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Hydrobiological Study of Water of Tighra Reservoir, Gwalior M.P (India)

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Abstract
The present paper deal study of Physico- chemical parameter in water of Tighra reservoir of Gwalior (M.P) the water of Tighra reservoir is life line of Gwalior city. Water is more useful of animal and plant as well as provided natural habitat of them. The biota of surface water is governed by various environmental Condition. The water of this reservoir is used for fish culture, irrigation, in industries, domestic and drinking purpose. The present study was carried out one year from July -2023 to June -2024. During investigation period physico-chemical parameter of water in Tighra reservoir like temperature, Ph, Transparency, Turbidity, sodium (Na+), potassium(k+), alkalinity, TDS, TSS, SS , nitrogen, phosphate, chloride , Conductivity, CO_2, Dissolved Oxygen, Total Hardness, Hardness Ca, Hardness Mg, BOD, COD, Nitrate, Chloride, were analysed. Most of the physico-chemical parameter are under permissible limit of NEERI.

Keyword: Tighra, Physico- chemical Parameter, water, Reservoir.

Introduction:

Water is an essential requirement for life and has been put to diverse uses including human and domestic consumption, irrigation, industry, and aquaculture and is also a basic requirement for sustaining a high quality of life for economic and social development. It forms the liquid constituent of all living matter and is used by both the animals and plants for their metabolic activities. The surface water and groundwater resources of the country play a major role in agriculture, hydropower generation, livestock production, industrial activities, forestry, fisheries, navigation, recreational purpose etc. The demand of freshwater has increased many folds and at the same time sewage, industrial wastes, agriculture runoff, varieties of synthetic chemicals and other anthropogenic activities degrade the quality of large share of this limited quantity of water. The water characteristics of any water body depend manly on geographical location, climate, seasons, topography and demographic pressure. The reservoirs located near the cities and towns receive a good amount of sewage load altering their physico-chemical characteristics. In Madhya Pradesh, there are many freshwater bodies in the form of rivers, lakes, and man-made reservoir in the state. The small, medium and large reservoirs in this state are estimated to be 1,73,901ha. The average size of these small, medium, and large reservoir is 3,50,2527 ha respectively, contributed to the maximum water spread of all Indian states under man-made lakes. Gwalior and Chambal divisions are rich in water resources and have approximately 54,839 ha water falling under reservoirs. The physico-chemical characteristics and play an important role in assessment of the water quality and tropic status of a water body. However, information on the ecology especially the tropic status of the reservoirs is scanty. Only a few workers have

attempted to study some of reservoirs for their nutrient's status. Therefore, this paper aims at the study of nutrients characteristics and tropic status of Tighra reservoir along with its suitability as habitat for aquatic organism.

The Gwalior's city water demand is mainly dependent on the primary source Tighra reservoir on the sank river situated about 20km south west of the city. This dam has been constructed in the vicinity of eleven villages. The villagers depend on this dam for their irrigation, drinking and domestic purpose. Gwalior, an ancient city known for the great musician Tansen, is situated in the north region of Madhya Pradesh. The city is gifted with a number of historical place and tourist places. Tighra reservoir is the major source of drinking water to Gwalior city. Besides, the water of Tighra reservoir is also used for irrigation and pisciculture. Tighra village which is in close proximity of SADA Magnet city. It lies on 26˚ 13' N latitude and 78˚ 30' E longitude at an altitude of 218.58m. The reservoir is surrounded by hills from three sides. The construction of the reservoir was started in the year 1910 across a seasonal rain fed sank river primarily to fulfil the water supply of the city. The reservoir is irregular in shape having shallow embayment at its periphery. The maximum depth of the reservoir is 130.80 km (4600mcft). The dead storage capacity of the reservoir is 232 mcft and the live storage capacity is 4390 M.

