

## *International Journal of Scientific Research and Reviews*

### **Studies on Nutrient Chemistry of Pantry Estuary at Rajakkamangalam –Kanyakumari District-Tamilnadu.**

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#### **ABSTRACT**

The study of physico-chemical properties of coastal environments is important, because the variations in the physicochemical properties were influence on the floral and faunal production. Study of coastal water quality plays important role in evaluating and determining the pollution status and health of the water. The present study was carried out to study the physico- chemical characteristics of water in Pantry estuary at Rajakkamangalam, South west coast of India. The physico-chemical parameters such as, turbidity, pH, DO, major elements sodium, potassium, chloride and nutrient elements like nitrate, nitrite, phosphate were studied. The concentration of the investigated parameters in the analysis of water samples predict that there is no harmful contamination in the estuary .

**KEYWORDS:** Physico-chemical parameters, nutrients, estuary, BOD, pollution

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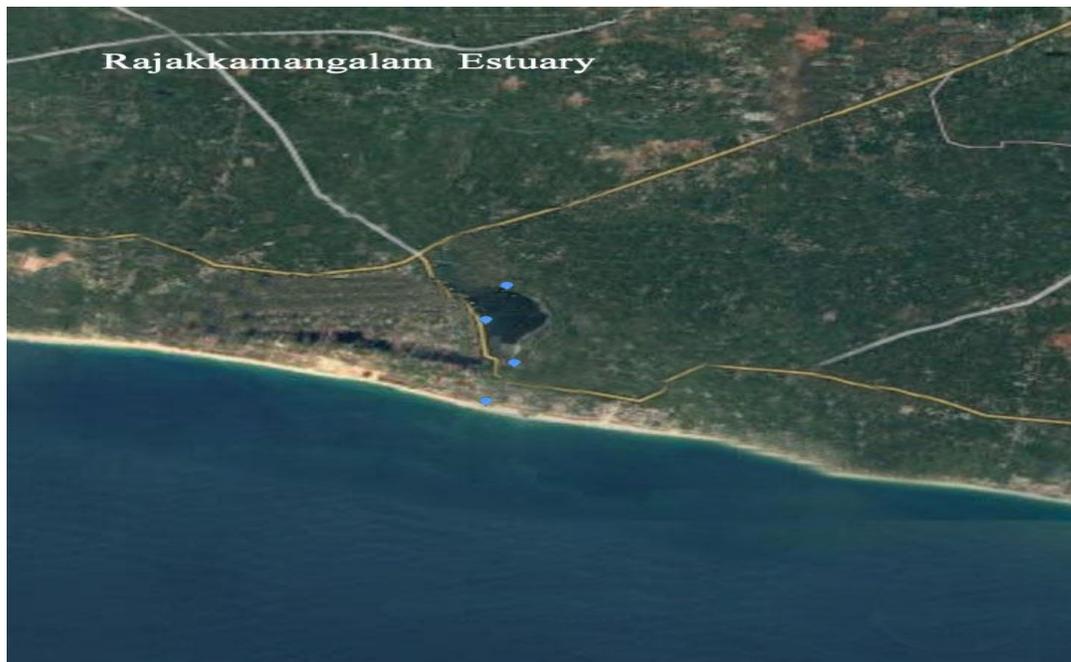
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## **I. INTRODUCTION**

Estuarine water exhibit seasonal variations in its physicochemical characteristics and nutrients content depending of physical and biological processes .Hence, the present study was designed to investigate the changes of physico-chemical parameters and nutrients in one of the estuaries of kanyakumari district. Pantry estuary is situated at Rajakkamangalam in Kanyakumari district along the south west coast of India ( $8^{\circ} 7' 44''$  N latitude and  $77^{\circ} 21' 50''$  E longitude) which has an area of about 12 hectares. One among the river systems in Kanyakumari district namely the Ponnivaikkal originates from Velimalai hills about 25 km northwest of Nagercoil. It forms a small estuary at Rajakamangalam before it joins the Arabian Sea. The estuary is seasonal and receives fresh water during the monsoon periods and gets separated from the sea by a sand bar formed by wave action during the other seasons.



