Monthly study of some physicochemical parameters associated with organic input in Gandhisagar lake of Umrer, Nagpur District, (M.S.), INDIA.

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Abstract: *The use of water by human, plants and animals is universal. Every living thing requires water. Public health depends on having safe and easily accessible water for drinking, household use, food production, and recreation. Improving sanitation and water supply as well as effective water resource management can support a countries economic growth and help to reduce poverty. This study focuses on the investigation of some physicochemical parameters of water in Gandhisagar lake, Umrer in Nagpur district (M.S.), India were analysed for one year from November 2022 to October 2023.Various physicochemical parameters like Alkalinity, Turbidity, Nitrate and Phosphate were evaluate. Several physicochemical properties exhibit notable seasonal change,according to the data during the study period.*

Key words: *Gandhisagar lake, Umrer, Physicochemical parameters, Seasonal variation.*

INTRODUCTION:

Water not only sustains life but also serves as the primary inorganic component, constituting about three-fourths of the weight of living cell. Its significance spans various biological and physical processes, given its universal solvent properties. Certainly water functions as a medium for temperature regulation and offers essential support to both plants and animals. Target 6.1 of the sustainable Development Goals promotes equal and widespread access to clean, affordable drinking water.Traditionally, lakes and reservoirs have been evaluated using static morphological or chemical characteristics, like depth and dissolved solids [8]. Freshwater lakes face considerable variations in water levels as a result of climate change and human activities[24]. The contamination of lakes had directly impact on human health as well as virtually every facet of the ecosystem [13]. It holds significant importance in every ecosystem, regional hydrology and economy[2]. Studying hydrobiology provides crucial insights into the principles of life, its sustainability,its diverse forms, and the various levels of existence on earth's surface[17]. Water quality is shaped by its physical, chemical, and biological properties, and understanding the connections between these elements can offer a precise evaluation of its overall condition[10]. Physicochemical parameters are instrumental in comprehending the factors that influence the quality of lake water [18]. It is strongly believed that lakes and reservoirs cannot maintain high fertility without a constant influx of nutrient from external sources[15].

Many lakes, particularly those near urban or residential areas are polluted to different extents due to human activities. The degradation of these lakes persists not only by the inflow of industrial effluents but also by domestic sewage, immersion of idols and various other practices such as laundry, cattle washing and improper waste disposal in the vicinity of the lake [9]. Urban lakes play a crucial role in balancing both surface and groundwater within the ecosystem [20]. Maintaining lake water quality requires regular monitoring in order to protect and maintain its appropriateness for the urban ecosystem. India boasts abundant freshwater resources however, rapid industrialization, population growth and various human activities have led to severe pollution of these water sources with numerous harmful contaminants [14]. Freshwater is an exceedingly valuable resource whose importance is growing with each passing day. The combination of high population densities, urbanization, modern agricultural practices, and various human activities posses significant challenges to maintain water quality. Achieving good water quality relies on careful monitoring of numerous

physicochemical parameters. In addition to evaluate the lake's pollution levels, the research attempts to investigate the physical and chemical properties of water.

To obtain a comprehensive understanding of water quality, data from various parameters indicative of quality can be compiled into an overall index known as the Water Quality Index (WQI).WQI can be defined as a rating system that reflects the combined impact of different water quality metrics on the general state of the water. It serves as a valuable tool for raising public awareness and developing policies aimed at enhancing water quality. The water from Gandhisagar lake is currently utilized for various domestic purposes, including agriculture and fishing. Many investigations have been conducted to assess the physicochemical characteristics of water to determine its quality.

Material and Method:

Umrer is a town and municipal council located in the Nagpur district of Maharashtra, India. Umrer is located at 20 51'14 N and 17 19' 29 E. It belongs to vidarbha region. It is located 48KM towards South from district head quarter Nagpur. It is taluka head quarter. The Umrer Karhandla Wildlife Sanctuary, widely regarded as the area's biggest attraction is situated close to the city.

