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Physico-chemical analysis of water quality of Kalle palli estuary of Nagavali River, Srikakulam District, Andhra Pradesh, India

[*1] Sridhar D, [2] Ramaneswari K

[1] Assistant Professor, Department of Aquaculture, College of Science and Technology, Adikavi Nannaya University, Rajamahendravaram, Andhra Pradesh, India

[2] Associate Professor, Department of Zoology, College of Science and Technology, Adikavi Nannaya University, Rajamahendravaram, Andhra Pradesh, India

Abstract
This study was aimed to estimate current status of Physico-chemical characteristics of Kalle palli estuary of Nagavali river, Srikakulam district, Andhra Pradesh. Monthly variations in physico-chemical parameters such as water Temperature, P^H, Alkalinity, Hardness, Dissolved Oxygen, Biological Oxygen demand, Nitrates and Phosphates were analyze for a period of two year from June 2012 to May 2014. In the present investigation all the parameters is in permissible range.

Keywords: physico-chemical parameters, seasonal variation of temperature, PH, alkalinity, salinity, hardness, dissolved oxygen, biological oxygen demand, nitrates and phosphates

Introduction
Water quality in any ecosystem gives a significant information about the available resources for supporting life in that ecosystem (Thirupathaiah *et al*. 2012) [22]. Estuarine environments are among the most productive on earth, creating more organic matter each year than comparably-sized areas of forest, grassland, or agricultural land and have important commercial value with providing economic benefits for tourism, fisheries, and recreational activities (Shahadat Hossain *et al*. 2013) [19]. Studies of the water quality through the appropriate control measures, and monitoring of diverse quality parameters have become very important and essential to ensure the sustainable development and management of the coastal systems and their resources (Mishra, 2007) [11]. Kalle palli estuary comes under minor estuary stream it is nearly 10 km from Srikakulam town. Water resources are of critical importance to both natural ecosystem and human development. The healthy aquatic ecosystem is depended on the Physico-chemical and biological characteristics. These characteristics can identify certain condition for the ecology of living organisms and suggest appropriate conservation and management strategies. In order to assess water quality index we have carried out the physico-chemical analysis of water resources.

Materials and Methods
Preparation of water samples
In order to determine the water quality index, for sample collection from the Kallepalli estuary june 2012 to july 2014 in the every month. Water samples were collected once in a month from the sampling site, water was collected through a pre-washed (with GC grade hexane) ambour coloured glass bottle once in a month for the estimation of hydrographical parameters All the sample collections and observations were made between 8.00 a.m and 02.00 p.m during the study period. These samples were collected from approximately 15-30 cm below the water surface. Care must be taken not to catch any floating material into the bottle.

Water samples already collected for the hydrographical analysis were brought to the laboratory and analysed immediately as far as possible. Standard Methods for Estimation of Water and Waste water 20th Edition, 1998 (APHA) were referred for estimation of parameters Preservation and transportation of the water samples to the laboratory were as per standard methods (APHA, 1998), Trivedy and Goel, 1984) [1]

Table 1: Methods employed for determination of physico-chemical parameters

S. No	Parameters	Method used
1	Temperature	Thermometry
2	pH	pH meter
3	Alkalinity	Titration
4	Salinity	Digital portable salino meter
5	Hardness	EDTA titration
6	Dissolved Oxygen (DO)	Winklers method
7	BOD	Incubation method
8	Nitrates	Spectrophotometer
9	Phosphates	Spectrophotometer

Results and Discussion
The monthly values of physico-chemical parameters Temperature, pH, Alkalinity, Hardness, Dissolved oxygen, Biological oxygen demand, Nitrates, and Phosphates of Kalle palli estuary water of the present study area were shown in Table-2.