Study Area:

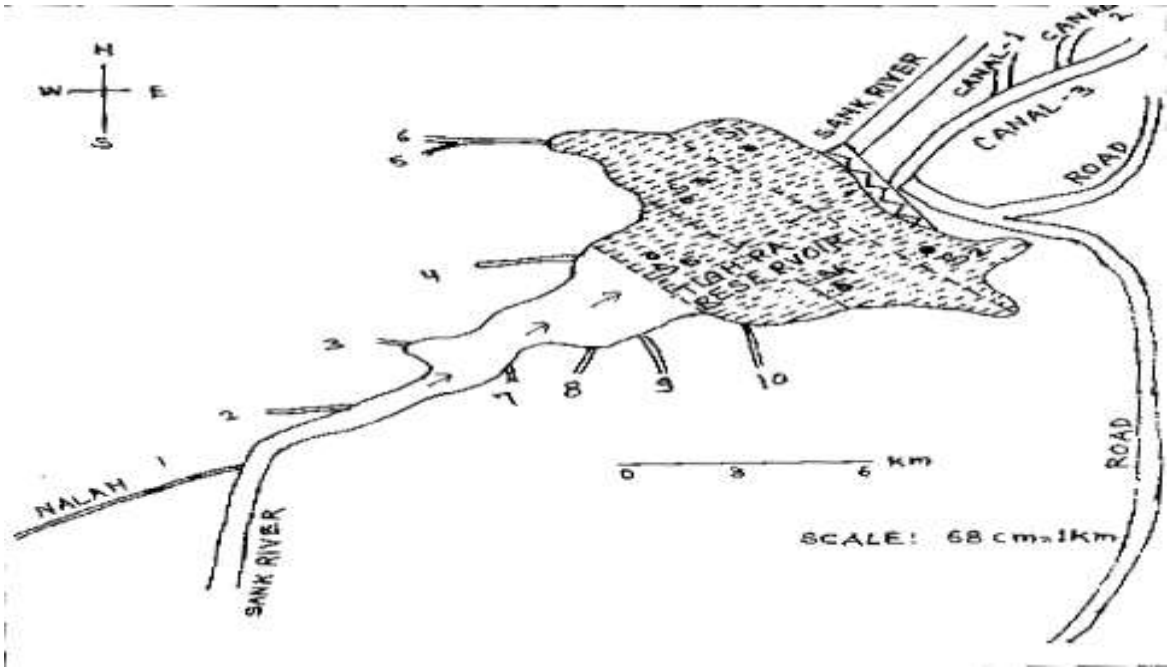
The Tighra Fresh Water Reservoir lies on 26-12'0" Latitude and 78-30-O" E longitude. It is located around 20 km West of Gwalior city MP, near saga magnet city at an altitude of 218.58 m. Tighra reservoir constructed on sank river and it is surrounded by three side of hills hence the name of this reservoir Tighra fresh water reservoirs. Previously is known as Madhav Jalashay and its reconstructed 1910 by the late maharaja Madhava Rao sindhiya.

The Sank River joins the reservoir through a gorge on the south western end. From the hill slopes about a dozen of small nallahas drain in reservoir. In the north east of the reservoir is a concrete masonry wall.

The reservoir is irregular in shape having many shallow embayment's at its periphery. The maximum length of the reservoir along the south west North East axis is 5.8 km and maximum width is 3.8 km. The maximum depth of the reservoir is 18m. while the gross storage capacity is 130.80 m (4622 m cft). The Tighra reservoir has a live storage capacity of 124.23 m (4390 m cft), leaving a dead storage below lowest still level (L.S.L.) of 6.56 M (232 m cft).The reservoir is also used as stocking pond by Fisheries department of MP.

Materials and Methods :

For analysing physico-chemical parameter of, the reservoir was divided into five zones. In each zone one sampling station was selected, as marked in the figure as S1, S2, S3, S4, and S5. The sampling stations were so selected as to cover the maximum area of the reservoir. The monthly samples of subsurface water collected in the early 9:00 am during second week of each month at regular bases. pH, transparency and temperature were estimated on the spot, while other parameters were estimated in the laboratory.



Method we used:

Method as describes in standard book for examination of water and waste water (APHA 1985 and Trivedi & Goel 1986) were used for the physico-chemical analysis. The physico-chemical parameters viz., transparency was determined by Secchi disc, electric conductivity by conductivity meter , total dissolved solids by digital (TDS) meter, pH by pH meter, free carbon dioxide by laboratory method (Goyal and Trivedi), sodium and potassium by flame photometer, DO (dissolve oxygen) by wrinkle's method , Nitrate by Brucine method, Water temperature and ambient temperature by the mercury filled thermometer. Turbidity by the Nephelometric turbidity meter, total Alkanity, total Hardness It was calculated by the method of ammonia buffer and EDTA, calcium hardness by EDTA titrimetric method, magnesium hardness by calculation method, chloride by Mohr's Method, phosphate by stannous chloride method.

