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Physico-Chemical Studies on Kagzipura and Mombatta Lake, Aurangabad (Maharashtra)

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Abstract: ***Two water bodies, Mombatta and Kagzipura lakes were surveyed for their important physcio-chemical parameters for a year. The water parameters such as temperature, pH, turbidity, total dissolved solids, total hardness, total alkalinity, dissolved oxygen and chlorides were documented from February 2016- January 2017 every month using standard protocols and multiparameter probes. Results revealed the good water quality of the water bodies and this points to the importance of conservation of such waterbodies. Importance of studying such water bodies is discussed.***
Keywords: Freshwater, Kagzipura lake, Mombatta lake, physico-chemical parameters.

I. INTRODUCTION

The earth is covered with 70% water, remaining 30% is land. Ninety seven percent of this water is marine. This percentage itself tells us about the importance of water. Freshwater bodies have a great ecological and economic significance. They are an important source of food, potable water and serve as an ecosystem for various plants and animals. Freshwater is found in lakes, ponds, rivers, streams, dams, reservoirs, wells etc. Specialized habitats like wetlands, beels, bogs, marshes are also present all over the world. Freshwater is water with low (less than 1%) or no salt concentration. Freshwater habitats are found on all the continents of the earth except in Antarctica. Study of inland freshwater ecosystems is generally termed as Limnology. The term "limnology" is derived from the ancient Greek word *limne* which means lake or pond[1]

The biodiversity in freshwater habitats is high as compared to other ecosystems as well. Even though freshwater habitats occupy less than 1% of the earth's surface, they provide a home for more than 10% of all animals and 40% of all fishes. Water is life, but can cause problems to life as well, if altered due to anthropogenic activities . Many researchers have studied fauna of freshwater bodies from India.[2,3,4,5].

Thus, ever increasing urbanization and anthropogenic pressures are taking a toll on these important habitats. Aquatic animals and hydrophytes are affected due to the changes in the habitats, resulting in decrease of their abundance as well as diversity. This has been revealed by many studies. Especially invertebrates and zooplankton are extremely sensitive to changes in the physico-chemical characteristics. Water quality in freshwater ecosystems degrade due to natural eutrophication, but social development and anthropogenic activities are accelerating the process of eutrophication.

Due to the benefits these habitats give continuous monitoring of aquatic ecosystems is needed to understand how pollution and human activities are affecting the flora and fauna contained in them. This baseline documentation of physico-chemical characteristics would be helpful for protection of these habitats stretches and also for planning of further conservation activities.

Two lakes Mombatta and Kagzipura were selected for year around physico-chemical study. Different parameters were selected for measurements and basic statistical analysis was done to see the variations during the study period. There have been few studies on the water bodies of Aurangabad, however it was worthwhile to see the parameters at a different time period.[6,7]

II. MATERIAL AND METHODS

Sampling and collection of zooplankton was done every month from February 2016- January 2017. The collection station was selected on the basis of topography, pollution status, anthropogenic activities, distance, collection efficiency, drying up frequency etc. The aim was to get as many samples as possible without any interference collection was done normally between 9-10 am every time a visit was done at the collection site. Two sites were collection for the year long study, Mombatta lake and Kagzipura lake.

A. Mombatta Lake

The water body is located (latitude 19° 57' 42" N and longitude 75° 13' 24" E) near Daulatabad village (Taluka Khultabad, Aurangabad), at a distance of 15 km from the Aurangabad city. It is about 8.30 meter deep. The Lake is situated in Daulatabad valley and is used for aquaculture [8]

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The ancient city, Devagiri or Daulatabad built in the 12th century by the Yadava Dynasty is currently the Aurangabad district headquarters. Daultabad means "city of prosperity". It is on the way towards Ellora caves and is situated on a hilly upland area. There is not much development and the area are more or less like a village. It is, however, a tourist place because of the Daulatabad fort.

B. Kagzipura Lake

The water body is located (latitude 19° 57' N and longitude 75° 15' E) near Kagzipura village (Taluka Khultabad, Aurangabad), at a distance of 17 km from the Aurangabad city. It is about 8-9 meters deep and is used for fishing and well as irrigation [8].

