

# Assessment of Physico-Chemical Parameters and Zooplankton Diversity in Tripuranth Lake, Basavakalyan, Bidar District, Karnataka

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## ABSTRACT

Tripuranth Lake is a critical freshwater resource supporting irrigation, aquaculture, domestic use, and local biodiversity. This study examines monthly variations in physico-chemical parameters and zooplankton diversity from January 2024 to December 2024 to evaluate the lake's water quality and ecological health. Key physico-chemical parameters, including atmospheric temperature, water temperature, pH, dissolved oxygen (DO), total dissolved solids (TDS), conductivity, total alkalinity, total hardness, calcium (Ca<sup>2+</sup>), and magnesium (Mg<sup>2+</sup>), were analyzed. Zooplankton sampling identified 31 species across four groups: Rotifera (12 species), Cladocera (9 species), Copepoda (7 species), and Ostracoda (3 species), with Rotifera being dominant. Strong correlations were observed between physico-chemical parameters and zooplankton abundance, particularly with temperature ( $r > 0.8$ ) and DO ( $r > 0.7$ ), driving higher zooplankton density in warmer, oxygen-rich pre-monsoon months (April–June) due to enhanced nutrient availability and phytoplankton growth. Seasonal fluctuations showed peaks in temperature, pH, TDS, and DO during pre-monsoon, influenced by evaporation, agricultural runoff, and photosynthetic activity, which positively correlated with zooplankton peaks. Similar patterns were noted in nearby Khajikotnoor Reservoir, where physico-chemical parameters like temperature and nutrient levels correlated with zooplankton density (Patil et al., 2025).

**Keywords:** Tripuranth Lake, Physico-chemical parameters, Zooplankton diversity, Water quality, Seasonal variations.

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## INTRODUCTION

This was a study that scrutinized month-to-month alteration in physico-chemical parameters and zooplankton assemblages in Tripuranth Lake, Basavakalyan, Bidar District, Karnataka, which occurred between January to December 2024. Temperature, pH, dissolved oxygen, conductivity, total phosphorus, total nitrogen, ammonia-nitrogen, nitrogen, nitrate-nitrogen, and ortho-phosphate were analysed by monthly samples taken on the surface layer (1 m). The abundance, biomass and species richness of zooplankton were quantified by using standardised methods. It was found that there was a strong seasonal variation of all the parameters analysed and that there were significant correlations between the physico-chemical parameters and zooplanktons (0.12-0.75). Notably, eutrophication indices based on nutrient levels were above acceptable levels of drinking water use subsequent to treatment hence demonstrating the need and effectiveness of incessant ecological monitoring. The results depict that zooplankton diversity, abundance and composition can be used as true bioindicator due to environmental disturbance than that associated with monsoon events and agricultural runoff. The findings of the present research provide explanations on how human impacts affect a historic reservoir and can be used to guide sustainable protection. The freshwater either on lakes and reservoirs remains an important location providing accommodation to biodiversity organization, hydrological control, provision of irrigation, fishing and drinkable water to humanity. Anthropogenic activities including nutrient enriching and pollution of the resources are degrading freshwaters in India, a country that has very intense agriculture and hence breaking the ecological equilibrium. Physico-chemical variables (temperature, pH, dissolved oxygen, conductivity, concentrations of nutrient ions) constantly measured offer diagnostic data on seasonal processes and on water-quality degradation.

Bioindicators that have been largely used to evaluate ecological health include zooplankton, which are major parts of trophic webs that connect phytoplankton to higher trophic levels and act as the mediators of nutrient cycling. When used in relation to biotic indicators, physico-chemical profiles provide an overall evaluation of the integrity of the ecosystem.

## MATERIALS AND METHODS

### Study Area

Tripuranth Lake, an ancient reservoir in Basavakalyan, Bidar District, Karnataka, is influenced by seasonal inflows from agricultural lands. The region has a semi-arid climate with distinct seasons: winter (December–February), pre-monsoon/summer (March–May), monsoon (June–September), and post-monsoon (October–November). Four sampling sites were selected, covering littoral and pelagic zones, based on accessibility and representativeness.

