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SEASONAL VARIATIONS IN PHYSICO-CHEMICAL PARAMETERS OF KALI ESTUARY, WEST COAST OF INDIA

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ABSTRACT
The present study was carried out to determine the monthly and seasonal physico- chemical characteristics of water in Kali Estuary South west coast of India, from February 2016 to February 2017. The study revealed that the physico- chemical parameters like atmosphere temperature, water temperature, transparency, hydrogen ion concentration, total dissolved solids, salinity, dissolved oxygen, and nutrients like nitrate, phosphate and silicate exhibited considerable seasonal and spatial variations. The study showed that the Kali Estuary is in a good state of health.

KEYWORDS: Kali Estuary, South west coast, physico- chemical, parameters.

INTRODUCTION

Estuarine and coastal areas are complex and dynamic aquatic environment (Morris *et al*., 1995). When river water mixes with seawater, a large number of physical and chemical processes take place, which may influence the water quality. Rivers play a major role in assimilation or carrying off of the municipal and industrial wastewater and runoff from agricultural land, the former constitutes the constant polluting source whereas the later is a seasonal phenomenon. Many studies have been carried out so far on physicochemical parameters of various estuaries of India (Ashok Prabu *et al*., 2008, Mary Helan *et al*., 2011, Anila Kumari *et al*., 2007, Muduli Bipra Prasanna *et al*., 2010, Jayachandran *et al*., 2011, Prabhahar *et al*., 2011). The present study was carried out for monitoring of the Kali estuary and future ecological assessment. Estuaries are physiologically unique aquatic systems where in the process of mixing of fresh and marine water brings considerable changes in the physico-chemical properties and biological processes (Patterson and Ayyakkannu, 1991; Senthilkumar *et al*., 2002; Prasanna and Ranjan, 2010). Understanding the productivity of these ecosystems will help to reduce the constraints imposed on their threatened biological resources Badsi *et al*., 2012. A few authors have studied the physical and chemical characteristics of some Indian estuaries and mangroves (Satpathy, 1996; Govindasamy *et al*., 2000; Rajasekar *et al*., 2005 and Asha and Diwakar, 2007). The present investigation is an attempt to study few of the physical and chemical parameters of Kali estuary.

Study area

The study was carried out along the lower stretch of the river Kali from the bar mouth up to Halga which is about 25 km away from the bar mouth. Six sampling stations were selected along the river in three different zones. Four of the six sampling stations were situated in the estuary which was within 6 km of radius. The six study stations along the river estuary were Kodibag (Stn 1), Kanasgeri (Stn 2), Kinnar (Stn 3), Halga (Stn 4). One in backwaters *i.e*. Sunkeri backwaters (Stn 5) and another one in Devbag Creek (Stn 6). The study was carried out during the period February 2016 to February 2017.

FIGURE 1: Map showing location of sampling sites along River Kali

MATERIALS & METHODS

Physico-chemical analysis of Kali Estuary was carried out on monthly basis from Feb 2016 to December 2016. Six Study sites were selected along the lower stretch of the river from the bar mouth (Kodibag) up to Halga which is about 25km away from the bar mouth.

The analysis of atmospheric and surface water temperatures was done with the mercury thermometer. pH was measured using a pH meter, while salinity was analyzed by Mohr Kundsen $AgNO_3$ titration method (APHA, 1998). Dissolved oxygen was fixed immediately after collection and then determined by Winkler's method. Nutrients such as Phosphate, Silicate and Nitrate were analysed as per procedure by Strickland and Parsons (1968).

RESULTS & DISCUSSION

The atmospheric temperature varied from 28°C to 33.5°C during the study period. Low Atmospheric temperature was recorded during Post monsoon whereas high temperature was seen during Pre monsoon. The surface water temperature varied from 25°C to 34°C during the study period. Post monsoon season showed a decrease in surface water temp compared to other seasons.

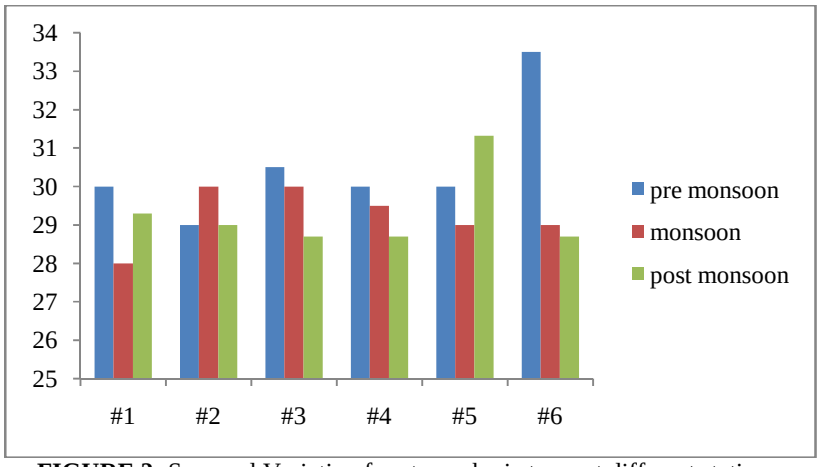

FIGURE 2: Seasonal Variation for atmospheric temp at different stations.