Five sampling sites are selected for lake water sample to monitor human activities along the lake. The location of Station A is in the lake's eastern region. Station B is situated in the northeastern portion of the lake. Station C is located in the northern part of the lake.The southeast corner of the lake is where Station D is located. Station E is situated in the lake's southernmost region. Sampling was performed in the early morning, between 8:00 am and 10:00 am. Samples were taken with 3-liter plastic bottles from a depth of 15-20 cm below the water's surface, with the bottles inverted to collect the water. These samples were sent to the lab right away so that different physicochemical properties could be measured and tested routingly in the laboratory using established methods recommended by [1] as well as by [7] and [19].

RESULT AND DISCUSSION:

Seasonal variation in physicochemical parameters of Gandhisagar lake water at Station 'A' Umrer presented in table below:

Table 1. Monthly mean variation in Alkalinity (mg/L) of Gandhisagar lake water during October 2022-September 2023.

Stations Month	Station A Mean ± S.E	Station B Mean ± S.E	Station C Mean ± S.E	Station D Mean ± S.E	Station E Mean ± S.E
Oct	190 ±2.12	248 ±1.04	242 ±1.12	180 ±2.04	270 ±1.34
Nov	182±1.10	240±0.94	232±0.66	178±0.59	260±0.90
Dec	171±0.73	237 ±0.86	230±1.08	168±1.28	258 ±2.16
Jan	166±1.50	232 ±1.12	224±2.00	163±1.20	252 ±1.28
Feb	175±1.23	244 ±0.76	237±0.67	177 ±0.80	262 ±2.02
March	190±2.20	254 ±0.87	248±1.15	182 ±1.12	265 ±0.85
April	186 ±2.22	261 ±2.08	254±0.62	180-±1.15	266 ±1.24
May	192±0.88	267±1.18	260±0.85	183 ±2.01	282±2.12
June	198±2.10	270 ±0.78	261±2.00	185 ±0.77	285 ±1.33
July	180 ±1.18	258 ±1.21	252±1.16	169 ±0.78	276±0.64
Aug	175±0.79	246 ±2.11	248±1.32	175 ±1.00	272 ±0.97
Sept	177±1.04	240±0.82	233±0.75	168±1.11	268 ±1.09

Table 2. Monthly mean variation in Turbidity (NTU) of Gandhisagar lake water during October 2022-September 2023.

Stations Month	Station A Mean ± S.E	Station B Mean ± S.E	Station C Mean ± S.E	Station D Mean ± S.E	Station E Mean ± S.E
Oct	22.7 ±0.072	25.6 ±0.045	27.2 ±0.033	23.3 ±0.113	30.1 ±0.023
Nov	19.6 ±0.10	23.8 ±0.034	23.4 ±0.021	18.7 ±0.077	25.2 ±0.039
Dec	16.4±0.091	19.3 ±0.17	18.7±0.025	15.7 ±0.040	20.9±0.076
Jan	15.3 ±0.032	17.5±0.065	17.0±0.048	14.0±0.023	18.8±0.065
Feb	18.7 ±0.060	20.5±0.038	20.2 ±0.023	17.7±0.102	22.4 ±0.087
March	20.0 ±0.041	21.7 ±0.032	21.2 ±0.035	17.4 ±0.066	23.7 ±0.035
April	20.3 ±0.13	23.3 ±0.11	22.8 ±0.028	18.6 ±0.090	26.8 ±0.065
May	20.6 ±0.081	24.4 ±0.066	24.2 ±0.109	19.0±0.048	27.3±0.088
June	21.0 ±0.034	24.8±0.040	25.5±0.098	20.5±0.113	27.5 ±0.024
July	25.6 ±0.044	29.2 ±0.087	28.3 ±0.062	24.1 ±0.50	34.6±0.044
Aug	25.8±0.043	30.7±0.024	28.8 ±0.077	24.6±0.037	38.8 ±0.111
Sept	25.2±0.076	28.5±0.033	27.0±0.048	23.8±0.080	33.5 ±0.046

Table 3. Monthly mean variation in Nitrate(mg/L) of Gandhisagar lake water during October 2022- September 2023.