Result and Discussion

The effects of monthly variation in physico-chemical parameters of fresh water from Tighra reservoir is given in table, and a pair of monthly variation of a physico-chemical parameters of fresh water is given in graphs and pie chart.

1. Ambient Temperature (°C)

Ambient temperature measures the air temperature surrounding the water body. It varied between 20°C and 33.2°C, with a noticeable spike at 33.2°C, much higher than the others. Apart from this outlier, the temperatures stayed between 20°C and 27°C, indicating generally mild conditions with one notably hot period.

2. Water Temperature (°C)

Water temperature is a measure of how warm or cold the water is. The temperatures ranged from 18°C to 31.1°C, closely following ambient temperature trends. The peak at 31.1°C stands out, while the rest of the readings remained around 20-25°C, typical for temperate waters.

3. Transparency (cm)

Transparency measures how clear the water is, based on how far light can penetrate. Transparency values

ranged from 131.20 cm to 225.40 cm. The highest transparency of 225.40 cm indicates very clear water, particularly in the latter part of the readings. Improved transparency towards the end suggests clearer conditions during that time.

4. Conductivity (S/cm)

Conductivity indicates the water's ability to conduct electric current, which relates to the concentration of dissolved salts or ions. Conductivity showed significant variation, from 128 S/cm to 620 S/cm. High readings, especially the peaks at 620 S/cm, suggest high levels of dissolved salts or ions in the water during these times.

5. pH (mg/l)

pH measures the acidity or alkalinity of water on a scale from 0 to 14, with 7 being neutral. The pH levels, ranging from 7.0 to 7.71, indicate the water is mostly neutral with slight fluctuations. These stable readings show the water's pH balance is consistently within a healthy range.

6. Total Solids (mg/l)

Total solids refer to the combined content of all inorganic and organic substances contained in the water. Total solids ranged widely from 88 mg/l to 765 mg/l. The highest reading of 765 mg/l indicates a significant amount of particulate matter or dissolved substances, particularly towards the end.

7. Total Alkalinity (mg/l)

Total alkalinity measures the water's ability to neutralize acids, reflecting its buffering capacity. Total alkalinity ranged from 55 mg/l to 220 mg/l, with higher readings in the middle and towards the end, indicating periods of increased buffering capacity in the water.

8. Dissolved Oxygen (mg/l)

Dissolved oxygen measures the amount of oxygen available in water for aquatic life. Dissolved oxygen levels varied between 7.0 mg/l and 8.2 mg/l, showing good oxygenation essential for aquatic life. These stable levels suggest a healthy aquatic environment.

9. Potassium (mg/l)

Potassium is an essential nutrient for aquatic plants and organisms. Potassium levels, between 0.8 mg/l and 1.54 mg/l, indicate a relatively stable presence of potassium, with slight increases in some readings.

10. Sodium (mg/l)

Sodium is a mineral found in water that can influence its taste and chemical characteristics. Sodium ranged from 5.0 mg/l to 10.31 mg/l. The higher values, particularly towards the end, show periods of increased sodium presence.

11. Total Hardness (mg/l)

Total hardness measures the concentration of calcium and magnesium ions in the water. Total hardness values ranged from 50 mg/l to 458 mg/l. The high reading at 458 mg/l indicates a significant concentration of calcium and magnesium ions at that time.

12. Hardness Ca (mg/l) Calcium hardness is a component of total hardness, specifically measuring calcium ion concentration. Calcium hardness ranged from 40 mg/l to 400 mg/l, following a similar pattern to total hardness, with a peak indicating high calcium ion concentration.

13. Hardness Mg (mg/l)

Magnesium hardness is a component of total hardness, specifically measuring magnesium ion concentration. Magnesium hardness values ranged from 10 mg/l to 66 mg/l, with higher values indicating varying levels of magnesium ions.

14. Chloride (mg/l)

Chloride is a common ion found in water, often from natural sources or pollution. Chloride levels ranged from 35.89 mg/l to 84 mg/l. Higher readings towards the end suggest periods of increased chloride ions, possibly from pollution or natural sources.

15. BOD (mg/l)

Biochemical Oxygen Demand (BOD) measures the amount of oxygen required for the decomposition of organic matter. BOD values ranged from 1.4 mg/l to 1.8 mg/l, indicating low organic pollution and overall good water quality.

16. COD (mg/l)

Chemical Oxygen Demand (COD) measures the amount of oxygen required to chemically oxidize organic and inorganic compounds. COD ranged from 12 mg/l to 72 mg/l, showing significant variability. Higher readings, particularly at the end, indicate periods of increased organic and inorganic pollutants.