The water temperature during November was low because of strong land breeze, fresh water influx and precipitation. High value during summer (March) could be attributed to high solar radiation (Govindasamy *et al*., 2000). The surface temperature may be influenced by the intensity of solar radiation, evaporation, fresh water influx, cooling and flow from adjoining neritic waters (Govindasamy *et al*., 2000, Saravanakumar *et al*., 2008). As observed by several workers like Desai, (1992), Arthur (2000) Saravanakumar *et al*. (2008) in the west coast of India, the present work also showed summer peaks and monsoonal troughs in air and water temperature.

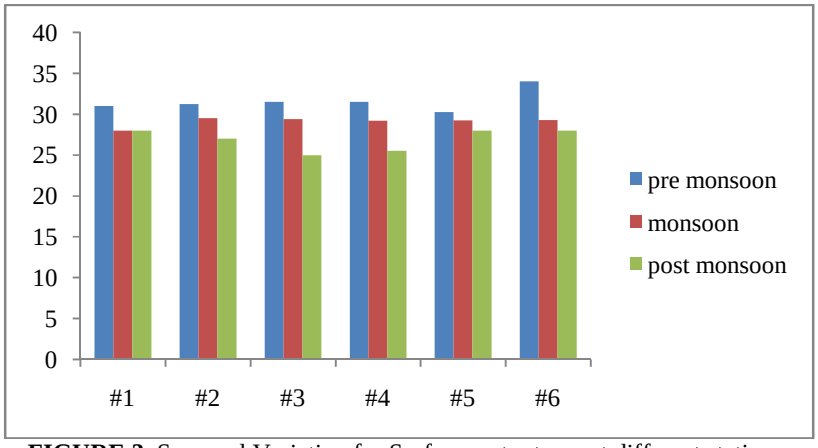

FIGURE 3: Seasonal Variation for Surface water temp at different stations.

Salinity showed a variation from 0.5 to 34.5 in the river stretch along the river Kali. Salinity was always less in the upper stretch of the river, while it was more in Lower area, Back water and Creek. Season wise it showed a wide fluctuation with lowest being in monsoon and highest during Pre monsoon. High salinity values may be due to high rate of evaporation, low rainfall and absence of river discharge. The salinity acts as a limiting factor in the distribution of living organisms, and its variation caused by dilution and evaporation is most likely to influence the fauna in the intertidal zone (Gibson, 1982).

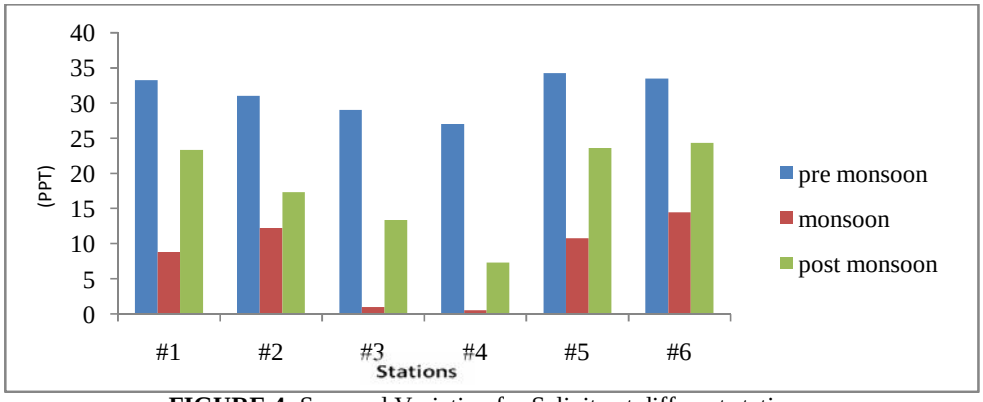

FIGURE 4: Seasonal Variation for Salinity at different stations.

pH Varied from 7.6 to 8.1 during the study period. Seasonally it was seen that high pH occurred during Pre monsoon compared to other seasons. Generally, fluctuations in pH values during different seasons of the year is attributed to factors like removal of CO_2 by photosynthesis through bicarbonate degradation, dilution of seawater by freshwater influx, low primary productivity, reduction of salinity and temperature and decomposition of organic materials as stated by Karuppasamy and Perumal, 2000; Rajasegar, 2003.