Table 2: Water quality parameters in the study area

Months	Temp	P^H	Alkalinity	Salinity	Hardness	DO	BOD	Nitrates	Phosphates
June, 2012	27.0	7.60	131	11.20	1821.24	6.3	1.81	1.96	0.60
July	26.1	7.20	129	9.100	1925.23	6.4	1.72	1.89	0.61
Aug	26.0	7.30	124	6.500	1826.42	6.1	1.62	2.87	0.60
Sept	26.0	7.60	127	2.300	850.000	6.8	1.20	2.11	0.59
Oct	27.0	7.80	138	14.60	2756.23	6.3	1.21	1.91	0.54
Nov	27.1	7.80	135	1.600	462.000	7.2	1.23	1.85	0.51
Dec	25.3	7.90	134	17.56	2918.46	7.4	1.20	1.98	0.53
Jan, 2013	24.0	7.70	136	19.12	2989.34	6.7	1.10	1.92	0.54
Feb	27.6	7.28	126	23.25	3562.14	6.2	1.70	1.23	0.51
March	28.4	7.56	127	24.21	4025.36	5.8	2.00	1.25	0.52
April	29.0	7.46	130	24.32	4986.69	4.9	1.90	1.20	0.49
May	30.0	8.10	136	26.10	5102.85	5.4	2.30	1.24	0.50
June	26.8	7.60	121	12.12	1798.94	6.2	1.60	1.95	0.59
July	27.0	7.40	128	11.10	1869.26	6.0	1.50	2.00	0.62
Aug	26.0	7.11	127	2.100	1836.25	6.4	1.20	2.85	0.63
Sept	25.8	7.60	128	7.100	1987.34	6.4	1.30	2.10	0.54
Oct	27.3	7.50	124	1.500	410.000	6.6	1.20	2.00	0.52
Nov	26.9	7.60	126	16.00	2842.24	6.9	1.00	1.89	0.55
Dec	26.0	7.12	131	17.26	2941.00	7.0	1.20	1.93	0.54
Jan, 2014	25.0	7.80	135	19.60	2976.51	6.6	1.40	1.89	0.61
Feb	27.0	7.24	128	23.81	3673.25	5.9	1.60	1.32	0.57
March	29.0	7.62	131	23.91	4014.25	4.9	2.10	1.19	0.48
April	29.0	8.00	137	25.12	4875.58	5.7	2.50	1.21	0.55
May	30.2	7.98	139	25.24	5045.98	4.7	2.10	1.23	0.56
Mean	27.062	7.577	130.333	15.196	2812.356	6.203	1.572	1.790	0.554
STD	1.556	0.278	4.922	8.531	1398.244	0.699	0.414	0.477	0.043
Variance	0.057	0.036	0.037	0.561	0.497	0.112	0.263	0.266	0.078

Temperature

Temperature is important for its effects on certain chemical and biological reactions taking place in water and aquatic organisms (Shrivastava and Patil, 2002) [21]. The water temperature during 2012-2013, at this sampling site varied between 24 ºC to 30 ºC, the water temperature during the same period of 2013-14, varied between 25 ºC to 30.2 ºC. Maximum value of temperature was recorded in the month of May 2014 and minimum in month of January 2013. Similar seasonal variation in water temperature was recorded by Batcha, (1998) [2], Singh *et al.* (1999) [20], Nath and Srivastava, (2001) [13], Shrivastava and Patil, (2002) [21].

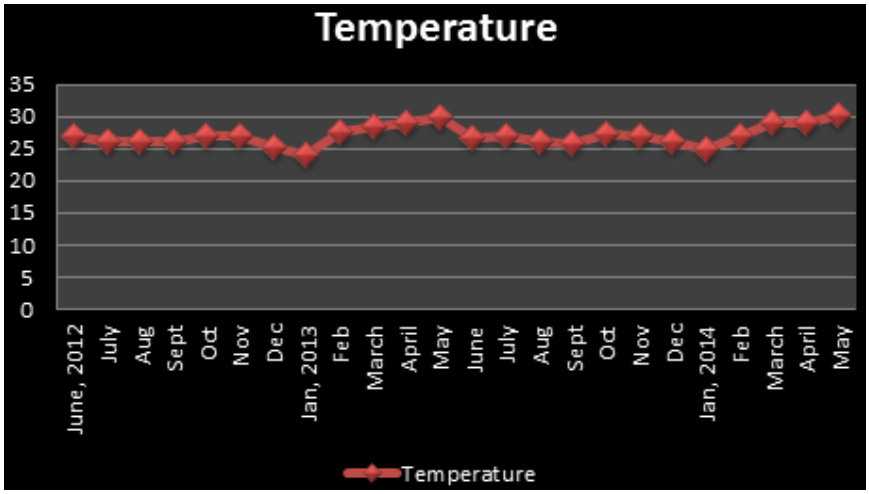

Fig 1: Monthly variations in the water temperature in Kalle palli Estuary

P^H of the collected water sample

The water P^H during 2012-2013, at sampling site varied between, 7.2 to 8.1. The water P^H during the same period of 2013-2014, varied between 7.4 to 8. Maximum value of pH was recorded in the month of May 2013 and minimum in month of July 2012. pH of a water body should remain in the range of 6.4 to 8.5 in order to support the optimum fish growth (Das, 1996) [3]. Our results also support to the fish growth, because pH of water is important because many biological activities can occur only within a narrow range and it affects the solubility and availability of nutrients.