Physico-chemical analysis were done using standard protocols and methods[9,10]. Parameters like temperature, pH, turbidity, total dissolved solids, total hardness, total alkalinity, dissolved oxygen, free CO_2 and chloride were taken every one month using multi parameter and samples were carried to the laboratory wherever possible. Temperature (°C) was taken using a handheld mercury thermometer on site. pH was taken using Elico pH meter C101/03 made of glass electrodes. Turbidity of the collected samples was estimated using laboratory turbidity meter. The readings were expressed in Nephelometric Turbidity Units (NTU). For determination of total hardness, the verse nate titration method was used. Dissolved Oxygen was calculated using Winkler's titration method.

III. RESULTS AND DISCUSSION

Different physico-chemical factors affect the quality of freshwater in lakes, ponds and rivers. Monitoring these factors is important for aquatic living organisms as fluctuations in the parameters can affect their diversity and abundance. The water properties are affected by its own geography, bottom sediment, run off from terrestrial areas, nutrients and pollutants added in the water bodies.

Following are the results of the yearlong study on the two lakes. The results document the parameters like temperature, pH, turbidity, total dissolved solids, total hardness, total alkalinity, dissolved oxygen and chloride. The results reveal the better condition of water in both the water bodies. The study also warrants the need for protection and conservation of these habitats in future.

A. Total Alkalinity in the two lakes

The alkalinity is a measure of its capacity to neutralize acids and is because of the presence of bicarbonates in water. The Alkalinity for Mombatta lake ranged from 128 to 164 mg/L during the period of the study. The values of Alkalinity differed between the two lakes with higher values observed in Kagzipura than Mombatta. Maximum values were observed in the summer months of April/May while lowest values were seen in the months of July/August. Two peaks were thus observed in alkalinity in both the lakes. The alkalinity values were not consistent through the study period.

The acceptable alkalinity for human usable water is generally between 30-500 mg/l as CaCO3. Water with alkalinity levels greater than 500 mg/l as CaCO3 have bad, unwanted taste.

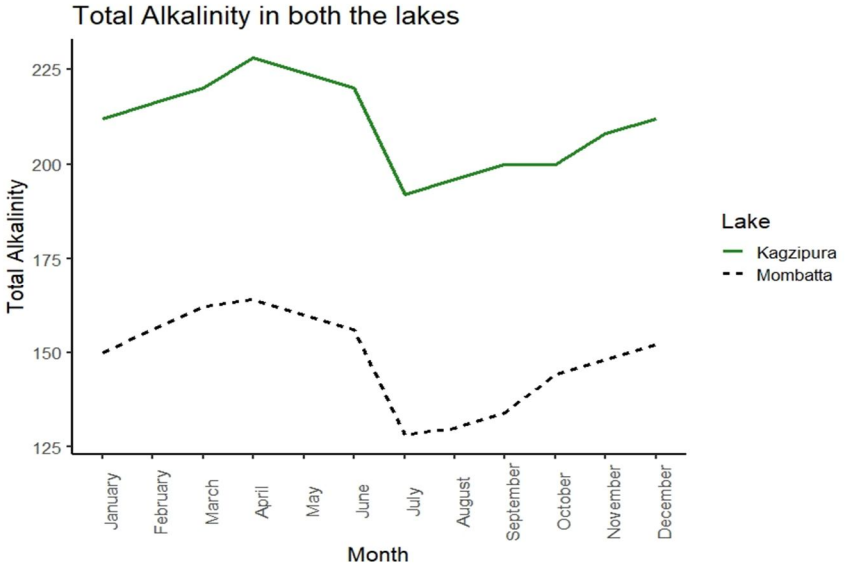


Figure 1: Alkalinity of Kagzipura and Mombatta lakes for all the collection months

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B. Chloride Concentration in the two Lakes

Chloride salts if exceed more than 100 mg/l give a salty taste to freshwater. When combined with Ca and Mg ions, chloride makes the water corrosive in nature. Experts recommend that chloride concentration must not exceed 250 mg/l. Chlorides are highly soluble in water.

The chloride levels for Mombatta lake ranged from 32-50 mg/L during the period of the study. Chloride value of Kagzipura was consistently higher than Mombatta lake. The values between the months did not change much for both the lakes. Chloride concentrations of between 1-100 mg/L are normal in freshwater. The values noted during the study period are well within the permissible limits.