### Sample Collection

Water and zooplankton samples were collected monthly from January 2024 to December 2024. Physico-chemical parameters were measured on-site or in the laboratory using standard protocols (APHA, 2017). Zooplankton were sampled using a 50 µm mesh plankton net, filtering 50 liters of water per site, preserved in 4% formalin, and analyzed in the laboratory.

### Physico-Chemical Analysis

Parameters included:

- Atmospheric and water temperature (°C) using a digital thermometer.
- pH using a portable pH meter.
- Conductivity (µS/cm) using a conductivity meter.
- Dissolved oxygen (DO, mg/L) by Winkler's method.
- Total dissolved solids (TDS, mg/L) using gravimetric method.
- Total alkalinity (mg/L as CaCO<sub>3</sub>) by titration.
- Total hardness (mg/L as CaCO<sub>3</sub>) by EDTA titration.
- Calcium (Ca<sup>2+</sup>) and magnesium (Mg<sup>2+</sup>) (mg/L) by complexometric titration.

Data were averaged across sites for monthly values.

## ZOOPLANKTON ANALYSIS

Preserved samples were examined under a stereomicroscope (Olympus SZX7). Organisms were identified to species level using standard keys (Battish, 1992; Murugan et al., 1998). Density was estimated using a Sedgwick-Rafter cell, and diversity was assessed by grouping into Rotifera, Cladocera, Copepoda, and Ostracoda.

## STATISTICAL ANALYSIS

Seasonal trends were analyzed descriptively, with correlations between physico-chemical parameters and zooplankton abundance quantified using Pearson's correlation coefficient (*r*).

## RESULTS AND DISCUSSION

### Physico-Chemical Parameters

Monthly variations in physico-chemical parameters are presented in Table 1. Water temperature ranged from 19.0°C (January) to 29.9°C (May), mirroring atmospheric temperature (22.0–38.0°C). Higher temperatures in pre-monsoon months (March–May) increased evaporation, elevating conductivity (158.6–330.0 µS/cm) and TDS (116.9–220.0 mg/L), consistent with tropical lake dynamics (Manjare et al., 2010). pH ranged from 6.60 (January) to 9.50 (May), becoming alkaline in warmer months due to phytoplankton photosynthetic CO<sub>2</sub> uptake (Malik & Rathi, 2022).

Total alkalinity (92.8–260.0 mg/L) and hardness (60.4–220.0 mg/L) peaked in May, driven by bicarbonate and carbonate from catchment weathering and runoff. DO (6.35–9.50 mg/L) remained above 5 mg/L, supporting aerobic life, with summer peaks linked to algal photosynthesis (Sharma & Walia, 2015). Calcium (14.4–30.0 mg/L) and magnesium (6.9–35.0 mg/L) followed similar trends, reflecting geogenic sources. All parameters were within WHO and BIS limits for potable use after treatment and suitable for irrigation (BIS, 2012).