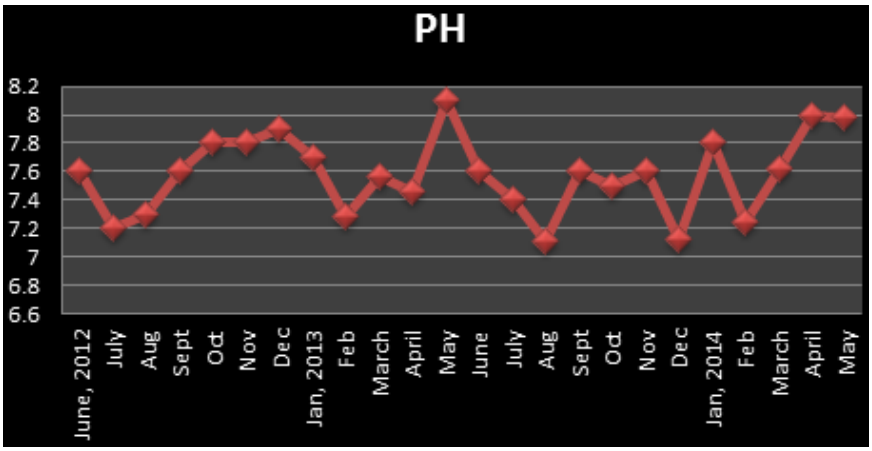

Fig 2: Monthly variations in the water pH in Kalle palli Estuary

Alkalinity

The water total alkalinity of this sampling site for the period of 2012-13, exhibited values ranging between, 124 mg/L to138 mg/L. The water total alkalinity during the same period of 2013-14, values ranging between 121 mg/L to 139 mg/L. Maximum value of Alkalinity was recorded in the month of May 2014 and minimum in month of June 2013. Similar observations made by Chawla *et al.* (2001). Deshmukh and Kanchan (2004) [5].

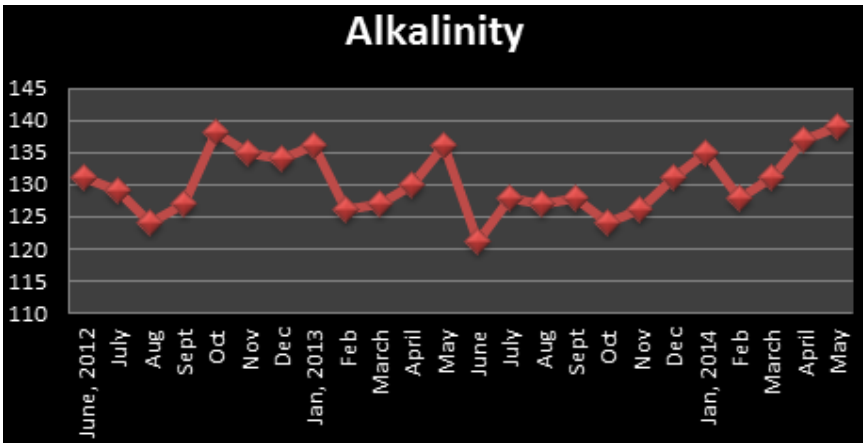

Fig 3: Monthly variations in the water alkalinity in Kallepalli Estuary

Salinity

The water salinity of this sampling site for the period of 2012-13, was observed to range between 1.6 ppt to 26.1 ppt. The salinity for 2013-14, was between 1.5 ppt to 25.24 ppt. The highest salinity was recorded as 26.1ppt in the month of May, at the sampling site S_{II}. The lowest salinity was recorded as 1.6 ppt in the month of November. Low salinity during the monsoon season due to heavy rainfall and the entry of fresh water. Similar results were observed by Rajkumar *et al.*, (2009) [16]; Sankar *et al.* (2010) [18].

