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A STUDY ON THE PHYSICO-CHEMICAL CHARACTERIZATION OFF GODAVARI ESTUARY, ANDHRA PRADESH

N. Prasanthi[1], A.V.V.S. Swamy*[2], K.N. Murty[3], N. Veerabhadra Rao[4] and V. Subhashini[5]

[1]Asst.Professor in Environmental Studies, Pragati Engg College (Autonomous)., Surampalem.
[2]Professor in Environmental Studies, Acharya Nagarjuna University, Guntur.
[3]Associate Professor in Fisheries, Ideal College of Arts and Sciences, Autonomous), Kakinada.
[4]Scientist, Fisheries Research Station (SVVU, Tirupathi), Undi.
[5]Faculty, Department of Environmental science, Acharya Nagarjuna University, Guntur.

Corresponding Author: A.V.V.S. Swamy
Professor in Environmental Studies, Acharya Nagarjuna University, Guntur.

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ABSTRACT

Water plays major function in biodiversity protection hence there is a need to conserve it. Godavari River carries the special religious importance in India. The reliability of an aquatic ecosystem can be accessed through the physico-chemical parameters and plankton structure in water. The sampling stations were selected along the Godavari estuary and water samples are collected for analysis by the standard methods. In this study Water Quality was determined on the basis of 10 parameters like Dissolved Oxygen, pH, Chlorophyll- a, Temperature, Transparency, salinity, Nitrates, Nitrites, Ammonia and Phosphates. The pollution level over a period of time is growing on the river water mainly due to industrial and other waste waters are discharged directly in to the river. The main objective of the study is to examine the water quality of the Godavari River and to evaluate the impact of such contaminated water on aquatic organisms.

KEYWORDS: Water quality parameters; Nutrients; Godavari Estuary.

INTRODUCTION

Fresh water is a renewable resource. Natural sources of fresh water include surface water and groundwater . The world's supply of groundwater is steadily decreasing, with depletion of water tables, saltwater encroachment, drying of aquifers, groundwater pollution, etc. In surface water rivers play an important role as they carry water and nutrients to areas all around the earth. They exhibit a very significant part in the water cycle, substitute as drainage channels for surface water. Rivers provide excellent habitat for aquatic organisms. Rivers have a natural tendency to dilute pollution to some extent, but severe contamination results in alteration in the fauna and flora of the community.

Water quality of the rivers has a considerable importance for the reason that these water resources are generally used for multiple matters such as: drinking domestic and residential water supplies, agriculture (irrigation), hydroelectric power plants, carrying and infrastructure, sightseeing, leisure, and other human or financial ways to use water.[1]

The quality of river water is getting deteriorated due to some important factors like increasing human activities at the water bodies, sewage discharge, Agricultural run-off industrial effluents, urbanization etc. Surface water pollution with chemical, physical and biological contaminants by anthropogenic activities is of great environmental attention all over the world.[2,3,4] River water quality is one of significant factors directly concerning with health of human and for survival of aquatic organisms. So, it is important to have the information on physico- chemical characteristics of water quality for effective pollution control and water resource management. Polluted water restricts some chemical substances and may induce algal bloom which indirectly causes problem to aquatic bodies such as eutrophication. Planktons have close links with the surrounding environment throughout their life cycles and they demonstrate rapid changes in their populations when disturbance occurs such as eutrophication. Thus, they are potential display species for water pollution.[5]

MATERIALS AND METHODS

The Gautami-Godavari estuary is one of the largest estuaries on the east coast of India. The Godavari

estuarine system is located at ~ 16º 42' 34" N and 82º 19' 09" E and covers an area of 15 km^2. Surface water samples were collected at monthly intervals from March 2015 to February2017 (21 months). During navigation, GPS (Global Positioning System), GARMIN was used. The sampling stations (Gautami Godavari River) are at a distance of 0 to 15 km from Vruddha to Bhairavapalem (Figure.1). The Water samples were collected from surface with the help of Niskin water samplers. The DO was estimated by the modified Winkler's method.[6] Filtered water, soon after collection, was used for the estimation of nutrients (nitrite, ammonium, phosphate, and silicate) onboard, and nitrate in the shore laboratory using standard methods.[6] For chlorophyll estimation, GF/F (47 mm) filters containing particulate matter of 1 L water of each sample, preserved at -20 ^{0}C extracted with 90% acetone overnight at 4^{0}C, and the absorption spectrum of the clear supernatant measured using Shimadzu 1800 double beam UV Visible spectrophotometer. The concentration of chl *a* was calculated using the Jeffrey equations.[7]

Figure 1: Study Area (Stations: Vruddha and Bhairavapalem).

