Water quality Status of tamasi Lake, near Bhadravati, Dist: Chandrapur (M.S) India

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Abstract

Water reserviors are naturally or artificially formed by depressions filled with water and are used for irrigation, fishery and recreation. The study deals with the seasonal variation of physicochemical characteristics of Tamasi Lake, that is free from human activities and is surrounded by a dense forest. The lake water is suitable for only wildlife drinking. Water quality determination was conducted for 12 months in the Tamasi lake between June 2022 and May 2023. The purpose of study is to assess the water quality in terms of several parameters, the Temp., pH, Conductivity, Transparency, Hardness, Ca- hardness, Mg- hardness, Total suspended solids, Total Solids, Total Dissolved Solids, Dissolved Oxygen, Carbon dioxide, Chemical Oxygen Demand, Biological Oxygen Demand, Phosphate, Sulphate and Nitrate. The present study summarizes that Tamasi lake water is pollution free and all the physico-chemical parameters were within the permissible limit.

Key words : Biological Oxygen Demand, Chemical Oxygen Demand, Physico- Chemical Parameters, Tamasi lake, Tamasi village,

Limnology is the scientific study of inland waters, including lakes, ponds, rivers, streams, wetlands, and reservoirs. It encompasses various aspects of these aquatic ecosystems,

including their physical, chemical, biological, and ecological characteristics. Limnology plays a crucial role in understanding the structure and function of freshwater environments and addressing environmental challenges related to water quality, habitat degradation, and ecosystem management. Limnology is the study of the functional relationship and productivity of aquatic communities as they're affected by their physical, chemical, and biotic terrain. Limnological study derives knowledge from varied disciplines as drugs, chemistry, biology, geology, terrain, and applied lores. It also involves a great deal of detailed field and laboratory ways to understand the structural and functional aspect of brackish surroundings.

Water pollution is an ongoing concern, and various sources contribute to it daily. While the specific sources and their contributions can vary by location and circumstances, some are common sources of water pollution that continue to impact water bodies around the world like Industrial Discharges, Agricultural Runoff, Urban Stormwater, Municipal Wastewater, Sewage Overflow, Agricultural Animal Waste, Mining Activities, Oil and Fuel Spills, Trash and Plastic Pollution, deforestation and Land Use Changes and Atmospheric Deposition. Efforts to mitigate water pollution involve a combination of regulations, waste water treatment, pollution prevention measures, and public awareness campaigns. Monitoring and addressing the sources of pollution continues to be important in protecting and preserving water resources for current and future generations. Most of researcher studied on water analysis viz. Manjare et al.,¹¹, Kistan et al.,10, Singh et al.,16, Solanki et al.,17, Ramesh and, Krishnaiah¹⁴ and Anita *et al.*,¹.

Study Area :

Tamasi lake is an Ex. Malguzari tank, situated in Tahasil Bhadravati of Chandrapur.

This project falls under Wardha sub- basin and Wainganga basin. The punarjjiwan of Tamasi Ex. Malguzari tank has been done by Malguzar farmers of Katwal, Tukum villagers before 200 years. The total area of the lake is 96 Hectare. It has a catchment area of 0.136 sq. mile. The catchment area of the lake is occupied by dense forest. It has a capacity to irrigate 188 hectares. However, at present irrigated area is 132 hectares. The water holding capacity of the lake is 1.97 mm³. Capacity for irrigation purpose is 1.94 mm³. The length of embankment is 1500 meter and height are 9.51 meter of lake with Longitude -79°26'78" and Latitude-20°28'25".

Examination was done for 12 months from June 2022 and May 2023 on physicochemical characteristics of water. Four different sampling sites were chosen for the lake. Water samples were collected during morning hours. The parameters like Temperature, pH and Conductivity were analyzed with the help of Thermometer and water analysis kit of EIPRODUCTS, (MODEL-161-E). Transparency was measured by Secchi disc. Physicochemical parameters were analysed by titrimetric, gravimetric and spectroscopy methods given in APHA² and NEERI¹³.