**Fig 1.satalite picture of pantry estuary -Rajakamangalam**

## **II. MATERIAL AND METHODS**

Water samples were collected every month during June 2011 to May 2012.Surface water samples were collected with a clean plastic bucket. Preservation and transportation of the water samples to the laboratory were as per standard methods <sup>1</sup>.The samples were analyzed for different parameters. pH was measured using a pH analyzer while dissolved oxygen was fixed immediately after collection and then determined by Winkler's method. Nutrients, were determined by standard photometric method<sup>2</sup>. Turbidity was measured by Nephelometer .The alkali metals like sodium and

potassium in water samples were determined by using flame photometer. The chloride content in the water sample was determined by Argentometric method.

### III. RESULTS AND DISCUSSION

Table 1. Seasonal variation of physico-chemical parameters, Major elements, Nutrient elements at different stations in Pantry estuary.

Physico-chemical parameters	Premonsoon				Monsoon				Postmonsoon			
	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4
PH	7.88	7.5	7.16	8.56	7.37	7.33	7.42	7.02	7.22	7.47	8.48	8.36
Turbidity	2	2	0	1	2	17	1	32	2	2	2	16
DO	4.2	6	6.1	5.3	6.4	6.8	5.7	5.1	1.2	5.3	5.3	6.7
Major elements												
Sodium	308	335	615	670	950	365	615	228	435	490	940	880
Potassium	65	78	80	45	210	40	90	23	58	55	160	90
Chloride	800	725	1640	1420	2100	1020	1360	480	1080	1040	2400	2050
Nutrient elements												
Nitrite	0.16	0.14	0.14	0.11	0.11	0.16	0.78	0.2	0.11	0.08	0.16	0.35
Nitrate	4	3	4	3	9	3	9	9	5	3	3	3
Phosphate	0.7	0.15	0.6	0.6	0.75	1.4	2.75	2.3	2.3	2.6	0.8	2.3

Table 2. Mean Seasonal variation of physico-chemical parameters, Major elements, Nutrient elements at different stations in Pantry estuary

Physical Examination	Premonsoon	Monsoon	Postmonsoon
Turbidity	1.25	13	5.5
PH	7.8	7.3	7.9
DO	5.4	6	4.62
Sodium	482	539.5	686.25
Pottassium	67	90.75	90.75
Chloride	1146.25	1240	1642.5
Nitrite	0.14	0.31	0.18
Nitrate	3.5	7.5	3.5
Phosphate	0.51	1.8	2

#### Physico-chemical Parameters

Turbidity in water is due to colloidal and extremely fine dispersions. The variation of physico-chemical parameters concentration in the water sample collected from 4 sites under study and the mean seasonal variation in Pantry estuary is given in the table 1&2 respectively. Turbidity values varied from 0 NTU to 32 NTU with an average value of 6.58 NTU. During premonsoon, monsoon and post monsoon, turbidity varied between 0 to 2 NTU , 1 to 32 NTU and 2 to 16 NTU with a mean value of 1.25 NTU, 13 NTU and 5.5 NTU respectively. In the present study the maximum turbidity of 32 NTU was recorded during monsoon and minimum of 0 NTU was recorded

during Premonsoon season. Weak tidal current and heavy land drainage could be the reason for the high turbidity at the site. The Variation in pH of all the samples were found to be alkaline throughout the study period. pH varied from 7.0 to 8.56 with a mean value of 7.64. During post monsoon, premonsoon and monsoon, pH varied between 7.22 to 8.48, 7.16 to 8.56 and 7.02 to 7.42 with a mean value of 7.88, 7.77 and 7.28 respectively. In the present study, maximum of 8.56 pH during premonsoon and minimum 7.0 during monsoon season was found. High pH(8.56) was found near the bar mouth because of the sea water intrusion from Arabian sea during high tide time. Maximum mean pH value (7.88) was recorded during post monsoon and minimum mean pH (7.28) was recorded during monsoon season<sup>3</sup>. The relatively lower pH values were obtained during monsoon season due to influence of riverine flow. Dissolved oxygen is an important constituent of water bodies. Insufficient dissolved oxygen in the water column causes the anaerobic decomposition of any organic materials present<sup>4</sup>. The Dissolved oxygen values are varied between 1.2mg/l to 6.8 mg/l with a mean value of 5.34mg/l. The minimum mean value of 4.62 mg/l was obtained during post monsoon season and maximum mean value of 6 mg/l was obtained during monsoon. The low levels of dissolved oxygen in the water may be due to microbial demand for oxygen in decomposition of suspended organic matter.<sup>5</sup> The decaying organic matter abundant in the mangroves which increase the organic load resulting in very high BOD may also cause a depletion in dissolved oxygen level<sup>6</sup> fig 2,3,4 explains the seasonal variation of turbidity, DO and pH respectively..