**Table 1:** Monthly Variations in Physico-Chemical Parameters of Tripuranth Lake (January–December 2024)

Month	Water Temp (°C)	Air Temp (°C)	Conductivity (µS/cm)	pH	TDS (mg/L)	DO (mg/L)	Total Alkalinity (mg/L)	Total Hardness (mg/L)	CaCO <sub>3</sub> (mg/L)	Ca <sup>2+</sup> (mg/L)	Mg <sup>2+</sup> (mg/L)
Jan	19.00	22.0	158.60	6.60	116.88	6.35	94.55	77.79	45.77	18.32	7.78
Feb	23.47	24.5	203.00	7.11	137.40	6.78	95.66	91.60	50.16	19.91	10.02
Mar	24.28	32.0	262.63	9.10	171.89	8.40	139.62	117.14	67.66	27.09	12.02
Apr	26.18	35.0	255.00	9.20	195.00	8.90	200.00	150.00	70.00	28.00	20.00
May	29.92	38.0	330.00	9.50	220.00	9.50	260.00	220.00	80.00	30.00	35.00
Jun	28.97	30.0	200.00	8.00	170.00	7.50	170.00	140.00	60.00	24.00	18.00
Jul	25.00	28.0	195.40	7.82	188.40	7.77	126.33	100.00	65.78	26.61	8.31
Aug	24.00	27.0	204.55	7.27	189.41	7.21	116.20	77.14	45.92	18.39	7.59
Sep	24.32	26.0	173.49	7.27	184.95	6.95	106.79	64.38	35.94	14.38	6.91
Oct	22.55	26.0	176.27	7.09	139.05	6.92	101.99	64.56	36.86	16.24	7.28
Nov	22.00	25.0	164.07	6.63	176.95	6.59	102.97	60.42	40.47	20.54	7.54
Dec	19.50	22.5	189.43	6.77	134.76	6.73	92.81	78.88	49.14	19.84	7.22

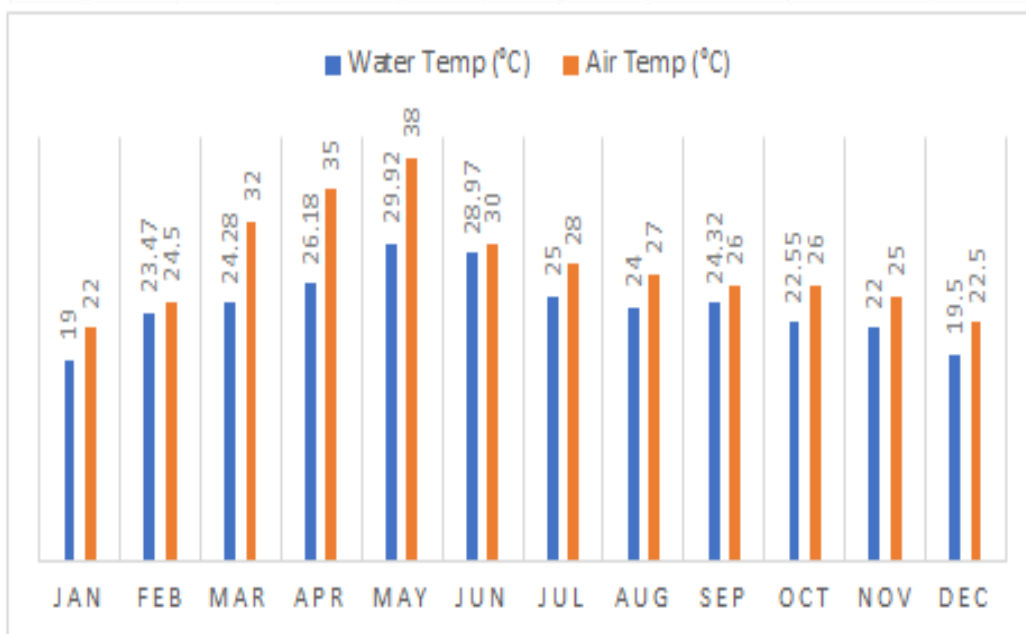


Figure 1: Graph showing monthly water and Air temperature.