17. Phosphate (mg/l)

Phosphate is a key nutrient that can contribute to the growth of aquatic plants and algae. Phosphate levels ranged from 0.12 mg/l to 1.32 mg/l. Higher values suggest possible nutrient loading, potentially leading to algal blooms, especially in the middle readings.

18. Nitrate (mg/l)

Nitrate is a nutrient essential for plant growth but can cause water quality issues in high concentrations. Nitrate levels ranged from 0.4 mg/l to 1.31 mg/l. Fluctuations suggest variations in nutrient inputs, with higher levels indicating periods of increased nitrate presence.

19. Turbidity (NTU)

Turbidity measures the cloudiness or haziness of water caused by suspended particles. Turbidity values ranged from 1.2 NTU to 3 NTU. These readings indicate relatively clear water with minor variations in suspended particles.

20. TDS (mg/l)

Total Dissolved Solids (TDS) measure the combined content of all inorganic and organic substances dissolved in water. TDS ranged from 80 mg/l to 400 mg/l, showing periods of higher dissolved substances. Higher readings suggest increased salinity or dissolved minerals.

21. SS (mg/l)

Suspended Solids (SS) measure the solid particles that are suspended in water. SS ranged from 4 mg/l to 76 mg/l. The higher values indicate periods of increased particulate matter, particularly towards the end.

22. Ammoniacal Nitrogen (mg/l)

Ammoniacal nitrogen measures the concentration of ammonia, which can be toxic to aquatic life at high levels. Ammoniacal nitrogen values ranged from 0.2 mg/l to 1.29 mg/l. Higher readings indicate periods of increased ammonia concentration, possibly due to organic decomposition or pollution.

Conclusion

The monthly readings indicate generally stable water quality with occasional spikes in certain parameters. These spikes suggest periods of increased pollution or natural fluctuations, which require regular monitoring to maintain water quality. Overall, the water body shows good oxygenation, low organic pollution, and stable pH, essential for a healthy aquatic environment. However, periods of increased nutrients, dissolved substances, and particulate matter highlight the need for ongoing vigilance to ensure these factors do not negatively impact the ecosystem. Regular monitoring and proactive measures are

necessary to maintain and improve the water quality, ensuring a healthy environment for aquatic life and safe water for human use.

TABLE: Monthly Variation of Physico-Chemical Parameter

parameters	Unit	JULY 2023 TO JUNE 2024 MONTH											
		July -23	Aug -23	Sep-23	Oct-23	Nov -23	Dec -23	Jan -24	Feb -24	Mar -24	Apr -24	May -24	June-24
Ambient Temperature	°C	23	21	24	33.2	20	19	27	22	24	26	25	26
Water Temperature	°C	22	20	22	31.1	18	18	25	20	22	24	24	24
Transparency	cm	140.20	131.20	142.30	146.20	171.20	181.0	154.2	180.3	208.20	222.21	225.40	229.5
Conductivity	µS/cm	302	208	205	130	620	129	325	128	440	620	600	615
pH	mg/l	7.20	7.64	7.61	7.71	7.25	7.67	7.0	7.68	7.04	7.24	7.18	7.19
Total solids	mg/l	150	157	150	88	465	92	280	88	300	476	580	765
Total Alkanity	mg/l	102	110	105	66	220	55	210	55	160	220	211	212
Dissolved Oxygen	mg/l	7.24	8.1	8.2	7.2	7.0	8.1	7.2	7.9	7.6	7.0	7.20	7.31
Potassium	mg/l	1.06	0.9	0.8	1.0	1.23	1.1	1.20	1.15	1.3	1.54	1.45	1.21
Sodium	mg/l	9.10	7.5	7.4	5.0	10.0	6.7	10.0	9.5	9.8	10.25	10.26	10.31
Total Hardness	mg/l	180	105	100	50	458	50	262	50	140	284	282	281
Hardness Ca	mg/l	100	70	70	40	400	40	200	40	100	218	215	220
Hardness Mg	mg/l	40	35	30	10	58	10	62	10	40	66	62	61
Chloride	mg/l	80	70	65	54.09	77	40	84.0	54	35.89	56	65	84.0
BOD	mg/l	1.5	1.7	1.6	1.6	1.6	1.5	1.6	1.6	1.8	1.4	1.5	1.6
COD	mg/l	65	18	17	43	56	14	54.0	12	17.36	54	58	72