Stations Month	Station A Mean ± S.E	Station B Mean ± S.E	Station C Mean ± S.E	Station D Mean ± S.E	Station E Mean ± S.E
Oct	0.81±0.030	1.29±0.017	1.18±0.021	1.35±0.011	1.50±0.015
Nov	0.75±0.022	1.10±0.020	0.87 ±0.030	1.10±0.018	1.31**±0.017**
Dec	0.64 ±0.031	0.73±0.010	0.68±0.020	0.78±0.030	0.94±0.031
Jan	0.57±0.018	0.68±0.030	0.60±0.040	0.73±0.020	0.80**±0.011**
Feb	0.69±0.020	0.77 ±0.038	0.73±0.012	0.88±0.012	0.96±0.025
March	0.73±0.040	0.92±0.021	0.77 ±0.022	0.99±0.018	1.00±0.012
April	0.74±0.024	0.97 ± 0.024	0.78±0.030	1.04±0.030	1.07±0.014
May	0.78 ±0.031	1.00±0.020	0.88±0.015	1.04±0.028	1.17**±0.021**
June	0.85±0.020	1.03±0.030	0.90 ±0.010	1.15±0.015	1.29 ±0.017
July	0.97 ±0.010	1.40±0.013	1.27 ±0.024	1.51±0.022	1.78±0.010
Aug	1.17±0.020	1.58 ±0.017	1.44 ±0.019	1.74±0.017	1.93±0.032
Sept	1.08±0.011	1.40±0.025	1.34±0.022	1.68±0.010	1.87±0.025

Table 4. Monthly mean variation in Phosphate (mg/L) of Gandhisagar lake water during October 2022- September 2023.

Stations Month	Station A Mean ± S.E	Station B **Mean ± S.E**	**Station C** **Mean ± S.E**	**Station D** **Mean ± S.E**	**Station E** **Mean ± S.E**
Oct	0.33±0.012	0.65 ±0.018	0.57±0.015	0.72 ±0.010	0.87 ±0.023
Nov	0.29±0.015	0.55 ±0.012	0.50 ±0.070	0.60 ±0.018	0.75 ±0.018
Dec	0.21 ±0.011	0.43 ±0.020	0.38 ±0.012	0.49 ±0.022	0.60 ±0.013
Jan	0.18 ±0.012	0.35 ±0.025	0.30 ±0.030	0.40 ±0.015	0.48 ±0.032
Feb	0.20 ±0.040	0.40 ±0.017	0.40 ±0.015	0.45 ±0.011	0.52 ±0.024
March	0.21 ±0.010	0.49 ±0.011	0.44 ±0.031	0.49 ±0.018	0.55 ±0.020
April	0.23 ±0.014	0.50 ±0.010	0.45 ±0.022	0.50 ±0.015	0.63 ±0.016
May	0.27 ±0.019	0.58 ±0.013	0.48 ±0.024	0.55 ±0.017	0.60 ±0.011
June	0.30 ±0.020	0.65 ±0.024	0.50 ±0.028	0.62 ±0.012	0.68 ±0.070
July	0.38 ±0.017	0.72 ±0.018	0.60 ±0.019	0.75 ±0.021	0.85 ±0.022
Aug	0.41 ±0.020	0.77 ±0.019	0.66 ±0.022	0.82 ±0.030	0.98±0.028
Sept	0.37 ±0.018	0.74±0.023	0.62±0.011	0.79±0.012	0.94 ±0.017

Figure 1. Graph Showing Monthly Variation in Alkalinity(mg/L) of Gandhisagar lake water during October 2022 to September 2023.