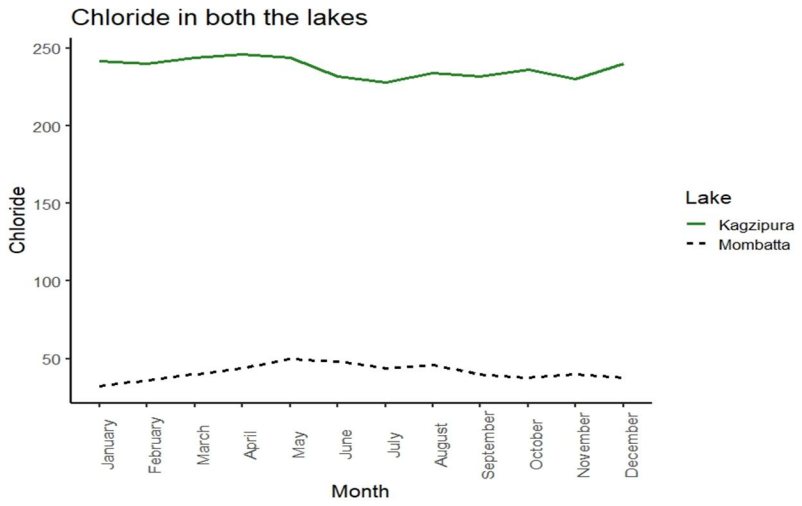


Figure 2: Chloride of Kagzipura and Mombatta lakes for the collection months

C. Dissolved Oxygen Concentration in the Two Lakes

Dissolved oxygen is a measure of how much oxygen is dissolved in the water i.e the amount of oxygen available to aquatic organisms. Itrefers to the level of free oxygen present in water. Oxygen dissolves in water by diffusion from the atmosphere, aeration of the water as it moves over rocks and waterfalls and due to photosynthesis.

The dissolved Oxygen for Mombatta lake ranged from 5-6.8 mg/L during the period of the study. Dissolved oxygen values of both the lakes changed similarly with lowest DO values observed in the month of April. The months of maximum values differed for both the lakes with Kagzipura having maximum values in July while Mombatta showing it in the month of August.

A concentration of 5 mg/L DO is recommended for fishes. Most fishes are stressed when DO falls between 2-4 mg/L. Death may occur if the concentrations fall below 2 mg/L.

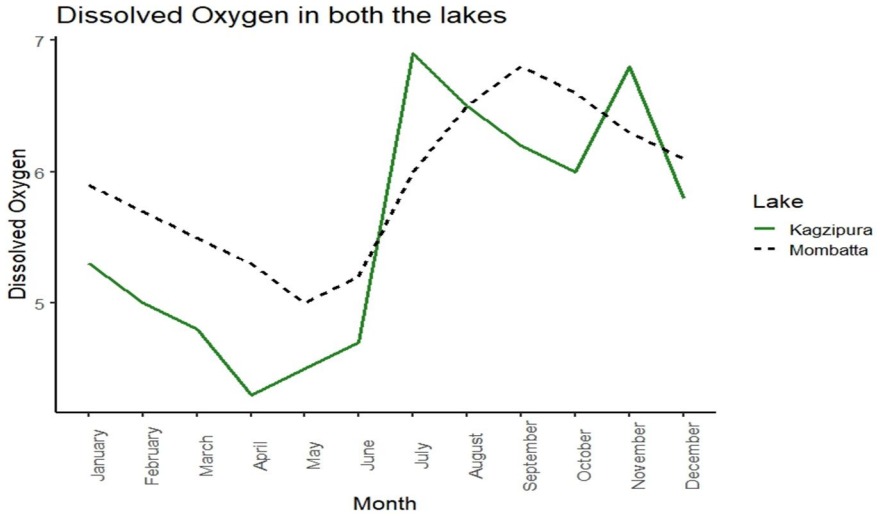


Figure 3: Dissolved of Kagzipura and Mombatta lakes for the collection months

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D. Total Hardness in the two lakes

Total hardness is defined as the sum of the calcium and magnesium concentrations expressed as calcium carbonate in mg/L. Hardness is caused by multivalent metallic cations, though the divalent cation as calcium and magnesium cations are usually the main cause of hardness.

