-----*------)
S3	8	5.9250	0.3240	(------*-----)
S4	8	5.9875	0.3643	(------*-----)
S5	8	5.9125	0.3399	(-----*-----)
S6	8	5.9500	0.2070	(-----*------)
S7	8	6.0000	0.1512	(-----*-----)
S8	8	6.0375	0.3204	(-----*------)
S9	8	6.3250	0.1581	(------*-----)
S10	8	6.3875	0.1885	(-----*-----)
S11	8	6.4750	0.2053	(------*-----)
S12	8	6.5250	0.1389	(------*-----)
				6.00 6.30 6.60

Pooled StDev = 0.2711

**Highly significant (P<0.01)

Table 4. One-Way Analysis of Variance Comparing Turbidity of different stations

Analysis of Variance

Source	DF	SS	MS	F	P
Factor	11	35.79	3.25	2.33*	0.015
Error	84	117.17	1.39		
Total	95	152.96			

Level	N	Mean	StDev	Individual 95% CIs For Mean Based on Pooled StDev
S1	8	1.550	0.833	(------*------)
S2	8	2.200	1.222	(------*------)
S3	8	2.175	1.267	(------*------)
S4	8	2.175	1.267	(------*------)
S5	8	2.300	1.296	(------*------)
S6	8	1.450	0.713	(------*------)
S7	8	1.575	0.787	(------*------)
S8	8	1.575	0.787	(------*------)
S9	8	3.763	2.455	(------*------)
S10	8	1.600	0.741	(------*------)
S11	8	1.625	0.694	(------*------)
S12	8	2.100	0.926	(------*------)

Pooled St Dev = 1.181

1.2 2.4 3.6 4.8

*Significant (P<0.05)

The results of the present study reveal that, turbidity shows seasonal variation pattern in both the years (Fig-1). The study reveals that the turbidity is higher in both monsoons (South West and North East) in both the years studied. While, the turbidity is low in other seasons. This may be due to influx of rain water which carries soil particles and dissolved matter in water. The turbidity of the river water differs significantly (P<0.01) in different stations (Table 4). The turbidity of the water shows a gradient of increase during flow of water, the increase in turbidity of the river in stations 3 and 9 (S_3 and S_9) monsoon. This may be due to the influx of rain water from the paddy fields and temporary canals in the river bank.

Further, the higher turbidity in S_{12} may be due to plantation production or nutrient upwelling in the estuaries zone associated with monsoon rainfall Sheeja *et al.* (2008), also reported such an increase in turbidity of the river during its flow and the present results is also in agreement with that. The pH is an important parameter of water which determines the acidic and alkaline nature of water. It is one of the significant indicators to identify many toxic chemicals and nutritive substances (Barnes *et al.*, 1998). In fact the good quality of water ranges from 7 to 8.3. Arivumani and Ebanasar (2011) report the seasonal variation in pH in reservoir.

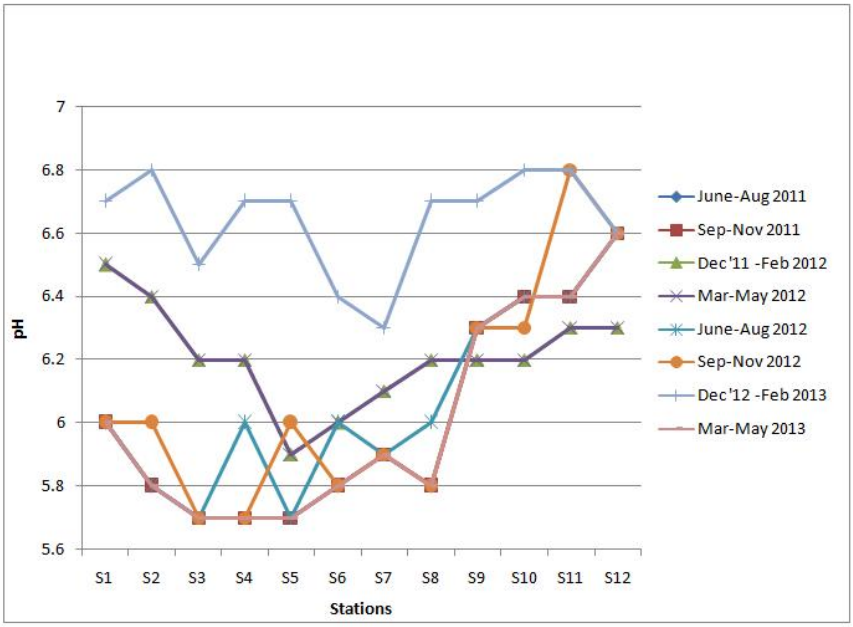

Fig. 1. Seasonal variations in pH of river Tambiraparani (West) during the study period