RESULTS

Based on the findings Gautami Godavari estuary region, it can infer that the environmental conditions showed wide variations in the study area depending on the water quality parameters, Salinity showed highest values (35.01 ppt) at Bhairavapalem (April, 2016) (Table 1). Low Dissolved Oxygen (2.20 ppm) values in station Bhairavapalem may be due to the non-flushing conditions of the water with increasing waste load in the mangrove surroundings (June, 2015). Temperature is seen similar in both the stations during the year 2015-2016 (Table 1) and 2016-2017 (Table 1). It is observed that the values of silicates and chlorophyll-a has increased in the year 2016-2017 (Table 1) when compared to 2015-2016 (Table 1). The range and mean values of physico-chemical and biological parameters of the study area are given in table 1.

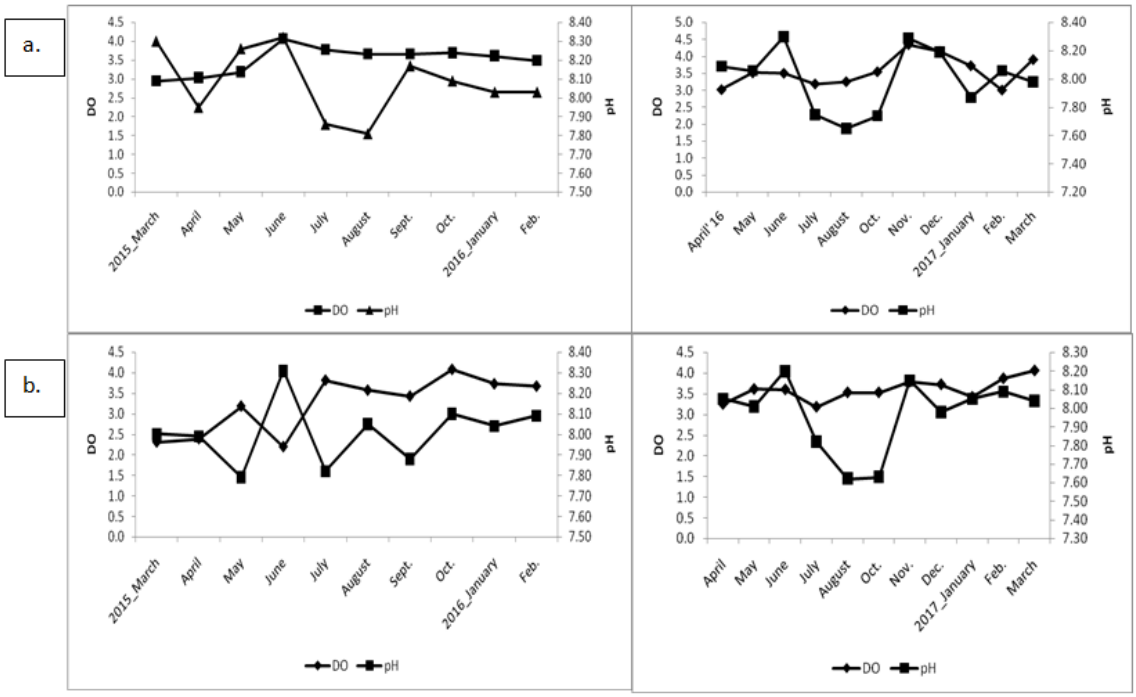
Table 1: Physico-chemical variables of Vruddha and Bhairavapalem (Gautami-Godavari Estuary) March 2015 to February 2017.