The hardness for Mombatta lake ranged from 188 to 228 mg/L during the period of the study. Kagzipura lake showed higher overall hardness than Mombatta lake. Both the lakes showed similar monthly trends with highest value in month of April and lowest values observed in the month of July.

A value less than 60 mg/L is considered soft water and values above 200 mg/L are considered very hard.

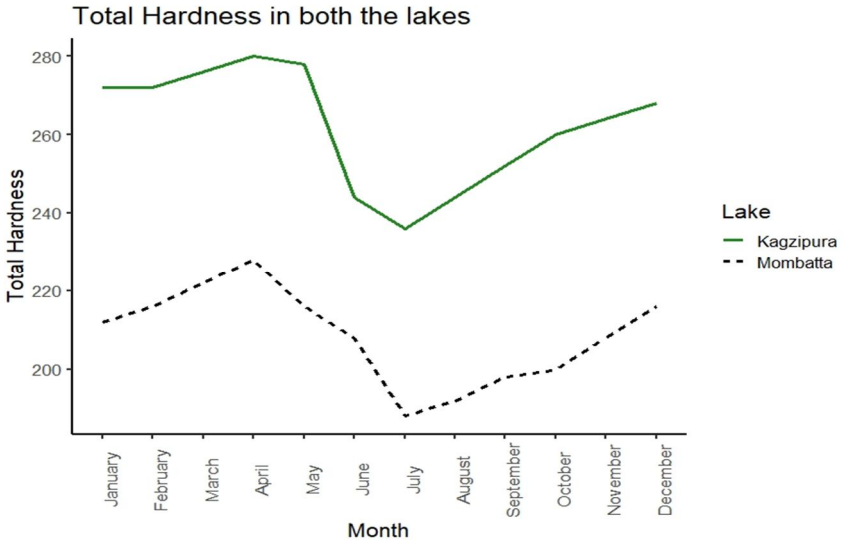


Figure 4: Total hardness of Kagzipura and Mombatta lakes for the collection months

E. Iron Concentration in the Two Lakes

The presence of iron in drinking water cause unpleasant taste and may pathogenic organisms to grow exponentially due to its abundance. Higher than 0.3 mg/l of iron stains laundry and makes utensils reddish-brown. Iron may enter into water from natural sources, wastes from Industries, refining of iron ores and corrosion of metals. Water may turn yellow or brown but may even be colourless.

The iron for Mombatta lake ranged from 0.08 to 0.15 mg/L during the period of the study.Iron content in both the lakes varied differently. Overall values were higher in Kagzipura than Mombatta. Highest value of Kagzipura was observed in March and in month of August for Mombatta. Two lowest values were observed in Mombatta while only single lowest value was observed for Kagzipura.

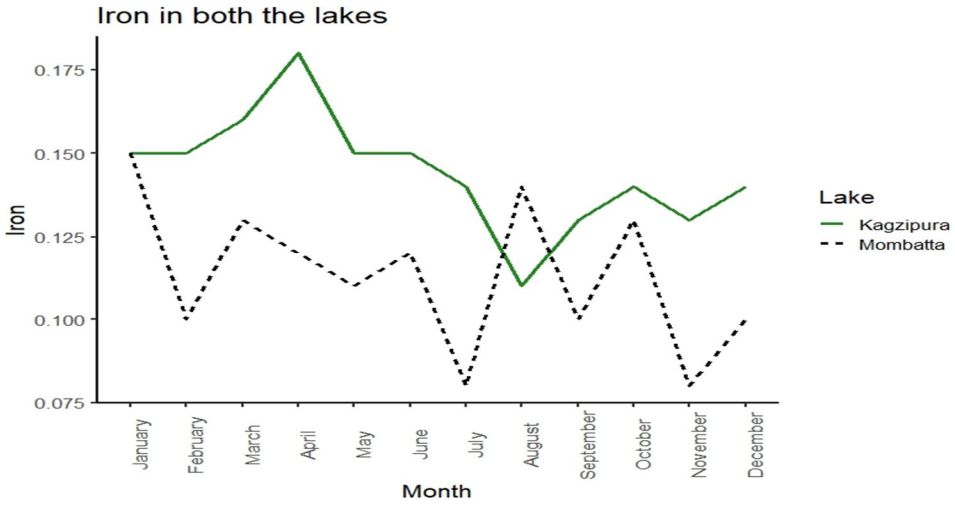


Figure 5: Iron content of Kagzipura and Mombatta lakes for the collection months

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F. pH in the two lakes

pH is a measure of hydrogen ion concentration and a measure of the acidity or alkalinity of a solution. pH stands for the "power of hydrogen. It is a number between 0 and 14 defining how acidic or basic a body of water is along a logarithmic scale.