Results are represented in table 1 and Fig. 1 and 2.

In the present investigation, water temperature ranged from 22.43 ± 3.61 °C to 24.95 ± 3.19 °C, minimum in the winter season and maximum in the summer season. In lake water, the average temperature typically drops from May to January before gradually rising again. A decrease in temperature was noted, which may have been caused by the low air temperature and high-water level. The water temperature was high because of the clear atmosphere, low water content, and maximum temperature in the summer. Similar observations are reported by Telkhade *et al.*,¹⁸.

pH :

Water pH was maximum 9.35 ± 0.20 during summer and minimum 6.65 ± 0.03 in winter. During summer season pH increases due to low water level and high temperature. Similarly, water pH was shown 7.7, less in winter season and as 8.3 more in the summer season in Sawanga lake of Amaravati¹⁹.

Conductivity :

Conductivity was maximum $407.25 \pm 0.03 \mu$ mhos cm⁻¹ during monsoon season. The monsoon's highest conductivity could be brought on by an overabundance of organic materials and household effluents. During winter, the minimum conductivity was measured as $246.0 \pm 0.02 \mu$ mhos cm⁻¹ because there is less dissolved solid pollution. Similar was stated by Manjare *et al.*,¹¹.

Turbidity :

Maximum turbidity was recorded 85.83 ± 3.51 cm during summer while minimum during monsoon 43.75 ± 2.42 cm. The monsoon season shows low turbidity readings, which might be caused by rainwater inflow from catchment areas, reduced light penetration, high turbidity from suspended inert particle matter, or the addition of sewage alone, which would negatively impact transparency.

Total alkalinity :

Total alkalinity was noted high $120.00\pm$ 71.53 mg/l and low 97.00± 2.38 mg/l. Elevated total alkalinity levels may be attributed to increased rates of organic decomposition and reduced levels of carbon dioxide released during the winter months. Similar findings were observed by, Singh, *et al.*,¹⁶ at Silisher lake, Alwar.

Dissolved oxygen and Free CO_2 :

In winter, high values of DO $6.98 \rightarrow \pm 6.32$ mg/l, can be attributed to low temperatures and high photosynthetic activity. In summer, the minimum value is 4.98 ± 0.10 mg/l., DO may have resulted by micro-organisms' which increases metabolic rate. Maximum concentration of free CO₂ was 4.78 ± 0.22 mg/l in monsoon season and minimum CO₂ was 2.88 ± 0.07 mg/l in winter season, higher rate of biological oxidation of organic matter could be the cause of the high concentration of CO₂ during the monsoon season. Similar trend was reported by, Khabade *et al.*,⁹ observed at Lodhe water reservoir, Tasgaon and Kadam *et al.*,⁷ reported at Masoli reservoir, Parbhani.

B.O.D and C.O.D :

Seasonally high B.O.D 32.08 ± 0.46 mg/l was recorded in the summer season; maximum values might be due to higher microbial activity. The minimum B.O.D 12.98 ± 3.61 mg/l was during winter.. C.O.D. seasonally maximum values determined were 201.75 ± 1.05 mg/l during monsoon, may be due to increased rate of oxidation in monsoon season. while it was minimum 99.50 ±0.30 mg/l during winter

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Table-1 Seasonal average values of Physico-chemical parameters in Tamasi lake, Tah- Bhadravati during 2022-23.

