Seasonal Response of Water Temperature of Lake Rudrasagar, in Relation to some Physico-chemical Characteristics

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Abstract—*Aquatic environment of a lake is greatly effected by changes in various physico-chemical characteristic of lake water and so the water quality is controlled by these parameters. A change in local climatic condition affecting meteorological forcing would affect the thermal structure as well as vertical transport by mixing which impacts the flux of nutrients and dissolved oxygen of lake also. The entry in nutrients in any water body is able to increase the biological activity of lake. Temperature puts a signature on the major physico-chemical and biological actions in inland water bodies influenced by the environmental intrinsic and extrinsic parameters. In this paper correlation results for Physico-chemical and bacteriological characteristics of lake water like Dissolved Oxygen (DO), Biological oxygen Demand (BOD), chemical oxygen demand(COD), electrical conductivity(EC), Total dissolved Solid(TDS) and pH value with surface water temperature has been investigated for the lake Rudrasagar , a natural lake of Tripura during one complete seasonal cycle. With in this time domain there exist good correlations among these parameters and surface water temperature. The present study also displays the seasonal variations of various physico-chemical parameters of this lake water. The productivity of this lake is very much influenced by such physico-chemical and bacteriological characteristics.*

Keywords: *Rudrasagar lake, DO, BOD, TDS, EC, COD*

1. INTRODUCTION

Temperature is one of the main meteorological driving factors that can control several major physico-chemical and biological actions in inland water bodies of a lake ecosystem.(Kumar et al., 1996) The biogeochemical activity influenced by the environmental intrinsic and extrinsic parameters is also controlled by the lake water temperature. (mihir et al., 2014). Metabolic and physiological behavior of aquatic ecosystem is also controlled by surface water temperature. Again the surface water temperature varied according to the seasonal fluctuations of atmospheric temperature. Several physico-chemical and bacteriological characteristics of lake water are in turn responsible for maintaining the lake water quality suitable for human consumption. Depletion of aquatic biota and deterioration of water quality are influenced by different anthropogenic activities and unsustainable practices followed by stakeholders including the farmers. (Rafifullah et al., 2012). In the Wetlands of TipturTaluk and Karnataka fluctuation in the physico-chemical characters of the water is due to in flow and change in the temperature as season changes. (Jagadeshappa et al, 2011) Physico-chemical parameters can also influence the growth of phytoplankton population. (R. Rani and K. Sivakuma et al, , 2012). Seasonal Changes in Phytoplankton Community were studied and correlated with physico-chemical factors to note the influence of change in aquatic environment on the population of phytoplankton. (Shiddamallayya, N. and M. Pratima et al, 2011).

The present study explores the seasonal variations of various physico-chemical and bacteriological parameters of the water of lake Rudrasagar – a natural lake in western Tripura for the period of one complete seasonal cycle. Correlation of these physico-chemical and bacteriological parameters with surface water temperature of this lake for this period has also been studied here. Several physico-chemical factors influences the biological productivity of the water body for which numerous organisms can make aquatic medium suitable for their habitats. So this study may also be helpful for following the seasonal variation of water quality of this lake in relation to primary productivity.

2. MATERIALS AND METHODS

2.1 Study area

Geographically the Rudrasagar Lake (23°29′ N and 90°01′ E), a floodplain wetland of Gumti river is located in the Melaghar Block under Sonamura Sub-Division and is about 50 km from the state capital of Tripura. Hydro morphologically, Rudrasagar lake is a natural sedimentation water reservoir, that has three