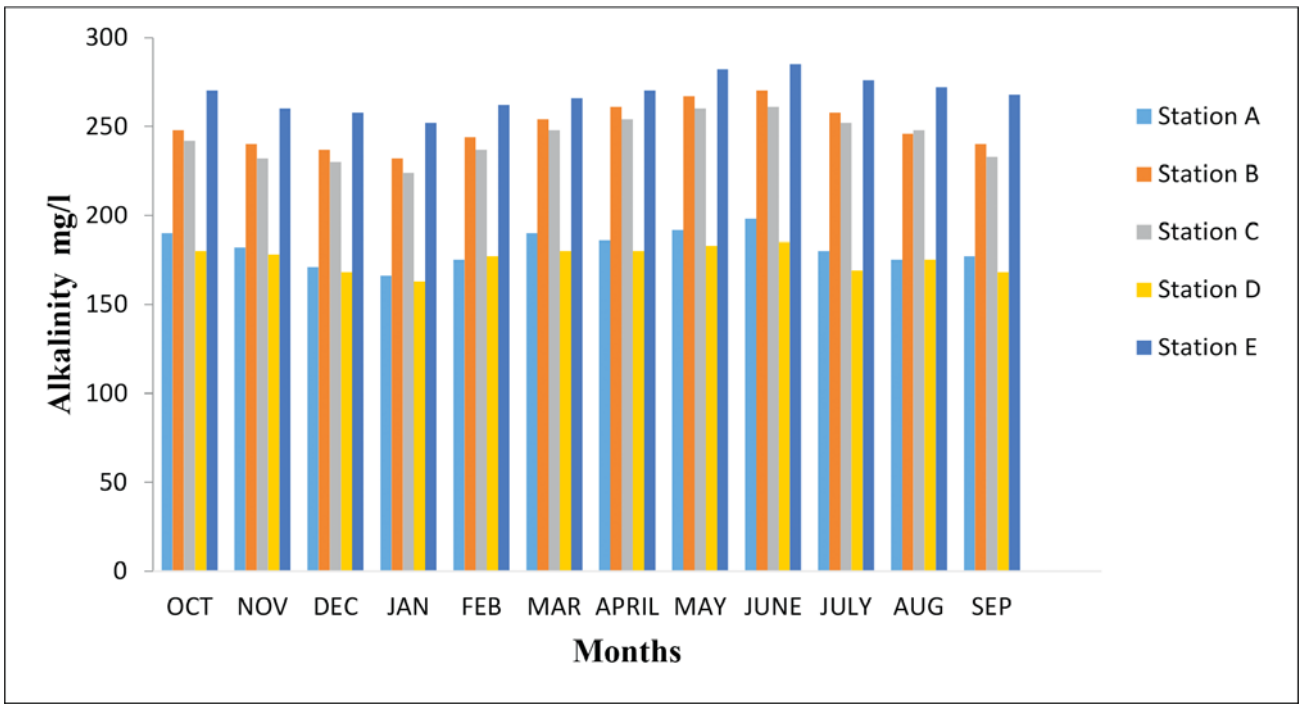


Figure 2. GraphShowing Monthly Variation in Turbidity(NTU) of Gandhisagar lake water during October 2022 to September 2023.