S.	Month/ Parameters	MONSOON	WINTER	SUMMER	MIN	MAX
1	Temp	24.58 ± 3.61	22.43 ± 1.97	24.95 ± 3.35	22.43 ± 3.61	24.95 ± 3.19
2	рН	8.38 ± 0.30	6.55 ± 0.06	9.35 ± 0.34	6.55 ± 0.03	9.35 ± 0.20
3	Conductivity	407.25 ± 0.030	246.00 ± 0.01	314.25 ± 0.04	246.00 ± 0.00	407.25 ± 0.01
4	Alkalinity	120.00 ± 61.74	97.00 ± 19.41	116.00 ± 59.91	97.00 ± 2.38	120.00 ± 71.53
5	Dissolved	6.68 ± 12.06	4.98 ± 6.32	8.23 ± 15.02	4.98 ± 0.10	8.23 ± 11.67
	oxygen					
6	Free CO ₂	4.78 ± 0.40	$2.88 ~\pm~ 0.47$	4.47 ± 0.26	2.88 ± 0.07	4.78 ± 0.22
7	BOD	28.10 ± 0.38	12.98 ± 0.59	32.08 ± 0.36	12.98 ± 3.61	32.08 ± 0.46
8	COD	201.75 ± 2.42	141.50 ± 0.60	99.50 ± 1.75	99.50 ± 0.30	201.75 ± 1.05
9	Total	124.08 ± 2.38	86.63 ± 3.73	99.25 ± 2.50	86.63 ± 0.03	124.08 ± 3.74
	Hardness					
10	Calcium	92.18 ± 0.10	$64.00 \ \pm \ 0.02$	67.00 ± 0.06	64.00 ± 12.59	92.18 ± 0.08
	hardness					
11	Magnesium	24.74 ± 0.07	19.11 ± 0.06	$24.85~\pm~0.03$	19.11 ± 61.74	$24.85~\pm~0.09$
	hard.					
12	TDS	283.25 ± 0.05	243.00 ± 1.11	235.75 ± 3.61	235.75 ± 12.06	283.25 ± 5.59
13	TSS	77.50 ± 1.80	$66.23 \ \pm \ 0.28$	$68.25 \ \pm \ 0.30$	66.23 ± 0.40	$77.50~\pm~0.33$
14	Total solids	420.50 ± 0.17	128.25 ± 0.05	251.00 ± 0.03	128.25 ± 0.38	420.50 ± 0.15
15	Sulphates	17.13 ± 8.56	10.45 ± 16.33	11.72 ± 61.74	10.45 ± 2.38	$17.13~\pm~26.82$
16	Phosphates	2.93 ± 12.02	$2.30 ~\pm~ 5.93$	1.25 ± 12.06	1.25 ± 0.10	$2.93~\pm~6.03$
17	Nitrates	4.25 ± 6.12	$2.63 ~\pm~ 0.42$	$2.88~\pm~0.40$	2.63 ± 0.07	$4.25~\pm~0.29$
18	Copper	0.79 ± 0.29	$0.41 ~\pm~ 0.22$	$0.59~\pm~0.38$	$0.41~\pm~0.30$	$0.79~\pm~0.30$
19	Iron	1.54 ± 0.27	1.28 ± 1.29	1.36 ± 2.42	1.28 ± 1.33	1.54 ± 1.68
20	Manganese	0.40 ± 0.84	0.24 ± 2.86	$0.36~\pm~2.38$	0.24 ± 2.03	0.40 ± 2.42
21	Chromium	0.03 ± 4.98	$0.02 \ \pm \ 0.11$	$0.02~\pm~0.10$	0.02 ± 1.73	$0.03~\pm~0.09$
22	Lead	BDL	BDL	BDL	BDL	BDL
23	Zinc	BDL	BDL	BDL	BDL	BDL
24	Nickel	BDL	BDL	BDL	BDL	BDL
25	Cadmium	BDL	BDL	BDL	BDL	BDL

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Fig. 1. Seasonal variation in the Physico- Chemical Parameters of water of Tamasi Lake during 2022-23



Fig. 2. Overall, View of Tamasi Lake, Bhadravati, Dist. Chandrapur



Fig. 3. Satellite image of Tamasi Lake, Bhadravati, Dist. Chandrapur

season. Similarly was reported by, Kavita *et al.*,⁸ and Gayathri *et al.*,⁴ in Shoolkere lake.