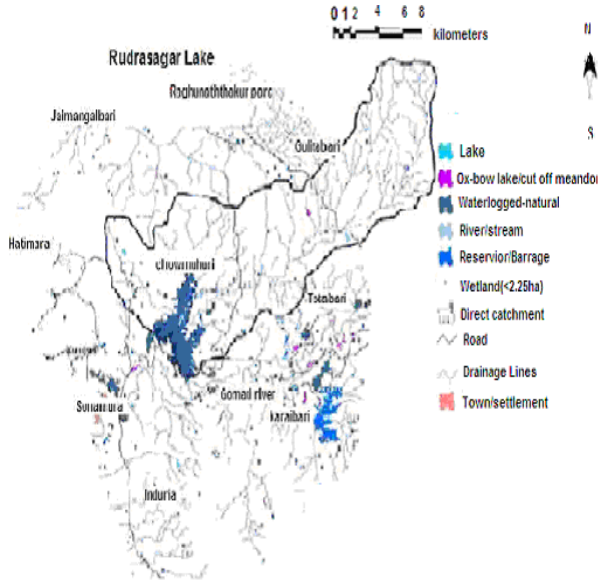

Figure 1.Map for Study Site of Rudrasagar lake based on Resourcesat-1 LISS-III(courtesy ISRO)

evergreen types of influx namely, Noacherra, Durlavnaraya cherra and Kemtali cherra.The actual sediment particles transferred along with the flow and takes up residence within the tank in the occasion as well as the apparent clear water discharges into the river Gomati through a connective route that is

Kachigang just as one outflow. Consequently no rock enhancement can be found having 50m is actually silt (Clay loam) and also down below enhancement is actually sandy. Encompassing hillocks are generally involving delicate sedimentary enhancement. Average water basin area of the lake has been identified 1. 95 sq kilometer throughout the entire observation periods

2.2 Sampling details: The sampling stations are selected considering the maximum water depth along the mid reach and considering the less human intervention of water of the lake. Temperature, TDS, EC, DO and pH are recorded by multipurpose water quality analyzer device. Data are stored in memory cells of the device which are then transferred to the database of the computer. The water quality analyzer device is usually calibrated before the field work in every sampling day following the laboratory methods (APHA, 1989).The water samples from these sampling sites are also been collected using polythene bottle of 1litre capacity in morning session of every sampling day and were analyzed in laboratory to measure BOD and COD by following standard method of APHA.

3. RESULTS AND DISCUSSION

The sampling programme has been carried out during the period of March 2013 to Feb 2014. The seasonal variation of surface water temperature and DO of lake water has been represented in fig.2 and fig. 3 respectively. The amount of gaseous oxygen (O2) dissolved in an aqueous solution can be estimated by measuring its DO value. Minimum water temperature has been recorded as 18.2^0 C in winter season and maximum has been recorded as 32.5^0 C in summer season. Whereas the maximum and minimum DO value

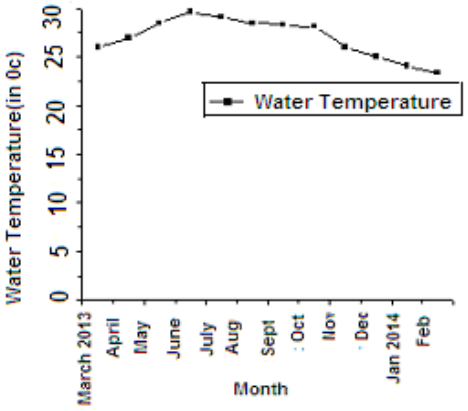

Fig 2 :Seasonal variation of Surface water Temperatur of the lake Rudrasagar

has been recoded as 7.9 in winter period and 3.4 in summer season. During the entire seasonal cyclic period of study the average value of surface water temperature and that of DO value has been calculated as 26.92^0 C ±2.06 and 5.75 ± 1.12 respectively. The extent up to which DO and surface water temperature are associated with each other can be measured by

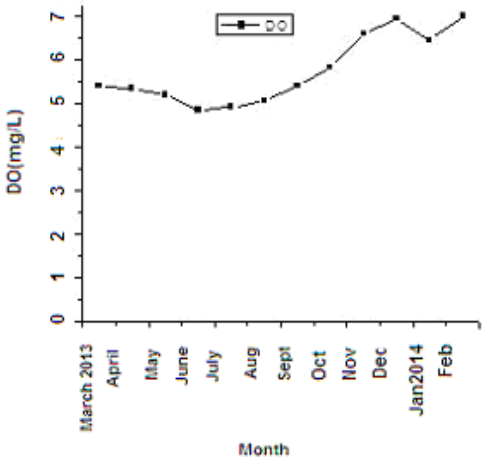

Fig 3 :seasonal variation of DO of the water of Rudrasagar lake

correlation coefficient between these parameters which shows a significant negative value as -0.88247 during the complete season of cycle.