The pH for Mombatta lake ranged from 6.72 to 8.22 during the period of the study. pH values varied similarly in both the lakes with higher values seen in Kagzipura after the month of July and were slightly higher in Mombatta in months of May and June. Highest value was observed in March for both the lakes.

Any fluctuations within the optimum range will disrupt the biochemical reactions, metabolic reactions, disable the enzymes and result in death due to stress of the organism. Most aquatic organisms prefer a pH range within 6.5-9.0 units. The pH during the study period lies well within the optimum limits.

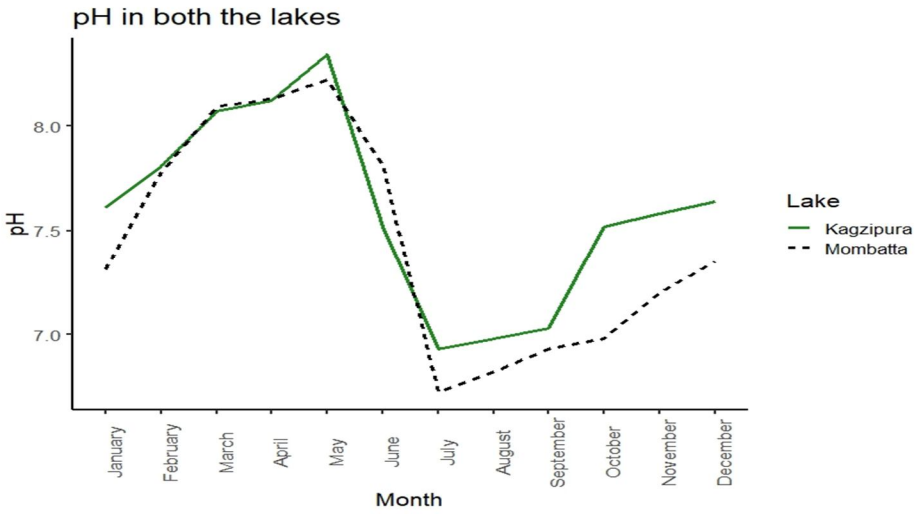


Figure 6: pH of Kagzipura and Mombatta lakes for the collection months

G. Sulphate Concentrations in the two Lakes

Sulfates are a part of naturally occurring minerals in some soil and rocks have come across some groundwater. In higher amounts, Sulfate in combination with other salts gives a bitter taste to drinking water.

The sulphates for Mombatta lake ranged from 26 to 34 mg/L during the period of the study.Mombatta lake had lower concentrations of sulphates than Kagzipura. The values of Kagzipura remained stable from January until June and were the highest values observed for that lake. Mombatta lake showed highest value in the month of April while lowest value was seen in October.Concentrations upto 500 mg/l may be considered safe for drinking. The sulphate concentration in the study period lies well below the permissible limits.

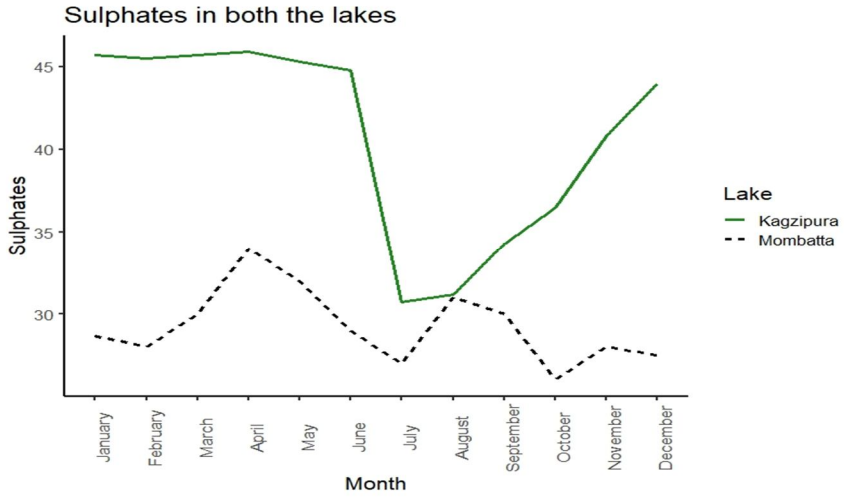


Figure 7: Sulphate concentration of Kagzipura and Mombatta lakes for the collection months