Phosphate	mg/l	0.9	0.7	0.14	1.1	1.20	0.12	1.32	0.12	1.2	1.26	1.22	1.14
Nitrate	mg/l	1.22	1.1	1.2	0.4	1.0	1.1	0.76	1.1	0.7	0.84	0.94	1.31
Turbidity	NTU	2.5	3	2	1.2	2.0	3	2.0	3	2	2.0	3	1.6
TDS	mg/l	280	130	125	84	400	80	210	80	280	400	380	400
SS	mg/l	42	27	25	04	65	12	70	08	20	76	70	65
Ammonical Nitrogen	mg/l	1.2	0.8	0.7	0.2	0.35	0.4	0.58	0.45	0.6	0.78	0.65	1.29

Figure :1 Monthly variation of Temperature ºC

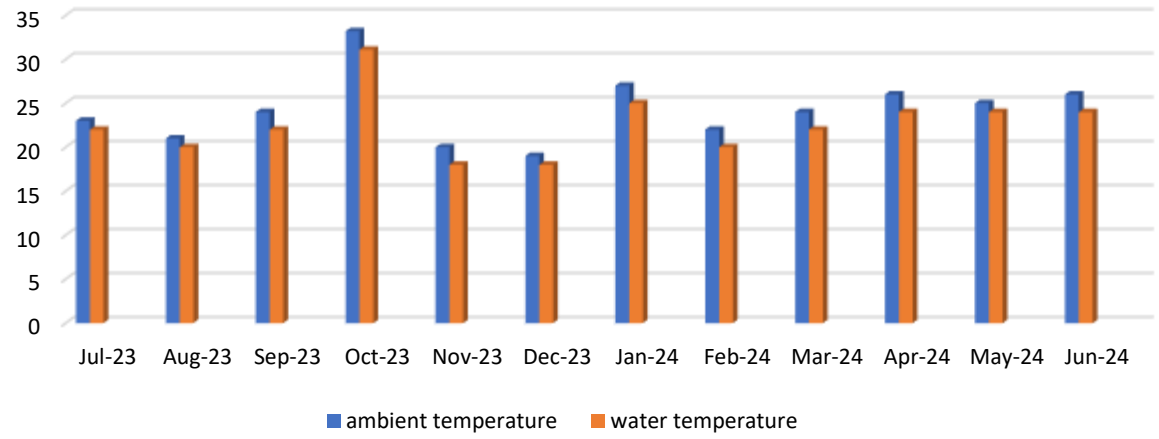


Figure: 2 monthly variation of pH,DO,Sodium,Potassium,BOD,Phosphate (mg/l)

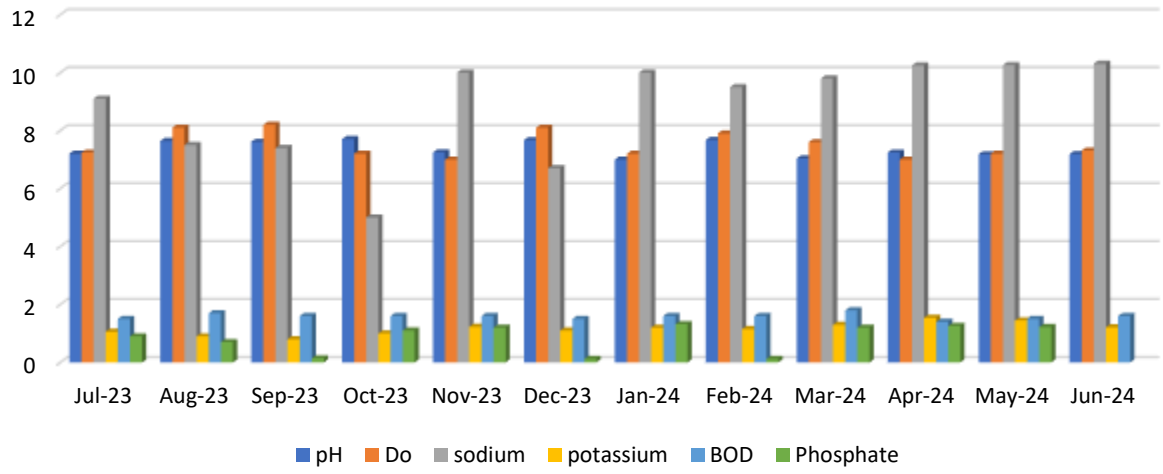


Figure: 3 Monthly variation of total solid, total alkanity, total hardness, calcium harness, magnisium hardness, chloride (mg/l)