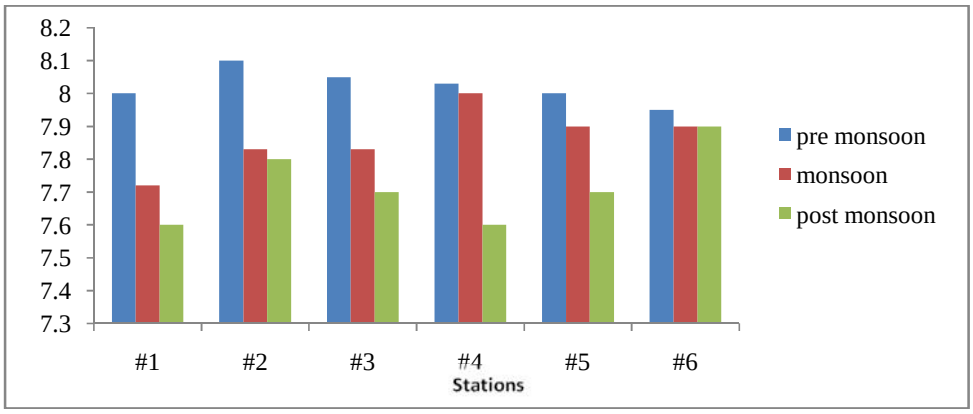

FIGURE 5: Seasonal Variation for pH at different stations.

Dissolved oxygen in surface water varied from 5.07 mg/l to 6.5 mg/l. Dissolved oxygen was comparatively high during monsoon season than other seasons. It is well known that the temperature and salinity affect the dissolution of oxygen (Vijayakumar *et al*., 2000). In the present investigation, higher values of dissolved oxygen were recorded during monsoon, and this might be due to the cumulative effect of higher wind velocity, rainfall and the resultant freshwater mixing (Das *et al*., 1997). Mitra *et al*. (1990) mainly attributed seasonal variation of dissolved oxygen to freshwater flow. DO is an indicative of the health of an aquatic system, the vital metabolism of aerobic organisms, such as respiration depends purely on the amount of oxygen dissolved in the water. Optimum concentration of dissolved oxygen is essential for maintaining the aesthetic qualities of water as well as for supporting life.

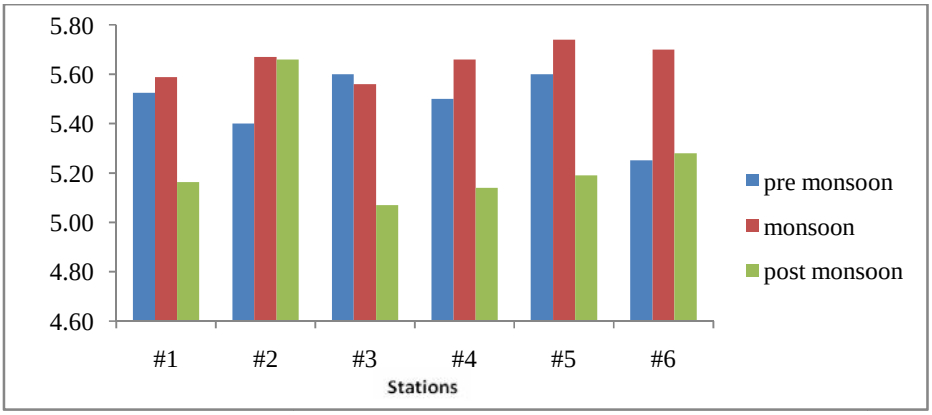

FIGURE 6: Seasonal Variation for Dissolved Oxygen at different stations

Nutrients are considered as one of the most important parameters in the aquatic environment influencing growth, reproduction and metabolic activities of living being. Distribution of nutrients is mainly based on the season, tidal conditions and freshwater flow from land sources. Phosphate varied from 0.02 mg/l to 0.11 mg/l during the study period. High level of phosphate was present in the river during the monsoon season compared to other season. The observed high level of Phosphate during monsoon season might possibly be due to intrusion of upwelling seawater into the creek, which increased the level of phosphate (Nair *et al*., 1984) The recorded low phosphates value during dry seasons could be attributed to the limited flow of freshwater, high salinity and utilization of phosphate by phytoplankton (Senthilkumar *et al*., 2002; Rajasegar, 2003). High level of Phosphate was seen in all the seasons at the station located in the backwater and creek.