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H. Total Dissolved Solids in the two Lakes

The TDS for Mombatta lake ranged from 245 to 268 mg/L during the period of the study. There was a distinct difference in the TDS values of both the lakes with higher values seen in Kagzipura. There was not much monthly variation seen in both the lakes

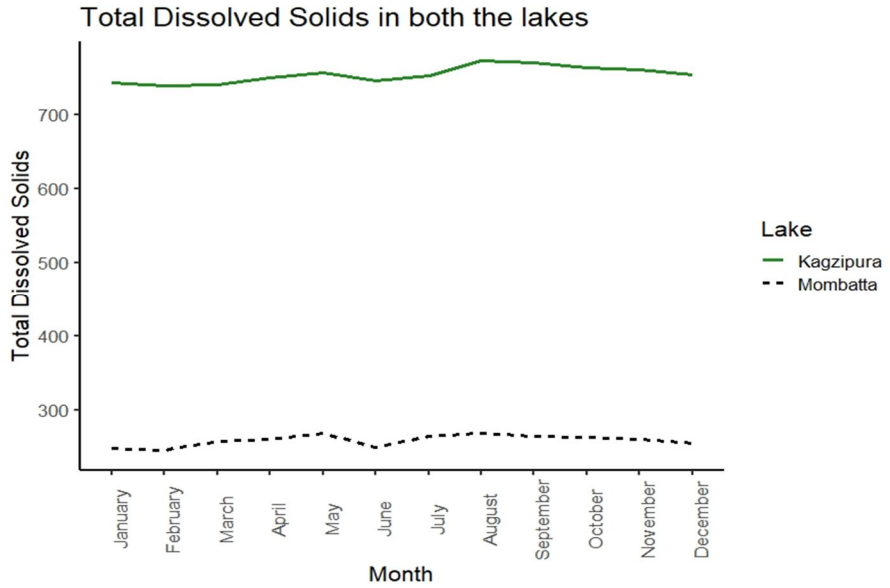


Figure 8: Total Dissolved Solids of Kagzipura and Mombatta lakes for the collection months

I. Water temperature in the two lakes

Temperature is one of the most important drivers of water chemistry and biology. Temperature fluctuations influence other water physical and chemical parameters such as density, Dissolved Oxygen availability, photosynthesis rates, ORP, pH, conductivity, salinity et. Temperature also affects the distribution of organisms, vertically and horizontally like moving to warmer or cooler water after feeding, predator-prey interactions, resting or migration patterns.

The temperature for Mombatta lake ranged from 15.6 to 27.2 degree Celsius during the period of the study.Temperature value trends were similar for both the lakes. Highest values were seen in May while lower values differed between both localities. Mombatta had a lower minimum temperature than Kagzipura.