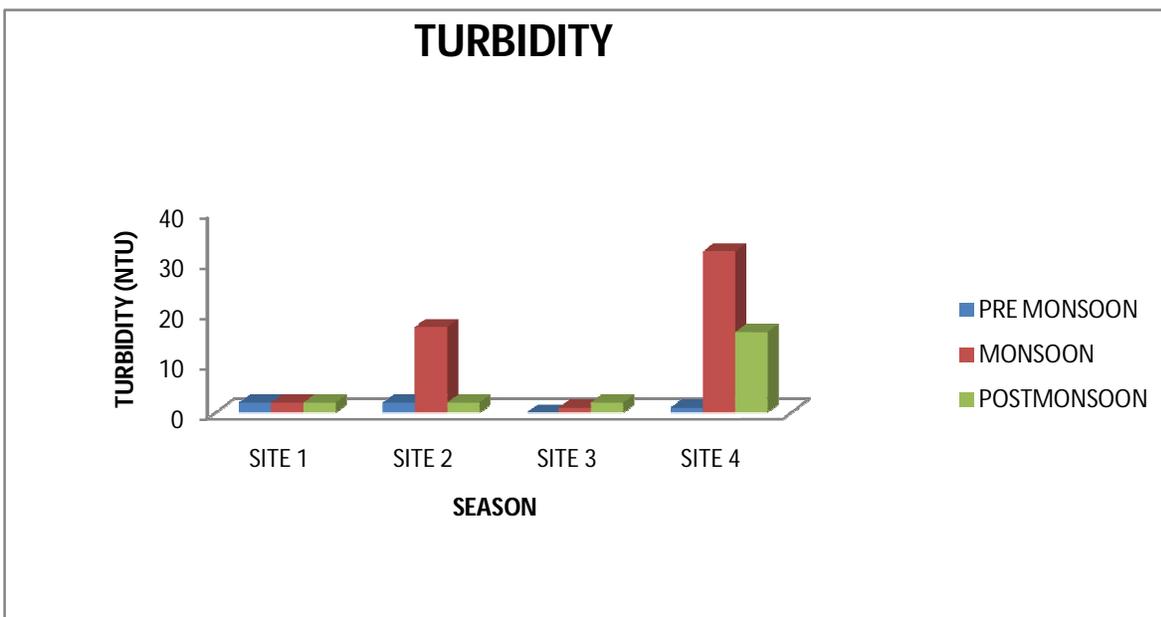


Fig 2 -Variation of turbidity at different seasons of pantry estuary

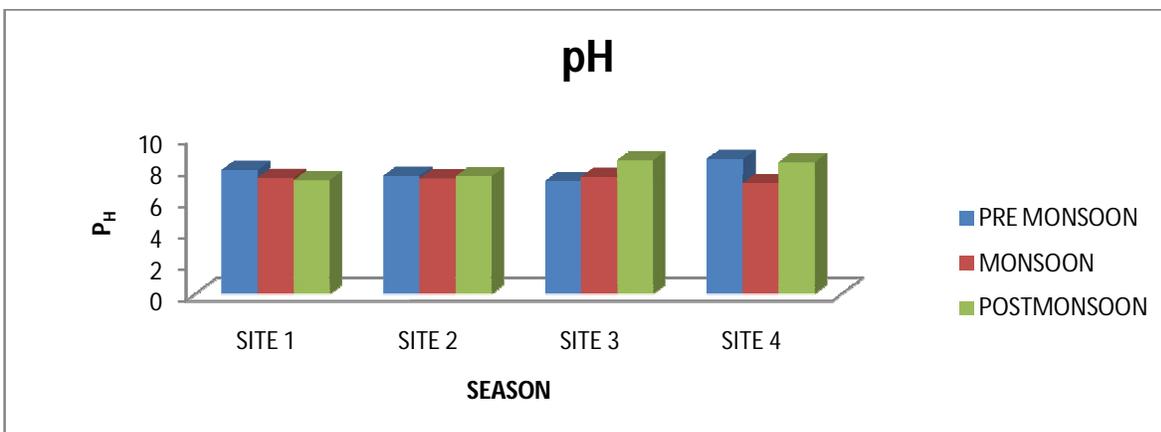


Fig 3 -Variation of pH at different seasons of pantry estuary

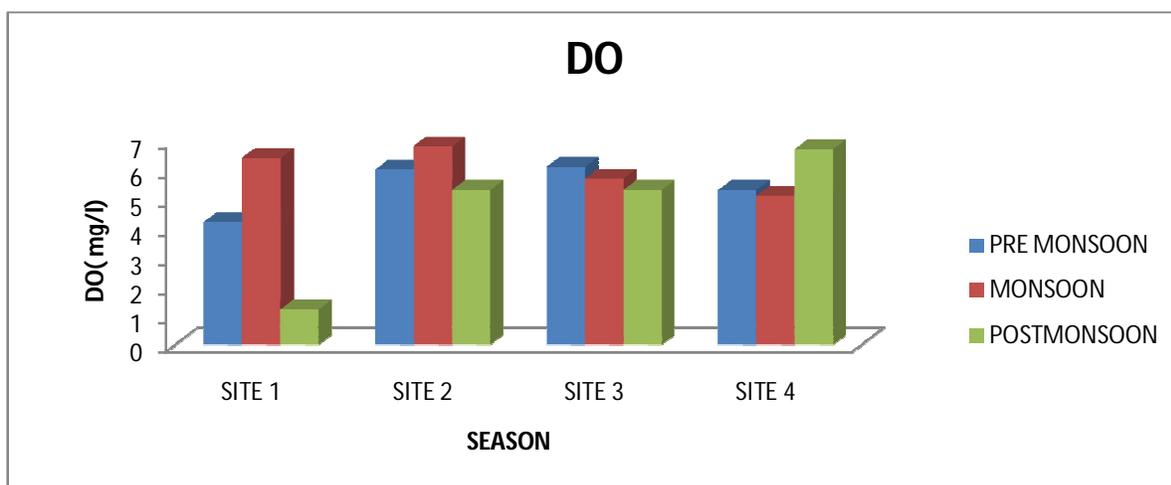


Fig 4 -Variation of DO at different seasons of pantry estuary

**Major Elements:**

Domestic sewage is rich in sodium and would increase its concentration in the estuary when it is discharged into the estuary. The variation of major elements concentration and seasonal variation is given in the table 1 and 2 respectively. Sodium varied from 228 mg/l to 950 mg/l with a mean value of 569.25 mg/l. During premonsoon, monsoon and post monsoon, sodium varied between 228 mg/l to 950 mg/l, 308 mg/l to 670 mg/l and 435 mg/l to 940 mg/l respectively. The mean sodium values are 539.5 mg/l, 482 mg/l, and 686.25 mg/l during pre monsoon, monsoon and post monsoon respectively. The maximum mean value obtained during post monsoon and minimum value obtained during monsoon season<sup>7</sup>. The high value during the postmonsoon season is due to high evaporation of estuarine water and the dominance of sea water intrusion. The overall mean value of potassium in this estuaries are, 82.83 mg/l. The potassium concentration varied between 23 mg/l to 210 mg/l during pre monsoon, 45 mg/l to 80 mg/l during monsoon and 90 mg/l to 160 mg/l during post monsoon season. The mean values of 90.75 mg/l, 67 mg/l, and 90.75 mg/l obtained during pre