	2015 to 2016		2016 to 2017	
Parameter	**Vruddha**	**Bhairavapalem**	**Vruddha**	**Bhairavapalem**
pH	(7.81-8.32) 8.08±0.18	(7.79-8.31) 8.01±0.15	(7.65-8.30) 7.99±0.22	(7.62-8.20) 7.96±0.19
Salinity (PSU)	(0.75-29.92) 16.91±12.19	(2.00-30.30) 18.13±10.95	(0.37-35.01) 15.27±12.68	(0.57-35.01) 17.69±12.76
DO (ppm)	(2.95-4.07) 3.51±0.35	(2.20-4.09) 3.22±0.69	(3.01-4.34) 3.57±0.44	(3.18-4.06) 3.60±0.26
NO_2-N	(0.39-1.56) 0.80±0.39	(0.30-1.26) 0.62±0.35	(0.06-2.75) 0.90±0.84	(0.04-1.93) 0.71±0.51
NO_3-N	(1.45-47.03) 16.84±17.27	(1.76-47.66) 15.69±17.37	(3.60-45.77) 15.32±13.49	(1.81-42.76) 14.11±13.43
NH_4-N	(1.16-7.05) 3.56±1.89	(0.72-6.05) 2.92±1.61	(0.79-6.32) 3.86±1.68	(0.43-26.56) 6.55±7.31
PO_4-P	(0.19-1.89) 0.91±0.70	(0.21-1.78) 0.89±0.62	(7.45-8.80) 8.11±0.39	(0.20-1.10) 0.58±80.60
SiO_4-Si	(5.29-184.08) 60.05±53.46	(5.84-156.96) 49.08±47.83	(11.10-424.12) 119.62±132.23	(11.10-254.84) 83.11±0.39
Chl*a*	(0.75-8.89) 4.69±3.19	(0.60-6.59) 3.80±1.90	(1.64-14.22) 7.59±4.95	(1.64-14.98) 7.78±5.23

Temp	(25.00-32.00) 29.85±2.08	(25.00-32.00) 29.76±2.08	(27.40-31.25) 29.07±1.26	(25.40-30.50) 28.57±1.48
Secchidisc	(0.00-1.40) 0.67±0.41	(0.00-1.00) 0.58±0.35	(0.50-2.30) 0.97±0.51	(0.40-1.50) 0.80±0.30

DISCUSSION

Dissolved oxygen absorption depends on many factors; but mainly due to photosynthesis and respiration by planktons in water. In aquatic ecosystem, oxygenation is the consequence of an inequity between the process of photosynthesis, deprivation of organic matter, reaeration[8], and hydrochemical properties of water.[9]



2015 to 2016 **2016 to 2017**

Figure 2: Monthly observation of DO and pH at Vruddha (a) and Bhairavapalem (b).

Salinity is one of the significant factors which extremely influences the great quantity and allocation of the animals in Rivers and coastal waters. Salinity values at the Godavari river, salinity has correlated positively (Table 1) with transparency showing a low (0 ppt) during the monsoon season (July - 2015) and high (35.01 ppt) in the pre-monsoon season (April-2016) (Table 1). Temperature is a significant physico chemical parameter, which influences almost every biochemical interaction and temperature difference is one of the factors in the coastal and estuarine ecosystem, which may influence the hydro graphical characteristics and also influence the allocation and large quantity of flora and fauna. Surface water temperature varied from 24.70^{0}C (January 2016) to 33.70^{0}C (August 2015) (Figure.3, 4 and 5).

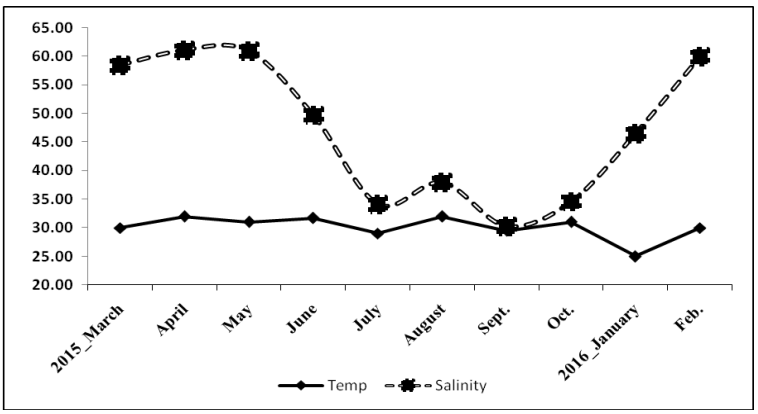


Figure 3: Monthly variation of Temperature and Salinity at Vruddha (2015 to 2016).