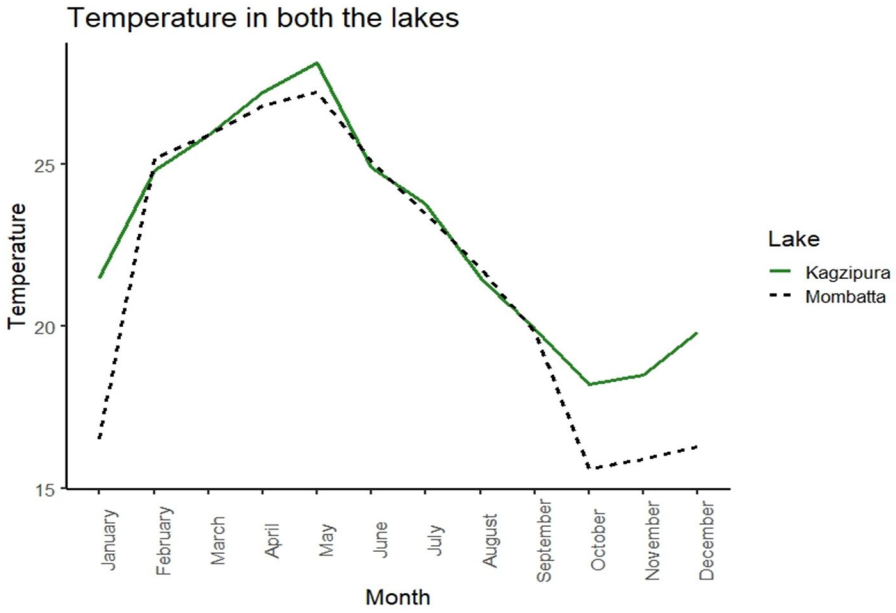


Figure 9: Water temperature of Kagzipura and Mombatta lakes for the collection months

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J. Water Turbidity in the two Lakes

Turbidity and clarity depend on the TSS (Total suspended solids). TTS is due to particles larger than 2 microns found in the water. Suspended solids are inorganic particles, bacteria and algae.

The water turbidityfor Mombatta lake ranged from 8 to 12.1NTU during the period of the study. Kagzipura lake was more turbid than Mombatta lake with highest turbidity seen in the month of July. Mombatta had consistently lower values of turbidity but peaking in the same month as that seen for Kagzipura

TSS significantly affects the clarity of water. More TSS results in less clarity and vice versa. Turbidity is an optical measurement of how clear the water is. Turbidity is a measure of water clarity. The turbid water will mostly be cloudy, murky, and colored, affecting visibility of aquatic organisms. TSS and turbidity measurements are important water quality testing parameters.

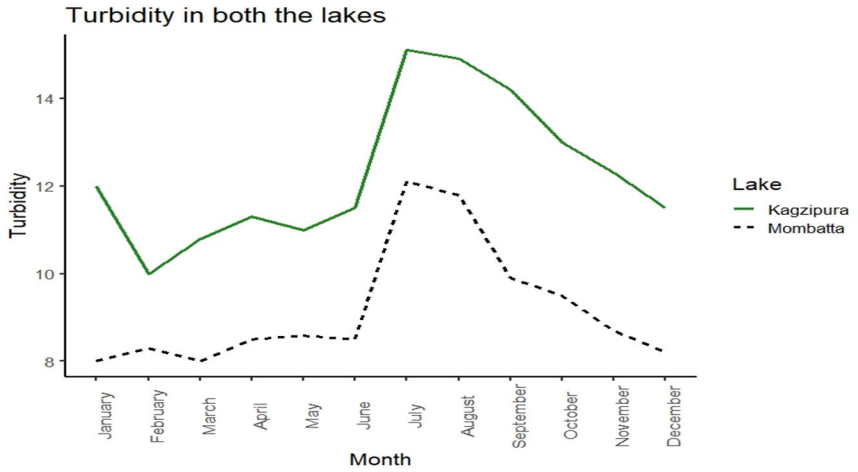


Figure 10: Water turbidity of Kagzipura and Mombatta lakes for the collection months

K. Overall Data Summary of Kagzipura and Mombatta lakes

Following are the mean, mediam and standard deviation values for Kagzipura and Mombatta lakes

1) Kagzipura lake

Environmental variable	mean	median	Std dev
Chloride	237.33	238	6.11
Dissolved Oxygen	5.57	5.55	0.92
Iron	0.14	0.15	0.02
pH	7.6	7.6	0.45
Sulphates	40.87	44.4	6.01
Temperature	22.84	22.65	3.4
Total Alkalinity	210.67	212	11.61
Total Dissolved Solids	753.5	753	11.26
Total Hardness	262.17	266	14.9
Turbidity	12.3	11.75	1.66

Table 1: Table giving the data summary of environmental variables collected from Kagzipura lake

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2) Mombatta lake

Environmental variable	mean	median	Std dev
Chloride	41.33	40	5.21
Dissolved Oxygen	5.91	5.95	0.58
Iron	0.11	0.12	0.02
pH	7.45	7.33	0.54
Sulphates	29.27	28.85	2.27
Temperature	21.63	22.65	4.59
Total Alkalinity	148.67	151	12.34
Total Dissolved Solids	258.75	260.5	7.74
Total Hardness	208.67	210	12.13
Turbidity	9.18	8.55	1.41

Table 2: Table giving the data summary of environmental variables collected from Mombatta lake

IV. CONCLUSION

The yearlong study on the two water bodies revealed the good quality of the habitats. Baseline documentation of physico-chemical data is important for protection of such kind of habitat and also the organism living in the water bodies. Fish, birds, amphibians and plankton are dependent on such kind of habitats. Proper documentation of water parameters and biotic components is necessary for the implementation of conservation activities. This study will make a way for more detailed studies in future.