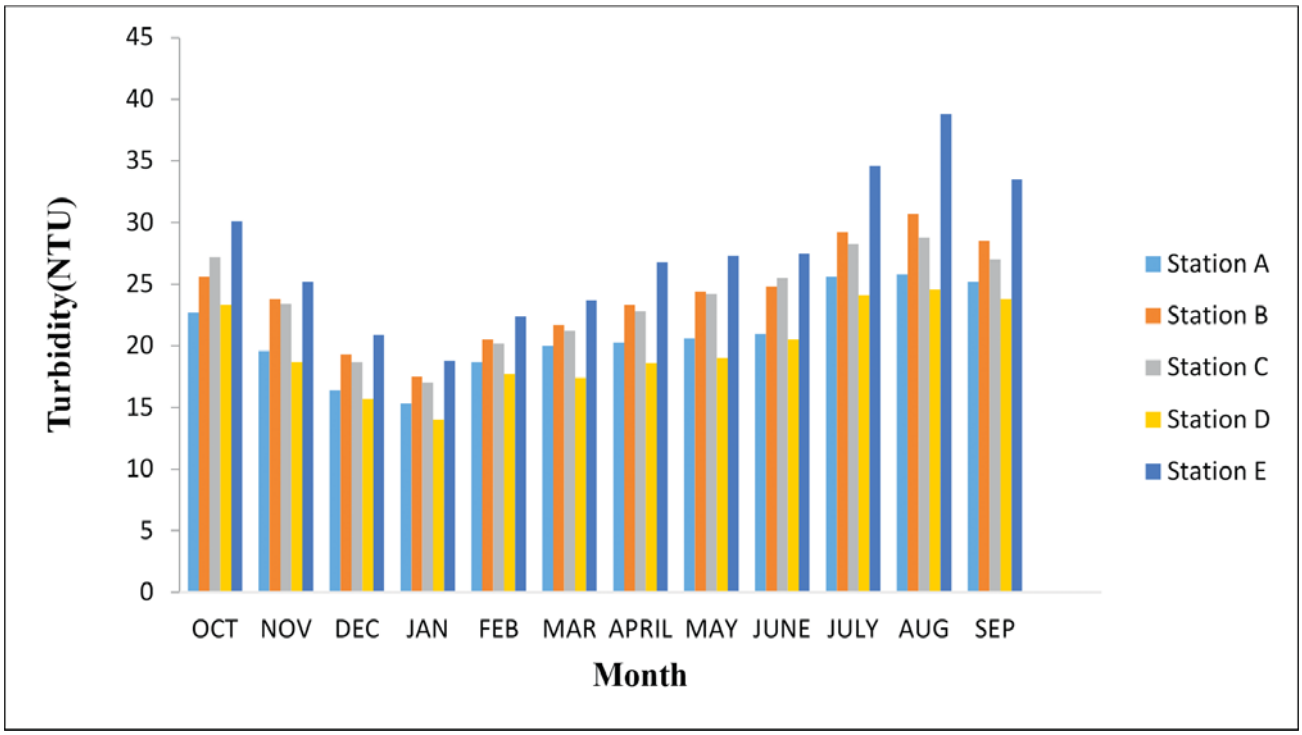


Figure 3. Graph Showing Monthly Variation in Nitrate(mg/L) of Gandhisagar lake water during October 2022 to September 2023.