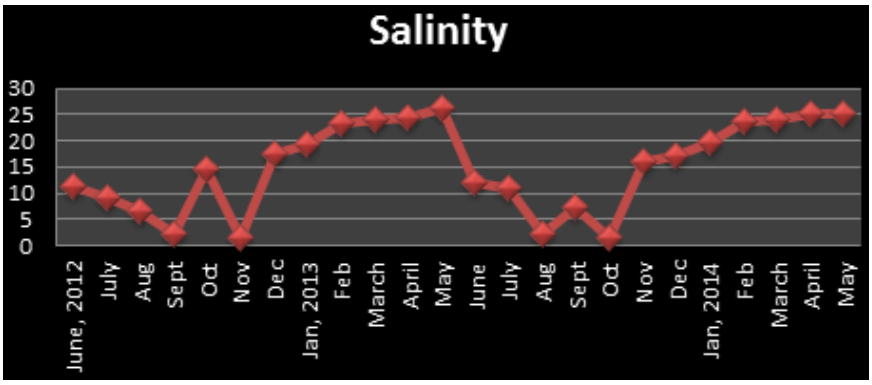

Fig 4: Monthly variations in the water sakinity in Kallepalli Estuary

Hardness

The water total hardness of this sampling site during the period of 2012-13 ranged between between 462 mg/L to 5102.85 mg/L. The total hardness during the same period of 2013-14 was 410 mg/L to 5045.98 mg/L. Maximum value of Hardness was recorded in the month of May 2014 and minimum in month of Oct 2013. Similer observations made by Thommai Arockia Gaspar and Lakshman (2014), Prasanna and Ranjan (2010).

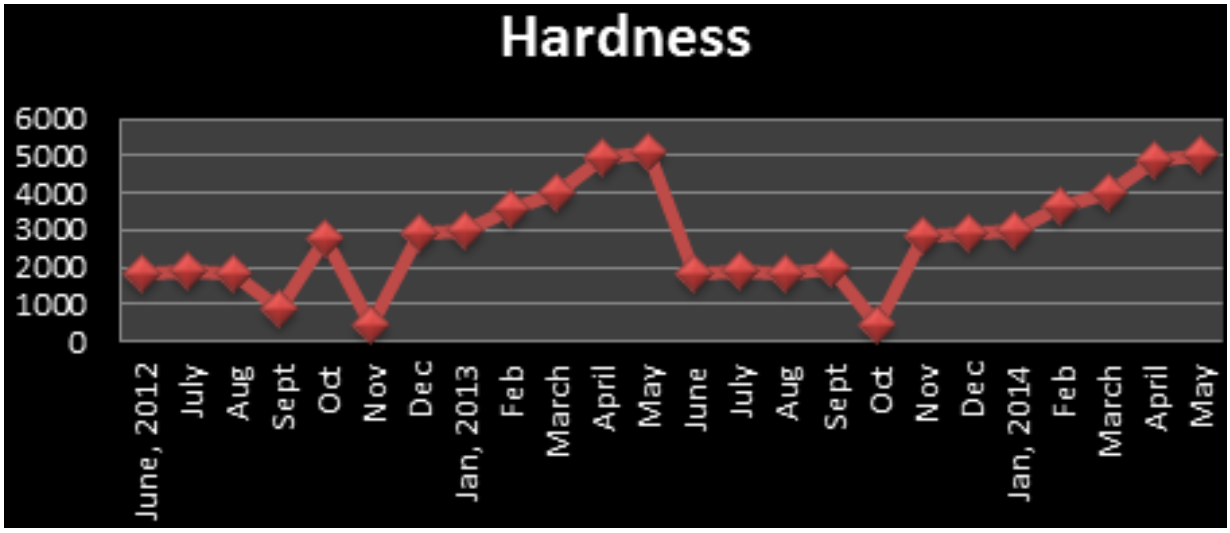

Fig 5: Monthly variations in the water hardness in Kallepalli Estuary

Dissolved Oxygen (DO): DO is one of the most important parameter in assessing water quality and understanding the physical and biological process prevailing in the water. The importance of DO was reported by many researchers because DO in aquatic ecosystem brings out various biochemical changes and it influence on metabolic activities of organisms. The DO of the collected water samples is about 6.9 to 8.2 mg/L. It is quite close to the prescribed values. The water dissolved oxygen during the period of 2012-13, values ranging between, 4.98 mg/L to 7.4 mg/L. The water dissolved oxygen during the same season of 2013-14, 4.7 mg/L to 7 mg/L. Maximum value of DO was recorded in the month of Dec 2012 and minimum in month of May 2014.