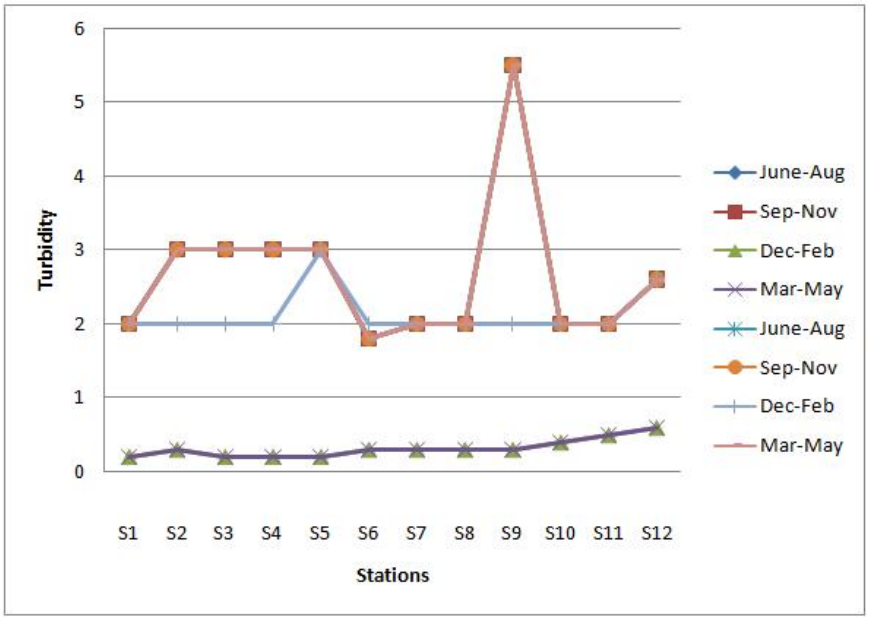

Fig. 2. Seasonal variations in Turbidity of river Tambiraparani (West) during the study period

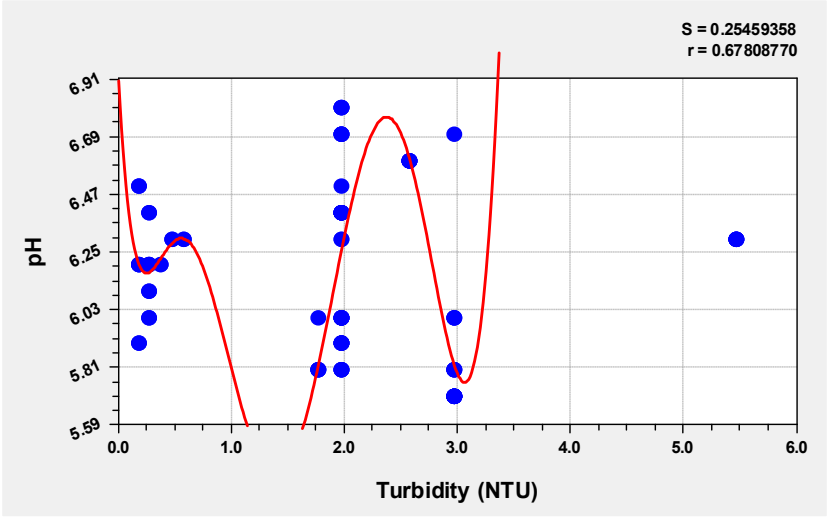

Fig. 3. Seventh degree Polynomial fit correlating pH with turbidity

The results of the present study reveal the pH shows a typical seasonal pattern in both years (Fig-1). The pH is found to increase from its origin to estuary. The seasonal variations show that pH in monsoon season is higher than that of other seasons. Further the pH in different stations is found to differ significantly ($P < 0.01$) during its flow (Table-3). A decrease in pH was found from station 1to 3. Further, an increase in pH was found in the flow of the river. This may be due to the stagnation of water as well as the sediment characteristics of the river. The pH in station 9, 10, 11 and 12 may be due to the influx of marine water and the confluence with the river water. The higher pH during the monsoon season and its random fluctuations may be due to the influx of the water from the adjoining agricultural lands as well as sholas adjoining the river.

Mathematical relationship between two factors is used as a tool for prediction of ecological dynamics. The results of the present study reveal that the relationship between pH and turbidity has significant (r=0.6780) polynomial fit relationship (Fig-3) and the relationship can be expressed as,

$$pH=7.068-9.096T+3.245T^2-5.008T^3+3.683T^4-.358T^5+2.411T^6-1.623T^7$$

Where T=Turbidity

Pazhanisamy and Ebanasar (2008) also reported that polynomial fit as the best fit model in expressing the relationship between physical characteristics of water in reservoir. The result of the present study is also in agreement with the observation of Pazhanisamy and Ebanasar (2008). The results also reveal that the river has peculiar type water quality characteristic during the flow and also have remarkable relationship with the altitude of the sampling sites.

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