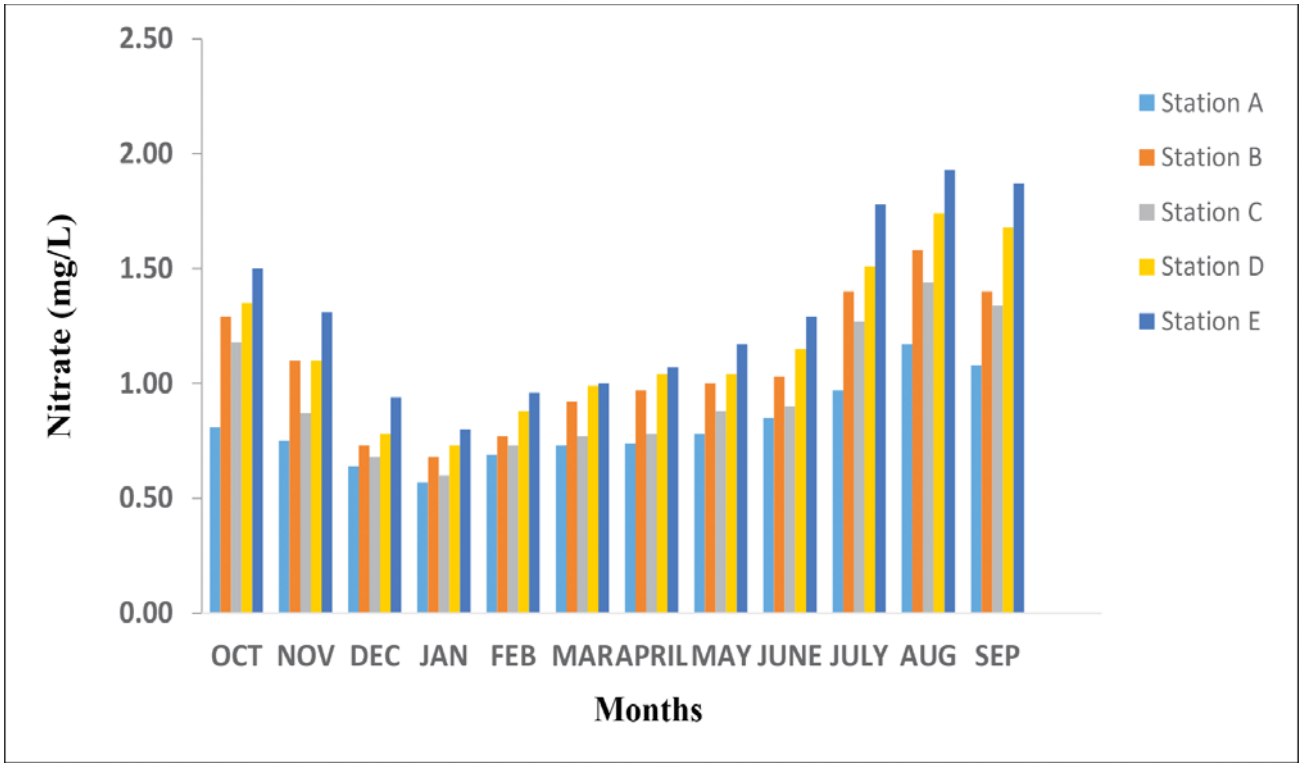
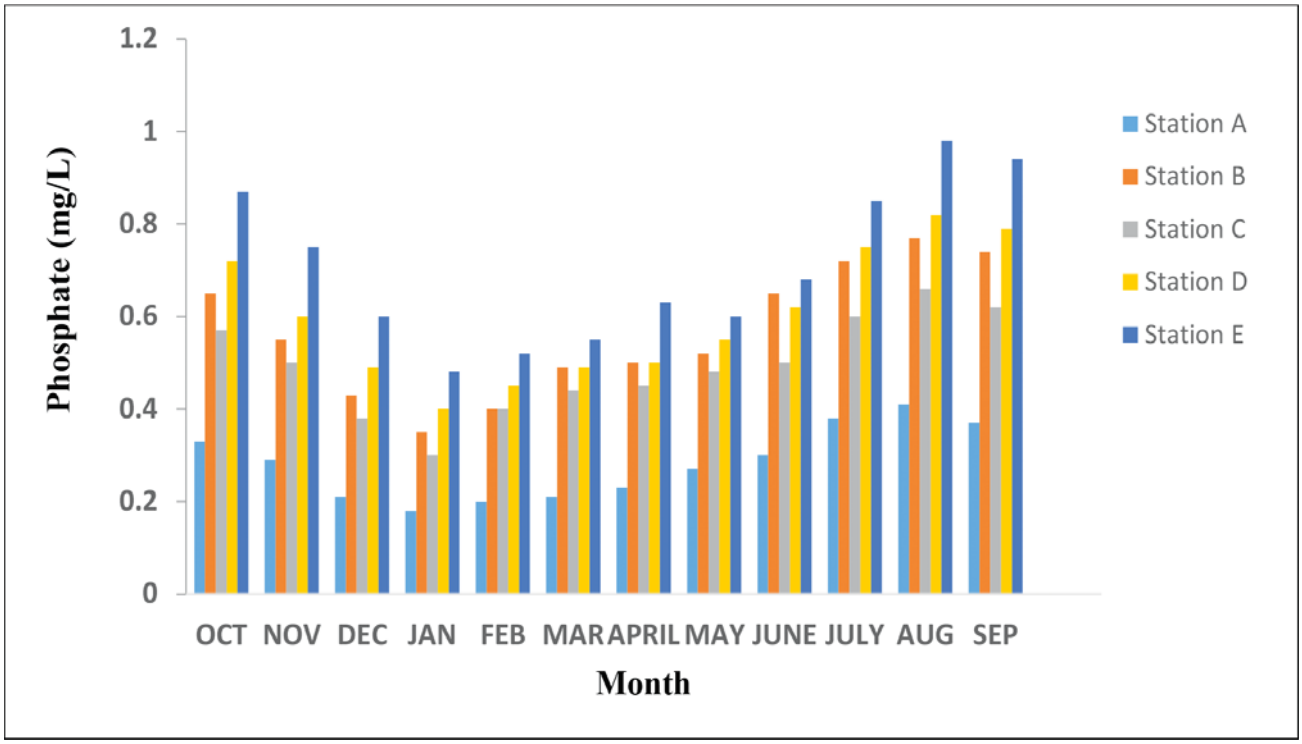


Figure 4. Graph Showing Monthly Variation in Phosphate(mg/L) of Gandhisagar lake water during October 2022 to September 2023.