monsoon, monsoon and post monsoon respectively. The maximum mean values obtained during premonsoon & post monsoon and minimum mean value obtained during monsoon season. Leaching of potassium from the nearby coconut plantation using potash fertilizers may be the reason for the higher concentration.<sup>8</sup> Chloride is present in all natural surface and ground water as low concentration to high concentration. Chloride content varied between 725 mg/l to 2400 mg/l. Chloride values ranged from 480 mg/l to 2100 mg/l, 725 mg/l to 1640 mg/l and 1040 mg/l to 2400 mg/l during pre monsoon, monsoon and post monsoon respectively. 1240 mg/l, 1146.25mg/l and 1642.5mg/l are the mean values of chloride concentration at pre monsoon, monsoon and post monsoon season respectively.<sup>9</sup> High values of chloride content obtained during the post monsoon season may be due to the tidal flow and low fresh water mixing. Fig 5, 6,7 explains the seasonal variation of sodium, potassium and chloride respectively.

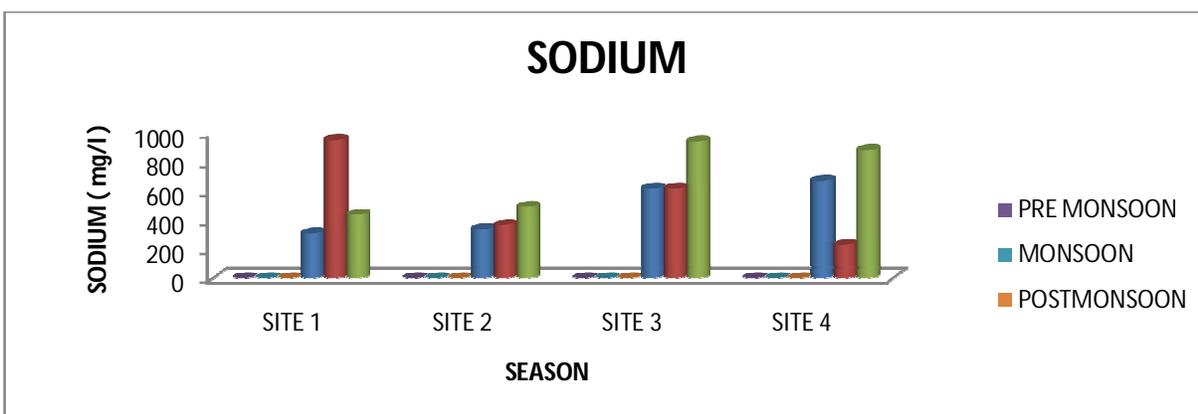


Fig 5 -Variation of sodium at different seasons of pantry estuary

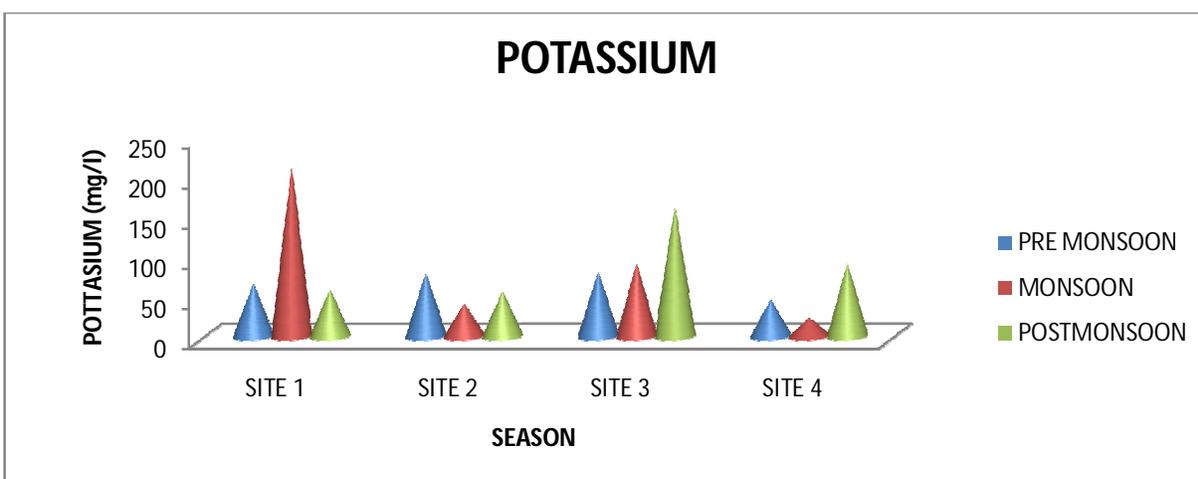


Fig 6 -Variation of potassium at different seasons of pantry estuary

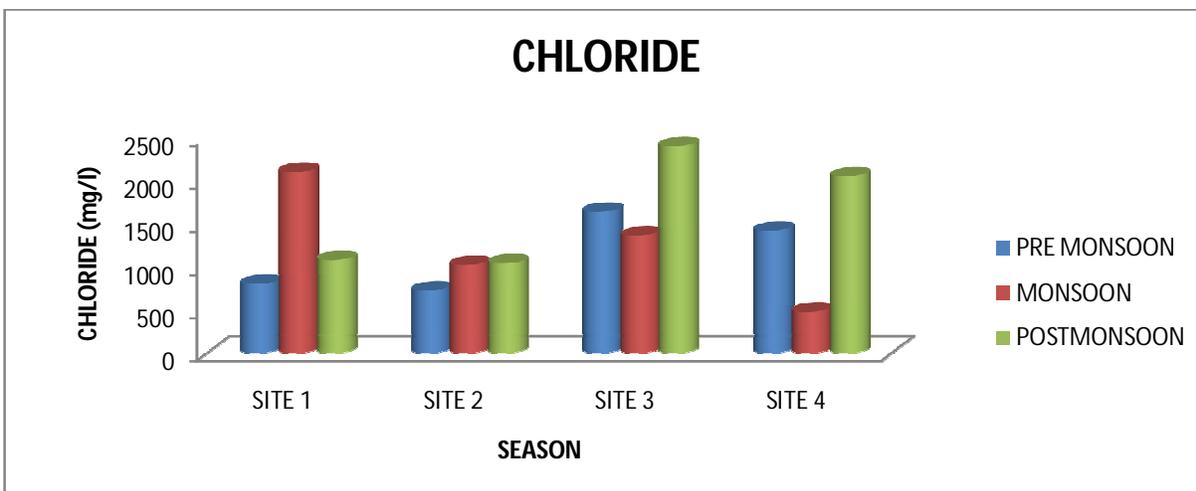


Fig 7 -Variation of chloride at different seasons of pantry estuary

### ***Nutrient elements:***

Nutrients - especially nitrogen and phosphorous are key water quality parameters in estuaries. Nutrient concentration vary according to surrounding land use, season and geology).The site variation and seasonal variation of nutrient parameters are shown in the table 1& 2 respectively. One of the nutrient element ( $\text{NO}_2^-$ ) nitrite concentration value ranged from 0.08 mg/l to 0.78mg/l with a mean value of 0.20 mg/l. During