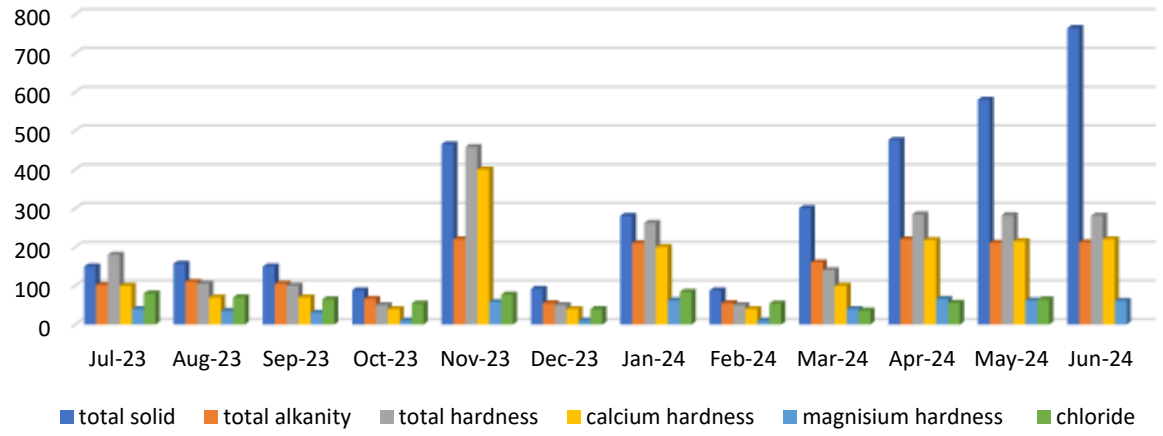


Figure: 4 Monthly variation of TDS, SS, COD (Mg/l)

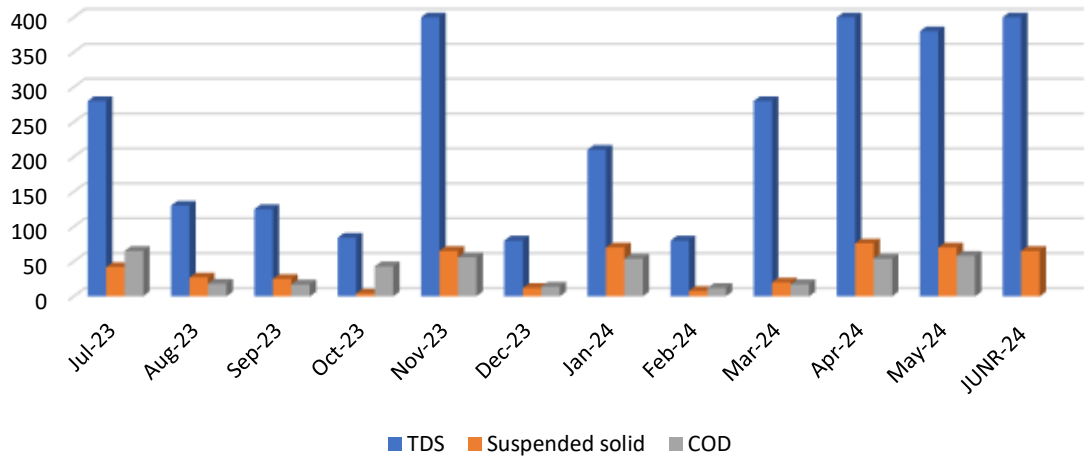


Figure: 5 Monthly Variation of Nitrate, Ammonical Nitrogen (Mg/l)