Minimum,maximum and average values are compared with WHO standards of Gandhisagar Lake Umred during October 2022-September 2023.

Sr.no	Parameters	Minimum	Month	Maximum	Month	Average	WHO standards	Result
1	Total alkalinity(mg/L)	163	January	285	June	224	<200	High
2	Turbidity(NTU)	14	January	38.8	August	26.4	<5.0	High
3	Nitrate(mg/L)	0.57	January	1.93	August	1.25	<45	Normal
4	Phosphate(mg/L)	0.18	January	0.98	August	0.58	<0.5	High

Alkalinity: Alkalinity in water refers to its capacity to neutralize acids,primarily due to the presence of bicarbonates,carbonates which plays important role in the productivity of the system[12]..Monitoring alkalinity is important for managing lake ecosystems and ensuring water quality.The study found that alkalinity level were highest in the month of June at station 'E' might be due to increased microbial activity which accelerate the breakdown of organic matter.This decomposition releases bicarbonates and other minerals into the water further raising the alkalinity and January had the lowest alkalinity levels.at station 'A' (Table no. 1,and figure no.1).Same results observed by[5].

Turbidity: Turbidity is a measure of water quality based on its optical properties, refers to the extent to which suspended particles impede the passage of light, resulting in a cloudy or murky appearance. It functions as a figurative measure of the clarity of water Heavy rainfall, strong winds and convection current can increase the turbidity at high degree[22].Turbidity can affect the physical and chemical characteristics of lake[4]. Turbidity can affect primary production in lakes by limiting light penetration[25]. The study found that turbidity level were highest in the month of August at station 'E' might be due to inflow of gathering clay,slits, suspended particles and also Excessive planktonic growth and decaying vegetation contributed to

the high turbidity. The lowest turbidity was recorded in January at station 'A'(Table no.2 and Figure no.2).This finding is consistent with the research[6] and [16].

Nitrate: High nitrate concentration in water often result in various ecological and environmental problems, including eutrophication and algal blooms, which reduce the ecosystem's ability to provide essential services [3]. In the current study, The highest nitrate concentration was detected at station 'E', whereas January had the lowest value at station 'A'(Table no.3 and Figure no.3). The elevated Nitrate levels can be attributed primarily to rainfall, surface runoff, agricultural runoff, and activities such as laundering. This observation aligns with findings according [10],[21].

Phosphate: Phosphate is a key element that influences water quality**.** High phosphate levels can lead to eutrophication, algal bloom, increase turbidity. In the current study high concentration of phosphate was measured in August at station 'E', whereas January had the lowest value at station 'A'(Table no.4 and Figure no.4). High concentration is due to increased runoff from agricultural and urban areas, enhanced erosion ,the release of laundry detergents , release of phosphates from decaying organic matter, also The increase in phosphate is caused by the ongoing input of residential sewage.Same result observed by[20],[11].

The relationship between nitrate, phosphate, alkalinity and terbidity in a lake are complex and interdependent. Elavated nutrients can lead to algal blooms, increasing terbidity and affecting alkalinity through various biological and chemical processes. Terbidity and alkalinity can also influence each other through sediment interactions and changes in biological activities.Values of these parameters are compared with standard values of WHO[23].From the observation it is shows that total alkalinity, terbidity and nitrate level is higher than normal permissible limit of WHO.

Conclusion: Based on the analysis of the physicochemical parameters, it's evident that most indicators exhibited monthly variations throughout the study period. The decline in water quality in the lake can largely be attributed to numerous human activities conducted in its vicinity**.** It's crucial to recognize the collective efforts of governments, organizations, and individuals working tirelessly to address water pollution. However, it remains a significant challenge that demands continued attention and action.

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