the pre monsoon, monsoon & post monsoon period the values are ranged from 0.11mg/l to 0.16 mg/l with a mean value of 0.13 mg/l, 0.11 mg/l to 0.2 mg/l with a mean value of 0.31mg/l and 0.08mg/l to 0.35 mg/l with a mean value of 0.17 mg/l respectively. Inorganic nitrite concentration was found to be lower than nitrate probably due to its very stable nature and it perhaps gets immediately converted into ammonia (or) nitrate and evaporated and its seasonal distributions was similar that of nitrate<sup>7</sup>. Nitrite content was also found to be higher during the month of October to January could be attributed due to the influence of seasonal floods. Low content of nitrites during the premonsoon season was due to less fresh  $\text{H}_2\text{O}$  input, higher salinity, higher  $\text{P}_\text{H}$  and also uptake by phytoplankton<sup>10,11</sup>. Nitrate is one of the important nutrient element. Its values are varied from 3mg/l to 9 mg/l with a mean value of 4.8 mg/L. During premonsoonperiod the nitrate concentration ranged from 3 mg/l to 4 mg/l with a mean value of 3.5mg/l. During monsoon period the values are ranged from 3mg/l to 9 mg/l with a mean value of 7.5 mg/l. In post monsoon, concentration ranged from 3 to 5 mg/l with a mean value of 3.5 mg/l. There is no considerable change in site side. The increased nitrates level was due to fresh  $\text{H}_2\text{O}$  inflow, and terrestrial runoff during the monsoon season. The low value recorded during non-monsoon period may be due to its utilization by phytoplankton as evidenced by high photosynthetic activity . The mean phosphate values varied between 0.14 mg/l to 2.75 mg/l. The mean phosphate concentration was found to be 1.43mg/l . Its concentration varied from 0.15 mg/l to 0.7 mg/l, 0.75mg/l to 2.75 mg/l and 0.8 mg/l