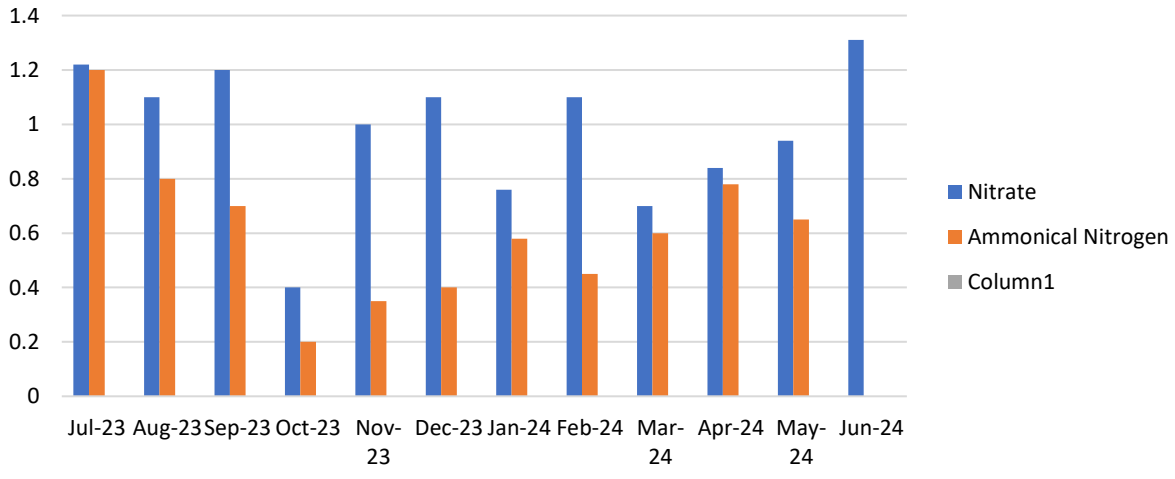


Figure: 6 Monthly variation of Conductivity (µS/cm)

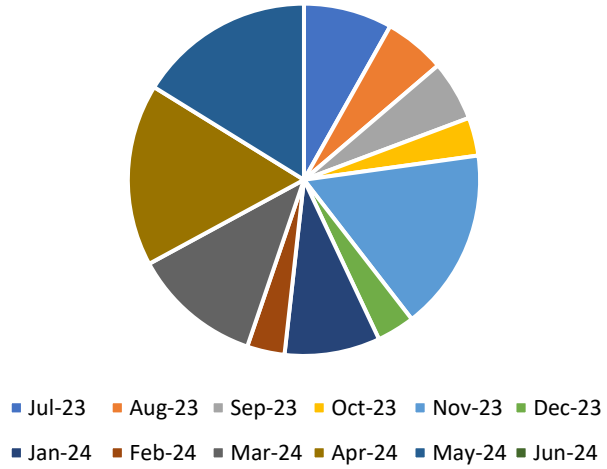


Figure:7 Monthly variation of Turbidity (NTU)

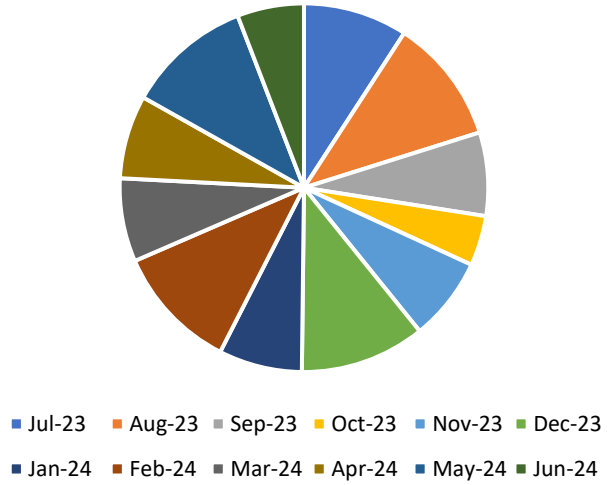
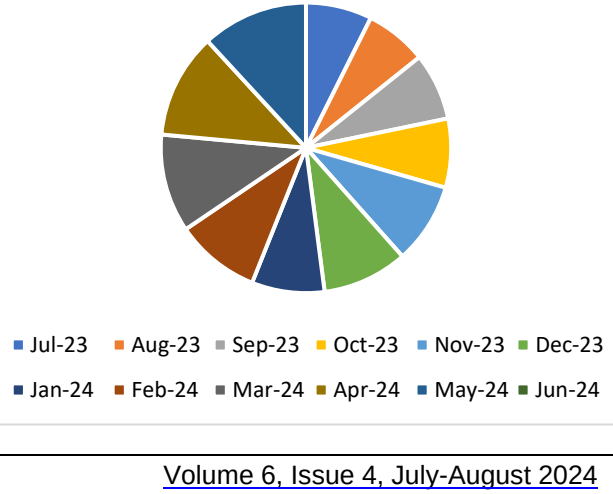


Figure: 8 Monthly Variation of Transparency (cm)



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