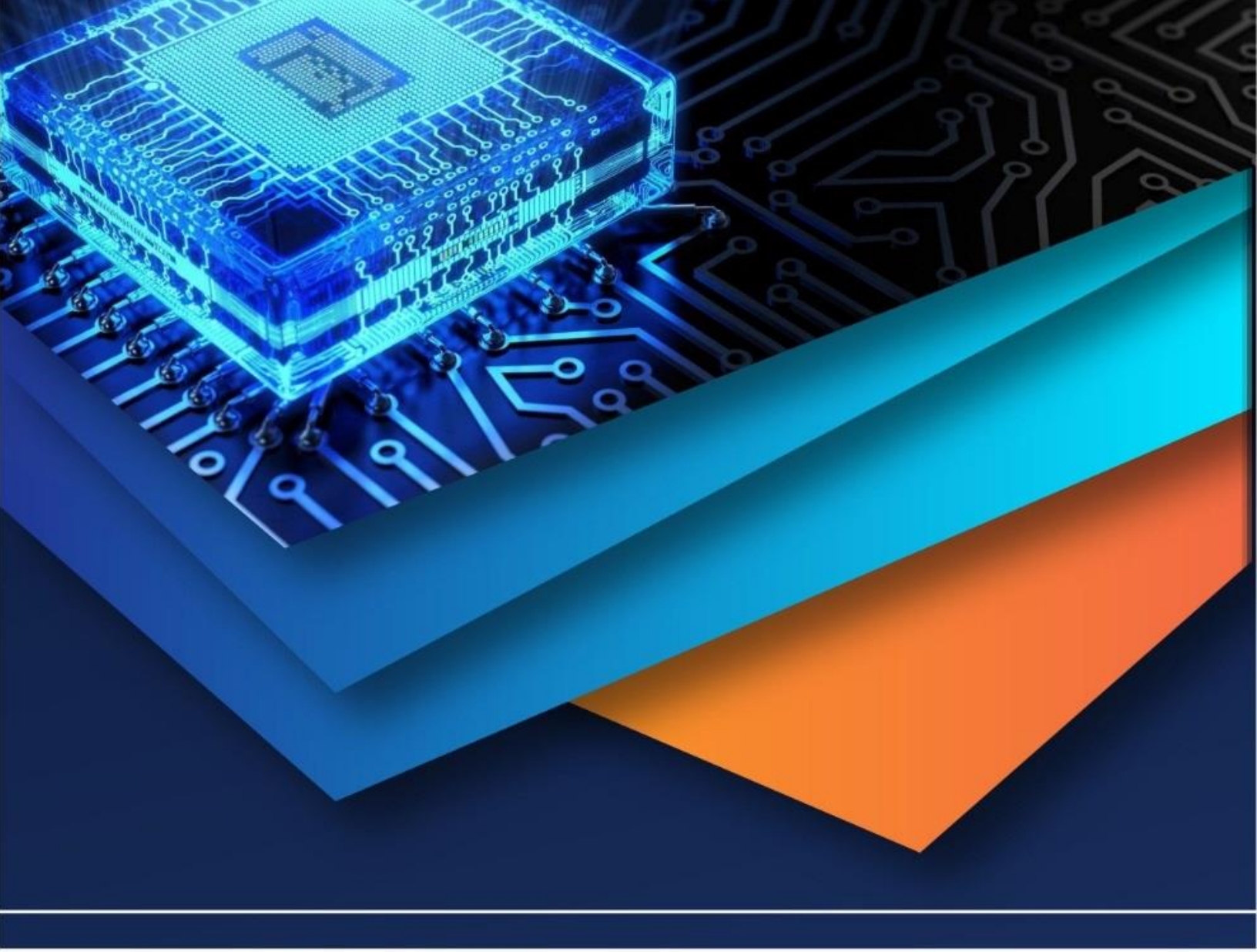
V. ACKNOWLEDGMENTS

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