to 2.6 mg/l during premonsoon, monsoon & post monsoon respectively. The mean phosphate values during premonsoon, monsoon & post monsoon were found to be 3.5 mg/l, 7.5mg/l and 3.5mg/l respectively. High concentration of phosphate observed during monsoon season may be due to intrusion of upwelling sea water into the creek, which increased the level of phosphate. The low value may be due to limited flow of fresh H<sub>2</sub>O, high salinity, and utilization of phosphate by phytoplankton.

Fig 8-Variation of turbidity at different seasons of pantry estuary. fig 8,9,10 explains the seasonal variation of nitrate, nitrite and phosphate respectively.

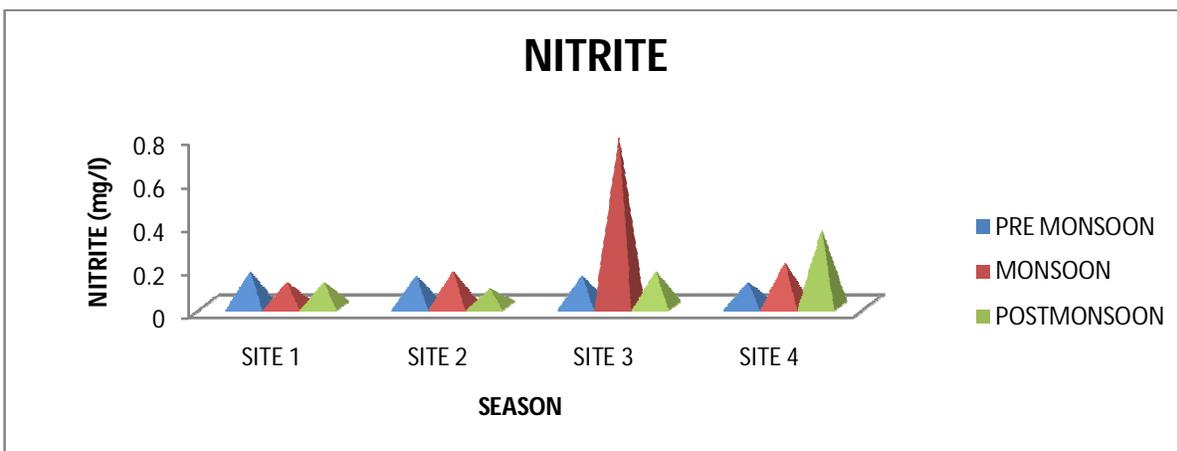


Fig 8 -Variation of nitrite at different seasons of pantry estuary

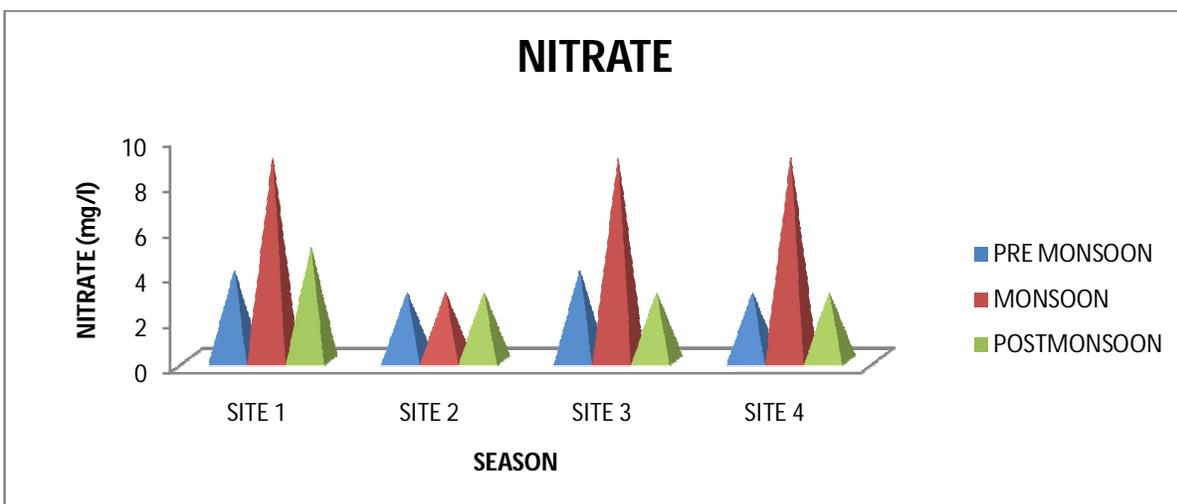


Fig 9 -Variation of nitrate at different seasons of pantry estuary

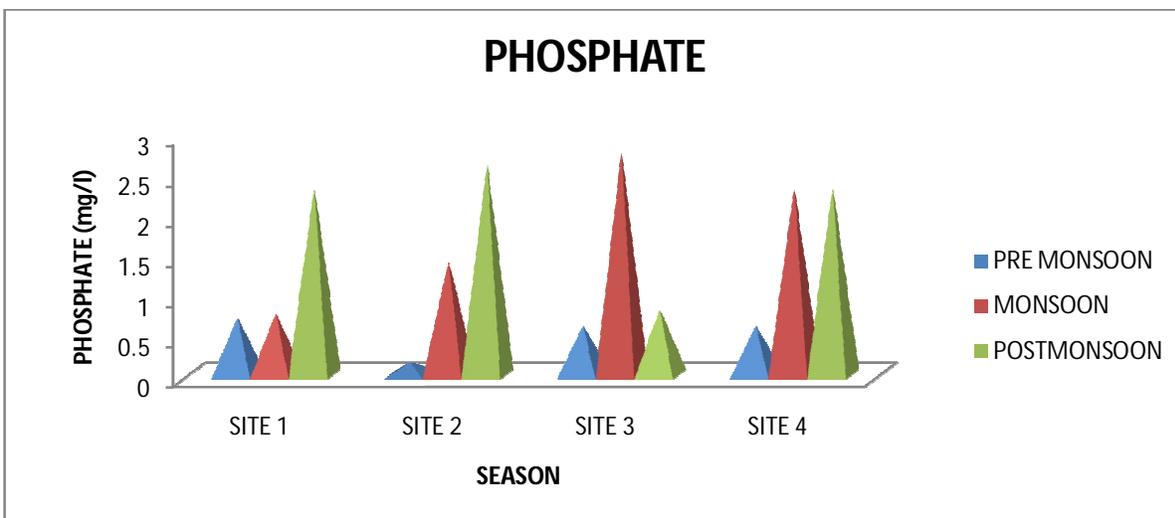


Fig 10 -Variation of phosphate at different seasons of pantry estuary

#### IV CONCLUSION

The present study summarizes the seasonal fluctuations in various physico-chemical parameters in the estuarine waters of studied four different sites of Pantry estuary. Comparing the nutrient characteristics in these estuaries suggest that Pantry estuary consist of less concentration of nutrient elements, mobile elements and carbonate elements. Due to different environmental conditions and ecosystem, water quality standards vary significantly. The physico-chemical characteristics of estuarine water in the study area and the statistical analysis suggested that there was no harmful chemical contamination. In order to protect the nature of this estuary proper measures are taken for the treatment of sewage before discharge and restrictions are put on various anthropogenic activities upstream, the estuary would remain healthy in the long run.

#### ACKNOWLEDGEMENT

The authors are thankful to the Management and staff of S.T.Hindu College, Nagercoil, Kanyakumari District, Tamilnadu, India.

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