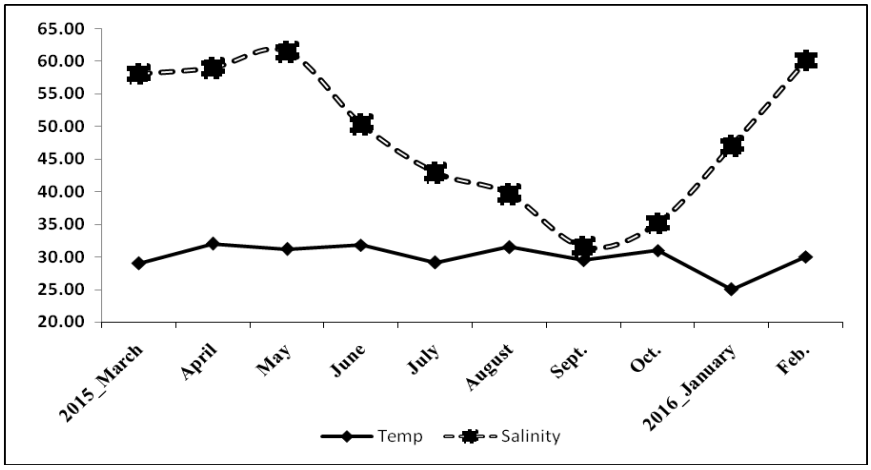


Figure 4: Monthly variation of Temperature and Salinity at Bhairavapalem (2015 to 2016).

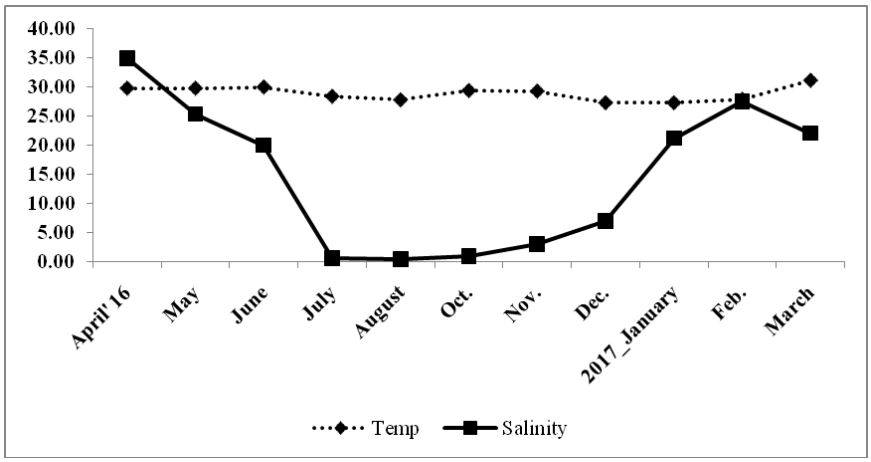


Figure 5: Monthly variation of Temperature and Salinity at Vruddha (2016 to 2017).

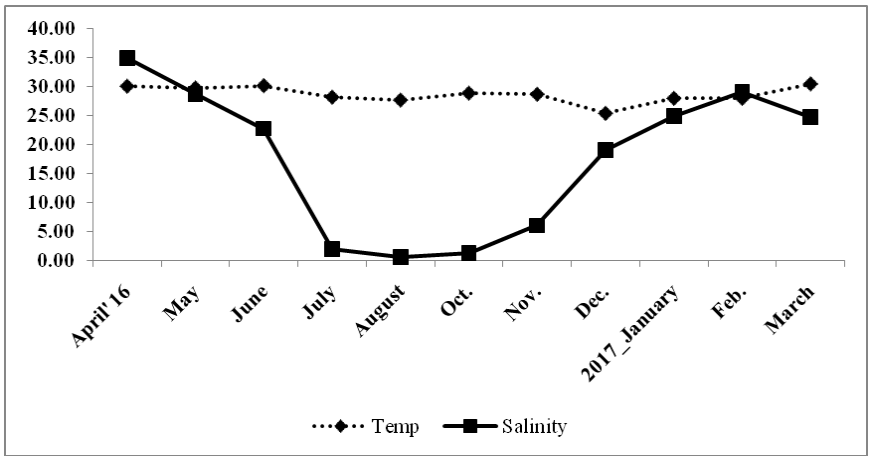


Figure 6: Monthly variation of Temperature and Salinity at Bhairavapalem (2016 to 2017).