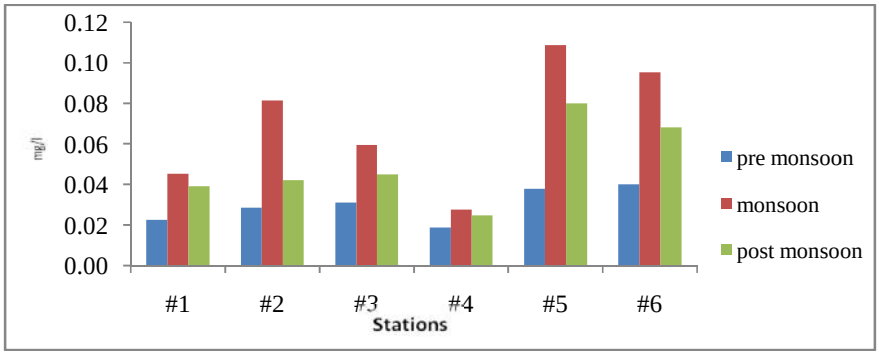

FIGURE 7: Seasonal Variation for Phosphate at different stations.

Nitrate ranged from 0.97 mg/l to 4.19 mg/l during the study period. High level of Nitrate was seen during the monsoon period compared to other seasons. When compared to the other stations backwater and creek showed high level of nitrate.

Nitrate levels over 10 mg/l in natural waters normally indicate man made pollution, but the measured values in this study were within the limited range. Nitrate, phosphate and silicate are important parameters of river water showing the pollution status and anthropogenic load in river water (Khan and Khan, 1997).

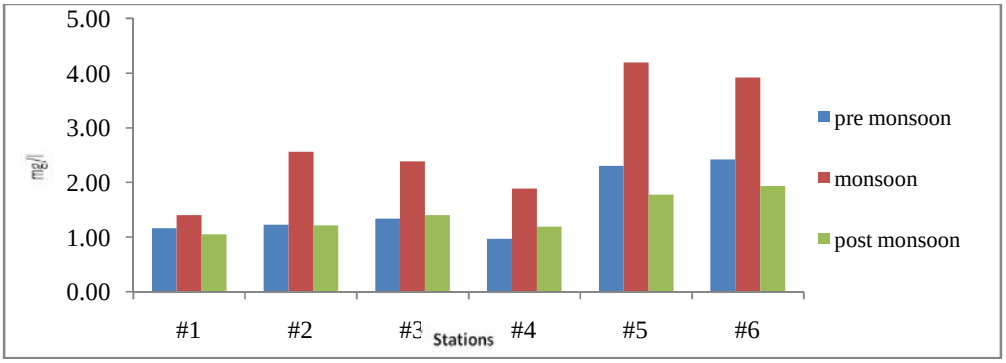

FIGURE 8: Seasonal Variation for Nitrate at different stations

Silicate ranged from 1 mg/l to 3.6 mg/l at the study station. Silicate showed similar trend of increased values in monsoon as compared with other nutrients. Silicate obtained in backwater and creek was more compared to the other stations.

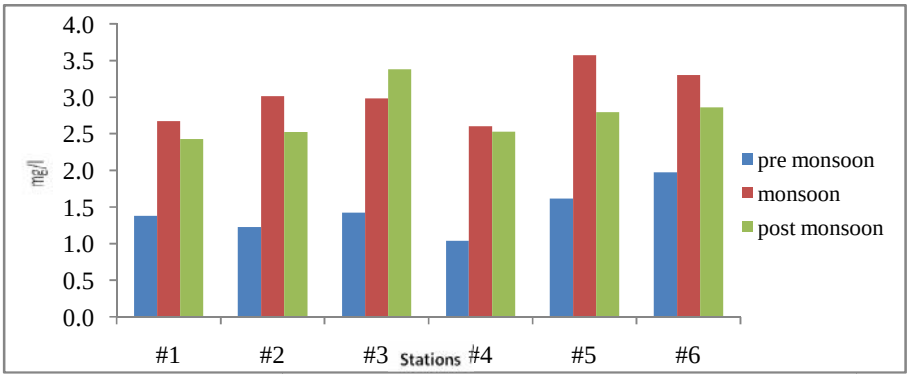

FIGURE 9: Seasonal Variation for Silicate at different stations

CONCLUSION

The water quality of the River Kali is relatively safe with respect to physiochemical parameters recorded in this study. Huge patches of mangroves are present on both sides of the river, with maximum growth occurring in backwater and creek. The availability of the nutrients in these regions is more compared to other regions in the river which is the reason why there is good resource of biotic organisms in the river Kali. The overall study suggests that the health of estuarine ecosystem of Kali River is found to be in a good state for the floral and faunal community thriving in the area.

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