The amount of biodegradable organic material present in a sample of water can be estimated by measuring the

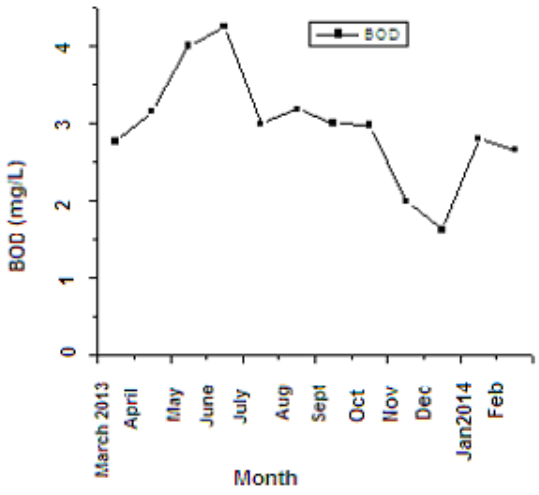

Fig 4 :Seasonal variation of BOD of the water of Rudrasagar lake

value of biochemical oxygen demand (BOD).Seasonal variation of BOD and pH value has been displayed in fig 4 and fig.5 respectively. Maximum and minimum value of BOD has been identified as 4.35 and 1.6 respectively whereas its average value was found as 2.95± 0 .72.Investigation on pH values measured, suggests that maximum and minimum value of pH is 8.75 and 5.23 and has been identified in winter and summer season respectively. Average value of pH has been estimated as 6.605±0.77.

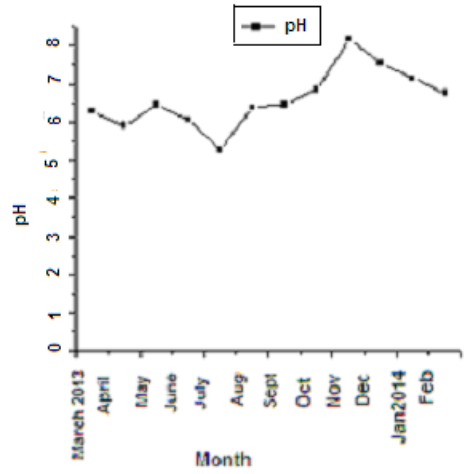

Fig 5:Seasonal variation of pH of the water of Rudrasagar Lake

The extent up to which pH value and surface water temperature are associated with each other can be investigated from the measured correlation coefficient between temperature and pH which was found as -0.571 during the complete seasonal cycle. The biological productivity of lake is very much controlled by the pH of the aquatic body. In the pre-monsoon period the lake water was slightly alkaline .As slightly alkaline conditions are favorable for primary production, this activity is prominent in pre-monsoon period of Rudrasagar lake. Whereas, correlation coefficient between temperature and BOD has been found as 0.6614 during the complete seasonal cycle.

Fig 6 represents the seasonal variation of COD of lake water. COD is an important parameter for judging the extent of pollution in water.(Esmaeili H R and Johal M S et al., 2005) The minimum and maximum value of COD measured during the entire season is measured as 36.25 and 112.37 respectively whereas the mean value was obtained as 72.96± 24.33. COD shows a highly significant positive correlation coefficient having value .86105 with surface water temperature for this lake.