Dissolved inorganic nutrients showed marked variation throughout the study period. Chlorophyll is measured as the majority dependable key of phytoplankton biomass. This ratio provides the first hand information on the physiological status of phytoplankton. The elevated absorption of Chl *a* observed in the stations may be due to the monsoonal overflow wherein high concentration of nutrients are bring into these environments interesting a rich phytoplankton intensification.[10] The low values observed during non-monsoon period may be due to its consumption by phytoplankton as marked by elevated photosynthetic activity and also due to the coastal water domination, which restricted irrelevant amount of nitrate.[11,12,13] The relatively high concentration of nitrite observed during monsoon period at Godavari estuary could be due to addition of nutrient rich fresh water into coastal domain.

In the current study, ammonia was found to be high in the Godavari estuary during monsoon period, may be

moderately due to the death and consequent breakdown of phytoplankton as well as the excretion of ammonia by planktonic species [14]. The terrestrial effluents mixing up with estuary may also have contributed to the high content. Phosphate constitutes the most significant inorganic nutrient that can limit the phytoplankton production in tropical coastal ecosystems [15] and thereby the overall ecological processes (Figure 7 and 8). Phosphate assimilation in coastal waters depends upon its addition in the river water that mixed with the coastal water within the land–sea interaction zone, phytoplankton uptake, addition through confined to a small area upwelling, and replenishment as a result of microbial decay of organic matter.[16,17,18,19,20, 21, and 22] In general, the average concentrations of NO_2-N and NO_3-N at the stations.

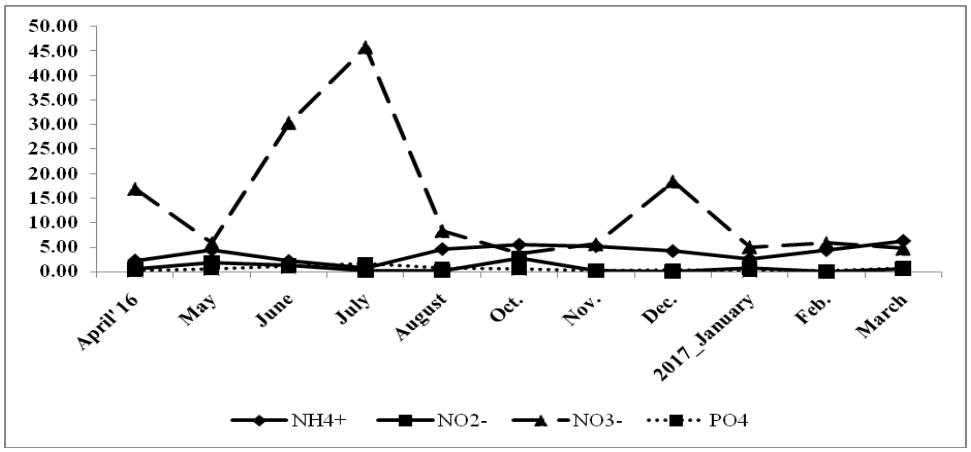


Figure 7: Monthly variation of Nutrients at Vruddha (2015 to 2016).

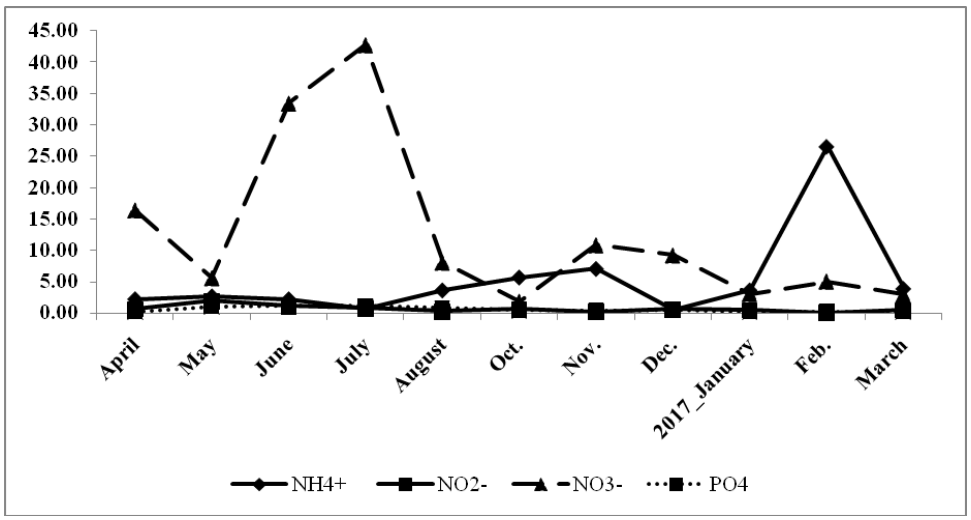


Figure 8: Monthly variations of Nutrients at Vruddha (2016 to 2017).