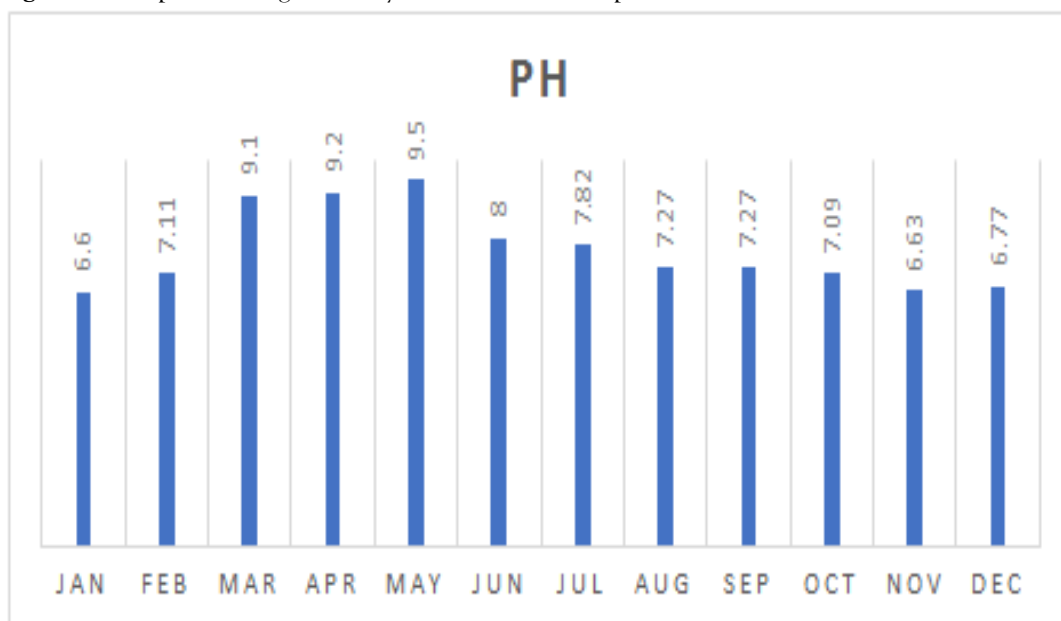
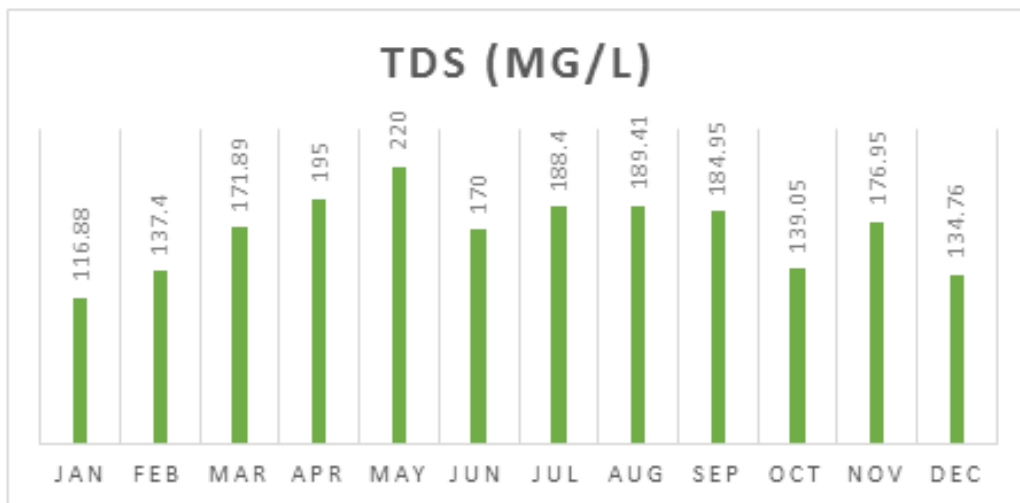
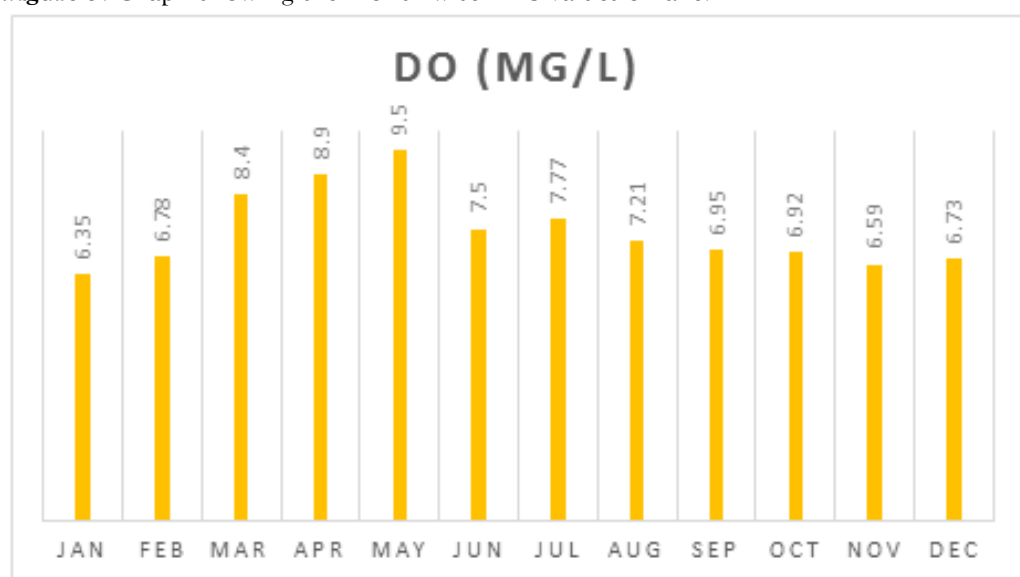