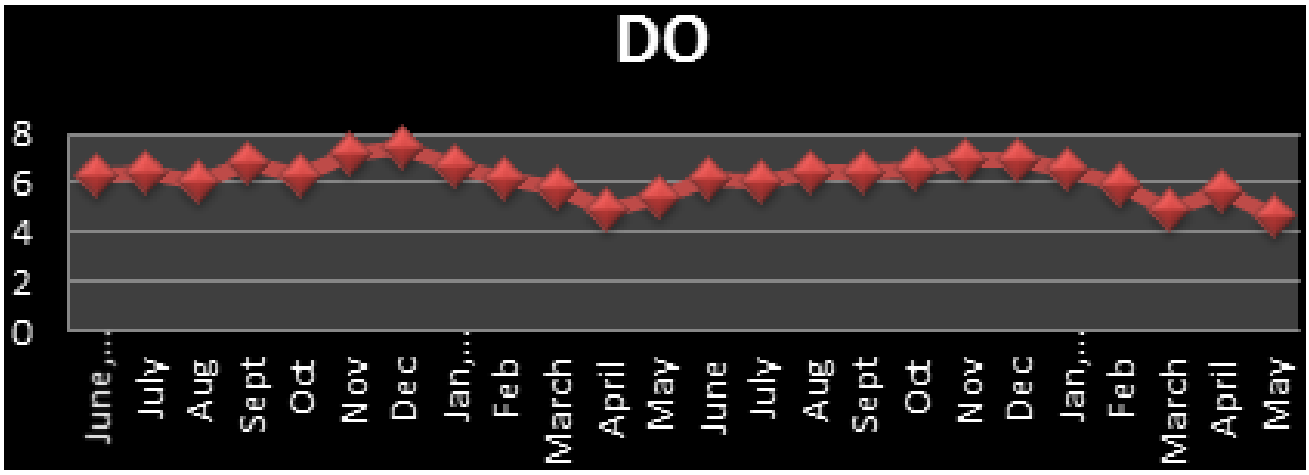

Fig 6: Monthly variations in the water dissolved oxygen in Kallepalli Estuary

Biological oxygen demand (BOD):

Biochemical Oxygen Demand (BOD) depends on temperature, extent of biochemical activities, concentration of organic matter and such other related factors. During the study period, BOD was observed to be in the range. The water BOD content during the period of 2012-13, 1.1mg/L to 2.3 mg/L. The water BOD during the same period of 2013-14, 1.0 mg/L to 2.5 mg/L. Maximum value of BOD was recorded in the month of April 2014 and minimum in month of Nov 2013.

Maximum value of BOD was recorded in premonsoon period and minimum BOD In postmonsoon period due to low temperature prevailing and low bacterial activity, higher levels of DO were encountered. This indicates a fall in BOD levels. Maximum value of BOD was observed in monsoon period due to the maximum biological affinity at elevated temperature and low in winter (Ghavzan, *et al.*, 2006) [6].

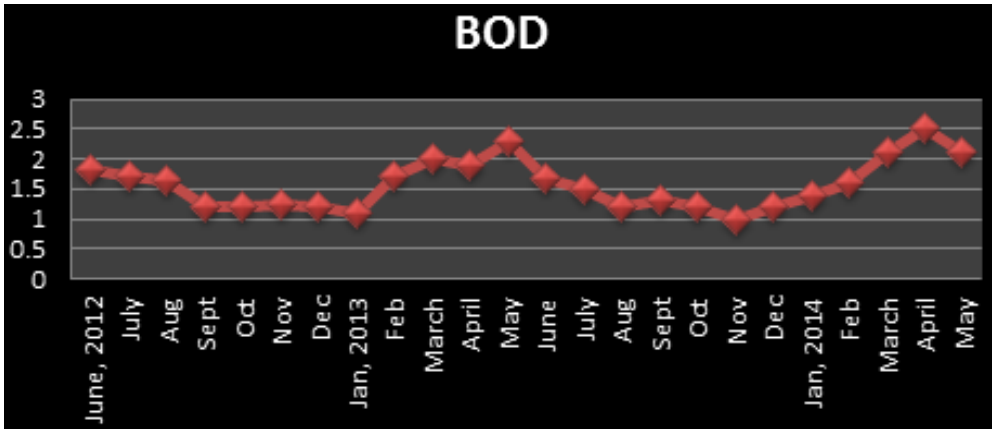

Fig 7: Monthly variations in the water Biological oxygendemand in Kallepalli Estuary

Nitrates

The water nitrates content during the period of 2012-13, 1.20 mg/L to 2.87 mg/L. The water nitrates content during the same period of 2013-14, 1.21mg/L to 2.85 mg/L. Maximum value of Nitrates was recorded in the month of Aug 2012 and minimum in month of April 2013. Similar observations also stated by Das *et al*. (1997) [4], Gouda and Panigrahy, (1993) [7].