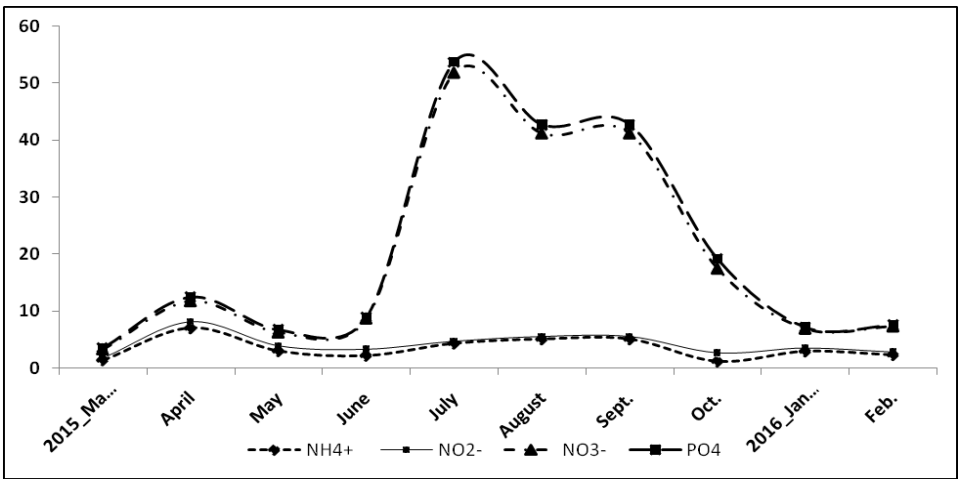


Figure 9: Monthly variation of Nutrients at Bhairavapalem (2015 to 2016).

It indicates the influx of anthropogenic inputs and waste discharges containing nitrogen and phosphorous compounds from river runoff into this environment. The life sustaining processes in the water requires an array of inorganic materials, but the role of nitrogen; phosphorus and silicon are measured vital in aquatic environment. Among nitrogenous nutrients, nitrite, nitrate and ammonia are the major constituents which play key roles in the phytoplankton growth and proliferation (Figure 10).

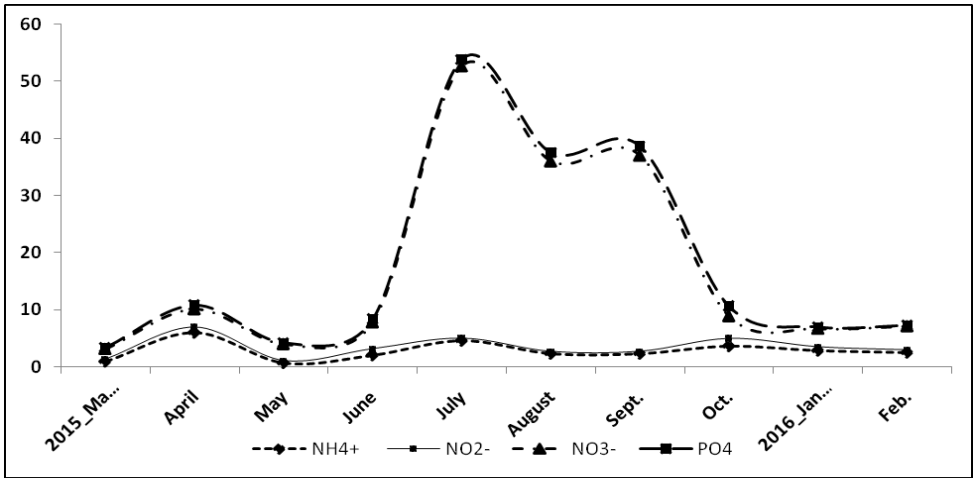


Figure 10: Monthly variation of Nutrients at Bhairavapalem (2016 to 2017).

CONCLUSION

In conclusion, it can be said that seasonality is the major factor in determining the environmental factors in the estuarine system. Indian coast associated with changes in temperature, salinity and nutrient concentration. The interrelationship between two biophysical parameters, like chlorophyll-a and temperature has shown characteristic relationship as mutually exclusive but time and again, inter dependent in view of different environmental conditions of the ecosystem. Seasonal variations were clearly observed which were primarily regulated by environmental variables like nutrient availability salinity and temperature variations.

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