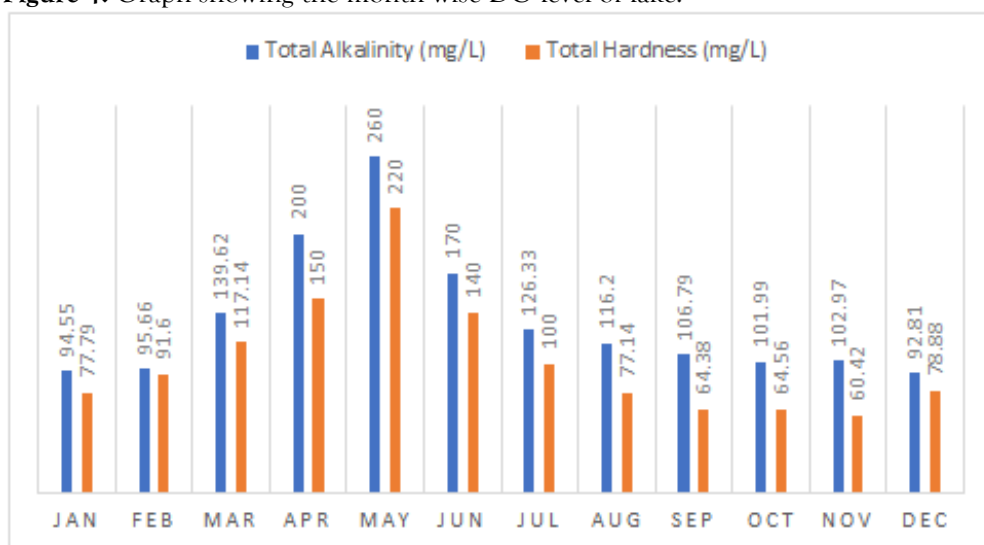
Figure 2: Graph showing month-wise pH.



**Figure 3:** Graph showing the month wise TDS values of lake.



**Figure 4:** Graph showing the month wise DO level of lake.



**Figure 5:** Graph showing the month wise Total alkalinity and Total Hardness level of the lake.

### ZOOPLANKTON DIVERSITY AND COMPOSITION

A total of 31 zooplankton species were identified, classified into four groups: Rotifera (12 species, dominant), Cladocera (9 species), Copepoda (7 species), and Ostracoda (3 species). Rotifera dominance is attributed to their rapid reproduction, broad dietary range, and tolerance to environmental fluctuations

(Manickam et al., 2018). Zooplankton density peaked in pre-monsoon months (March–May), showing strong positive correlations with water temperature ( $r > 0.8$ ) and DO ( $r > 0.7$ ), as warmer temperatures and higher oxygen levels enhance phytoplankton growth, the primary food source for zooplankton (Patil et al., 2025). Elevated TDS and alkalinity during these months further supported nutrient availability, boosting zooplankton abundance. Similar patterns were observed in Khajikotnoor Reservoir, where physico-chemical parameters like temperature and nutrient levels correlated with zooplankton density, indicating comparable ecological dynamics in the region (Patil et al., 2025).