Total hardness, Ca hardness and Mg hardness :

Total hardness is a measure of the concentration of dissolved minerals, primarily calcium and magnesium ions, in water. It indicates the water's capacity to precipitate soap and form scale deposits, which can have practical implications for various applications, including household water use, industrial processes, and agriculture. Total hardness is typically expressed in units of milligrams per liter (mg/L) or parts per million (ppm) of calcium carbonate (CaCO₃) equivalent.

Seasonally, maximum value of hardness, Ca hardness and Mg hardness was recorded during summer season 124.08 ± 3.74 , 92.18 ± 0.08 and 24.85 ± 0.09 mg/l respectively, hardness of water increased in summer due to high temperature and rate of evaporation, while minimum during winter season 86.63 ± 0.03 , 64.00 ± 12.59 and 19.11 ± 61.74 mg/l respectively. Similar findings were made by Manjare *et al.*, ¹¹ and Anita *et al.*, ¹.

Total Solids, T.D.S and T.S.S. :

Total Solids (TS) represent the total amount of solid material in a water sample, while Total Dissolved Solids (TDS) specifically measure the concentration of dissolved solids, and Total Suspended Solids (TSS) quantify the concentration of suspended particles. These parameters are essential for assessing water quality, understanding sedimentation processes, and identifying sources of contamination in aquatic ecosystems. For TS, TSS and TDS, maximum total suspended solids 283.25 ± 5.59 , 77.50 ± 0.33 and 420.50 ± 0.15 mg/l found during monsoon season. Minimum were 135.75 ± 12.06 , 66.23 ± 0.40 and 228.25 ± 0.38 mg/l during winter seasons. High values in monsoon may be due to surface run off from catchment area. Similar report was made by Kadam *et al.*,⁷ and Singh *et al.*,¹⁶, worked on of Silisher Lake, Alwar.

Phosphate, Sulphate and Nitrate :

The maximum phosphate recorded 2.93 \pm 6.03 mg/l during monsoon season, and minimum 1.25 \pm 0.10 mg/l during winter, the maximum sulphate was 17.13 \pm 26.82 mg/l during monsoon season while minimum 10.45 \pm 2.38 mg/l during winter season. Maximum nitrate range was 4.25 \pm 0.29 mg/l during monsoon season, minimum 2.63 \pm 0.07 mg/l was observed during winter season, Similarly, Solamki *et al.*,¹⁷, Ramesh and, Krishnaiah¹⁴ and Kistan *et al.*,¹⁰.

Copper, Iron, Manganese and Chromium:

The concentrations of copper (Cu), iron (Fe), manganese (Mn), and chromium (Cr) was maximum $0.79\pm0.30,1.54\pm1.680,40\pm2.42$ and 0.03 ± 0.09 during monsoon season and minimum was $0.41\pm0.30, 1.28\pm1.33, 0.24\pm2.03$ and 0.02 ± 1.73 respectively in winter season. Similarly reported by, Ramesh and, Krishnaiah¹⁴.

Inorder to study the water quality

status, the analysis was done in Tamasi lake. The data after the study indicates very slight changes in the physico chemical parameters pH, alkalinity, DO, CO₂, BOD, COD, Sulphate, Phosphate and Nitrate values seasonally that did not reach beyond the permissible limit. But a noticeable change was seen during rainy season as the values for suspended and dissolved solids were increased. However Lead, Zinc, Nickel and Cadmium were below level as per BIS. The conclusion from the present investigation may be drawn that most of the physico- chemical parameters were found within the permissible limit of WHO ISI, and ICMR for domestic use, agriculture and fisheries. Therefore, the study concluded that Tamasi Lake indicates oligotrophic nature and there are no anthropogenic activities. Lake is untouched from domestic activities, so the environmental condition of lake is good.

Conflicts of interest :

The authors declare no conflict of interest.

We are thankful to Dr. Pramod Katkar, Principal of Sardar Patel Mahavidyalaya, Chandrapur.

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