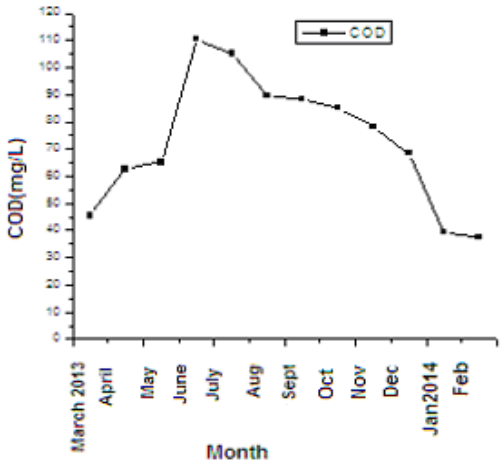

Fig 6 :Seasonal variation of COD of the water of Rudrasagar lake

Seasonal variation of EC and TDS has been displayed in fig 7 and fig.8 respectively. Maximum and minimum value of EC has been identified as 104.35 and 53.76 respectively whereas its average value was found as 81.18 ± 3.52 throughout the entire season of study.

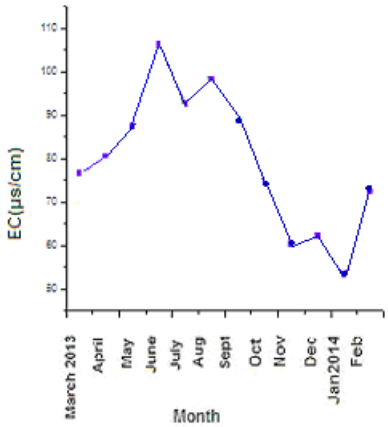

Fig 7: Seasonal variation of EC of th water of Rudrasagar lake

Investigation on TDS measured, suggests that maximum and minimum value of TDS is 68.75mg/L and 35.23mg/L and has been identified in summer and winter season respectively. Average value of TDS has been estimated as 49.242±9.77 throughout the entire seasonal cycle studied. The nutrient status of the water body is controlled by the conductivity of electrolyte.

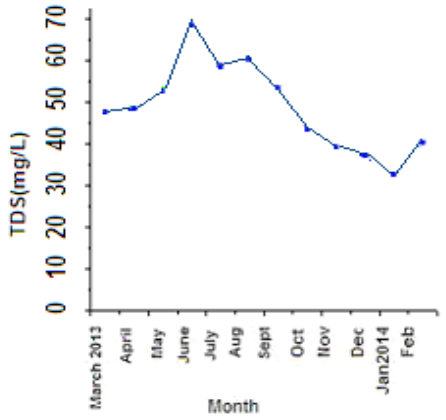

Fig 8 : Seasonal variation of TDS of the water of Rudrasagar lake

Both EC and TDS show a highly significant positive correlation coefficient with surface water temperature for this lake. In case of EC it is .816 and for TDS it is 0.836 respectively. The seasonal variation of EC and TDS of this lake show several spikes in their profile. Dilution of the water source occurs in wet season due to rainfall and thereby decreasing the conductivity level. On the other hand if floodplain contains nutrient-rich soil, previously dry salt ions can enter solution as it is flooded, thereby raising the conductivity level. For such lowering or rising of conductivity level in the seasonal pattern, spikes occur.

4. CONCLUSIONS

Rudrasagar lake is located in the upper catchment area of the river Gumti. Correlation coefficients between various physico-chemical and bacteriological characteristics with surface water temperature reflects how much extent these quantities are associated with surface water temperature. The lake also receives domestic, industrial and agricultural wastewater from its surrounding area. So seasonal variations in physico-chemical and bacteriological characteristics of this lake discussed here are not only affected by average temperature but also by water flow. Since flooding occurs due to heavy rain fall in rainy season, the conductivity is directly depends on water body and surrounding soil.

This study is helpful for following the seasonal variation of water quality of this lake and it may also be helpful in sustainable management of the Rudrasagar wetland. This study also demands that a policy is to be adopted for water allocation linking hydrological, ecological and socio-economic aspects of life, with the involvement of all of the stake holders of Rudrasagar wetland.

5. ACKNOWLEDGEMENTS

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