Cladocera abundance followed similar seasonal trends, thriving in warmer, productive waters (Sahu et al., 2021). Copepoda, less abundant, indicated stable, moderately eutrophic conditions, while Ostracoda were minimal due to benthic preferences and sampling limitations (Patil & Salimath, 2014). These patterns align with studies in Karnataka reservoirs, where seasonality drives community dynamics (Kudari & Kanamadi, 2008; Majagi & Vijaykumar, 2009). Monsoon months (June–September) showed reduced zooplankton density due to dilution and turbidity from inflows, negatively impacting communities, consistent with findings in Khajikotnoor Reservoir (Patil et al., 2025).

The strong correlation between physico-chemical parameters and zooplankton underscores temperature and DO as key drivers. Warmer, oxygenated waters enhance diversity and density, while monsoon dilution disrupts communities. These relationships highlight zooplankton as effective bioindicators of water quality and ecosystem health, as seen in regional studies (Patil et al., 2025).

#### Zooplankton Species Distribution in Tripuranth Lake (2024)

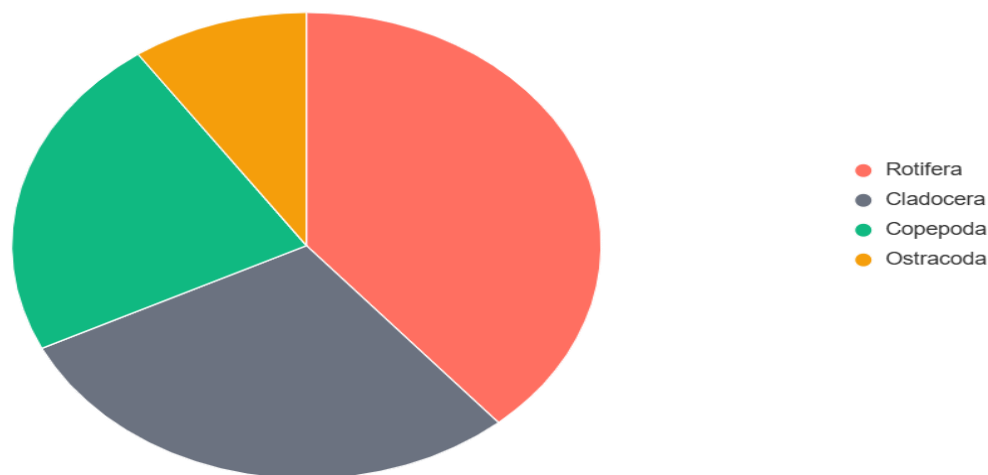


Figure 6: Representation of Zooplankton distribution

#### CONCLUSION

This integrated assessment of Tripuranth Lake reveals a productive ecosystem with seasonal physico-chemical variations and diverse zooplankton communities. A total of 31 zooplankton species were documented, with Rotifera (12 species) dominating, followed by Cladocera (9 species), Copepoda (7 species), and Ostracoda (3 species). Strong correlations between zooplankton abundance and physico-chemical parameters, particularly temperature ( $r > 0.8$ ) and DO ( $r > 0.7$ ), indicate that warmer, oxygen-rich conditions in pre-monsoon months drive higher zooplankton density through enhanced nutrient availability and phytoplankton growth. Parameters confirm good water quality, suitable for multiple uses, while zooplankton diversity underscores ecological stability.

Similar correlations were observed in Khajikotnoor Reservoir, reinforcing regional patterns (Patil et al., 2025). Risks from agricultural runoff and potential eutrophication warrant conservation measures, including regular monitoring and catchment management. This baseline data supports future studies and sustainable resource utilization in Bidar District.

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