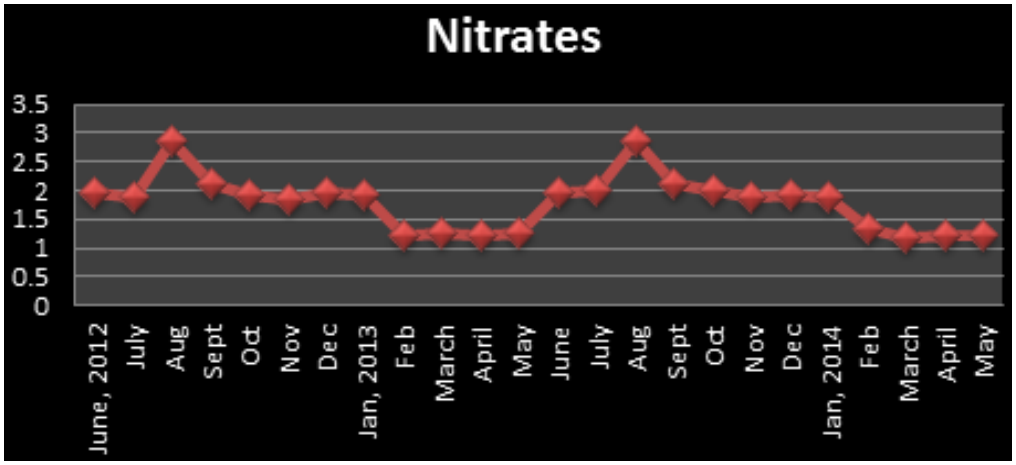

Fig 8: Monthly variations in the water Nitrates in Kallepalli Estuary

Phosphates

The water phosphates content during the period of 2012-13, fluctuated between, 0.49 mg/L to 0.61 mg/L. The water phosphate content during the same period of 2013-14, 0.48 mg/L to 0.62 mg/L. Maximum value of Phosphates was recorded in the month of July 2012 and minimum in month of April 2014. Similer observations made by (Nair *et al*. 1984), Chandran and Ramamoorthy (1984) Gowda *et al*. (2001) [8].

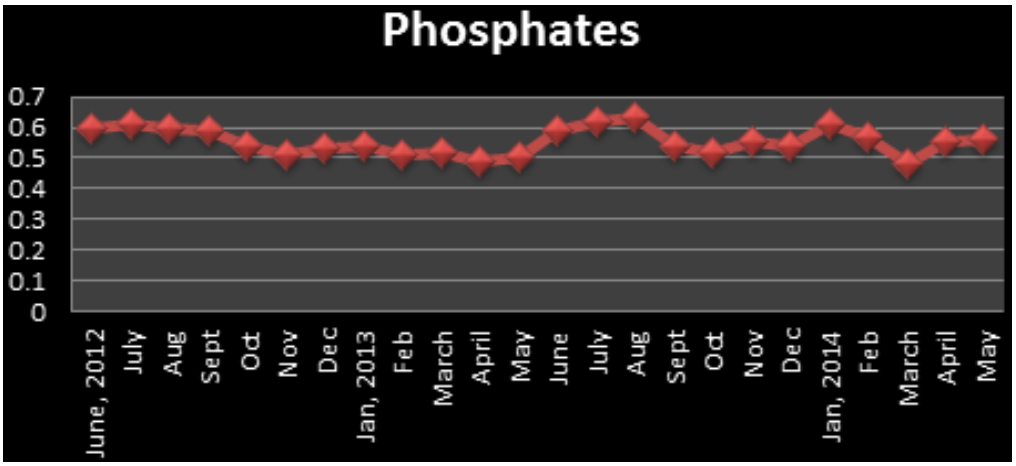

Fig 9: Monthly variations in the water Phosphates in Kalle palli Estuary

Conclusion

The analysis of the water quality parameters of Kalle palli Estuaries shows that Temperature, P^H, Alkalinity, Hardness, Dissolved oxygen, Biological oxygen demand, Nitrates and Phosphates values are well within the permissible limits. Habited water is generally suitable for aquatic life. After physico-chemical analysis we found that the habitat water is pollution free and ecologically balanced.

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