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Water quality footprint of Gundolav Lake, Kishangarh, Ajmer (Rajasthan)

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Abstract
Gundolav Lake situated in Kishangarh, Ajmer, is an important freshwater ecosystem possessing ecological, cultural, and economic significance. The present study was undertaken to evaluate the current status of water qualityand anthropogenic impacts affecting the lake. Systematic sampling was conducted, and selected physico-chemical parameters including temperature, pH, total dissolved solids (TDS), dissolved oxygen (DO), chlorides,transparency and alkalinity were analyzed using standard methods.The findings reveal variations in water quality parameters indicating increasing pollution levels due to sewage discharge, agricultural runoff, and nearby human activities. Elevated nutrient concentrations, particularly nitrates and phosphates, suggest the onset of eutrophic conditions leading to habitat degradation. The study provides baseline data for future ecological monitoring and highlights the urgent need for sustainable management and conservation strategies to protect the lake ecosystem.

Keywords: Anthropogenic impacts, Water quality, eutrophication, freshwater ecosystem, Physico-chemical parameters

Introduction

Freshwater ecosystems play a vital role in maintaining ecological balance and supporting biodiversity. Lakes, in particular, function as reservoirs of biological productivity and provide water for domestic, agricultural, and industrial purposes. The assessment of water quality is therefore essential to determine the ecological health and sustainability of such aquatic systems. According to Purohit and Singh (2020) [11], physico-chemical characteristics of water significantly influence species diversity, abundance, and metabolic activities of aquatic organisms. Similarly, Khanna *et al.* (2012) [9] emphasized that water quality parameters regulate ecological homeostasis within aquatic environments.

In recent decades, increasing urbanization, industrialization, and agricultural intensification have exerted severe pressure on freshwater resources. Sanchez (2007) [12] reported that improper management of water bodies results in progressive deterioration of lake ecosystems. Industrial effluents, domestic sewage, and agricultural runoff introduce excessive nutrients and pollutants into water bodies, leading to changes in chemical composition and biological productivity (Karanth, 1989). Verma and Khan (2015) [8, 15] further stated that water pollution not only affects aquatic biodiversity but also poses serious threats to human health and socio-economic development.

One of the major consequences of nutrient enrichment in lakes is eutrophication, characterized by excessive growth of algae and aquatic weeds. Wetzel (2001) [16] described eutrophication as a natural aging process of lakes that is accelerated by anthropogenic inputs of nitrogen and phosphorus. High concentrations of nitrates and phosphates reduce dissolved oxygen levels and disturb aquatic life (APHA, 2005). Therefore, continuous monitoring of physico-chemical parameters such as temperature, pH, total dissolved solids (TDS), dissolved oxygen (DO), chlorides, alkalinity is necessary for evaluating trophic status and pollution levels (Trivedi and Goel, 1992) [14].

Gundolav Lake, situated in Kishangarh of Ajmer district, Rajasthan, is a significant freshwater body surrounded by expanding urban settlements and agricultural fields. Increasing anthropogenic activities around the lake have raised concerns regarding its ecological integrity. However, comprehensive scientific data on its present water quality status remain limited. Hence, systematic investigation of its physico-chemical properties is essential to understand pollution trends and to provide baseline data for future monitoring. The present study aims to assess the water quality status of Gundolav Lake by analyzing selected physico-chemical parameters and evaluating the impact of anthropogenic activities. The findings will contribute to sustainable management strategies and help in preventing further ecological degradation of this important freshwater ecosystem.

Material and Methodology

Gundolav Lake is a rain-fed, man-made freshwater lake situated in the northern part of Kishangarh in Ajmer district. Geographically, it lies between 26°28′ N latitude and 74°52′ E longitude at an elevation of approximately 500 meters above mean sea level (MSL). The lake is located in the eastern semi-arid agro-climatic zone of Rajasthan.The surrounding terrain consists of low hill ranges interspersed with nearly plain surfaces that form a natural catchment basin. This topography supports seasonal water accumulation during the monsoon period and contributes to the lake's hydrological dynamics.Gundolav Lake is one of the important perennial shallow water bodies in the region. Other nearby freshwater bodies include Hameer Pond, Santolav Pond, and Ransamand Pond, which collectively form part of the local drainage and water resource system.Water sampling was carried out during the morning hours between 8:00 a.m. and 10:00 a.m. to minimize the influence of diurnal fluctuations on physico-chemical parameters. Many water quality variables, particularly dissolved oxygen and temperature, show significant variation throughout the day due to photosynthetic activity and atmospheric interactions. Therefore, sampling during

fixed morning hours ensures uniformity, reliability, and comparability of data. Samples were collected on alternate days throughout the study period. The investigation was conducted over months from September 2024 to February 2025, covering post-monsoon and winter seasons. This systematic sampling schedule enabled assessment of seasonal variations and provided representative data on the water quality status of Gundolav Lake.

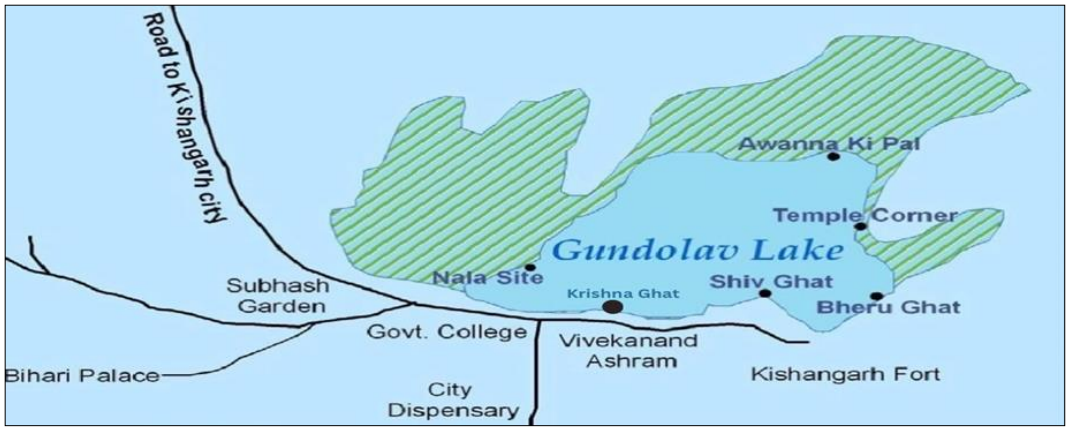

Fig- Map of Gundolav lake

Three sampling stations were selected based on the intensity of anthropogenic activities. These stations were selected to represent different ecological and pollution gradients within the lake.

Station I – Krishna Ghat: Dominated by bathing, washing, and religious activities.

Station II – Shiv Ghat: Deeper water zone with frequent human interference and ritual practices.

Station III – Bhairav Ghat: Comparatively less disturbed site, representing relatively cleaner conditions.

Water samples were collected in clean, pre-washed polyethylene bottles. Samples were taken from about 20–30 cm below the surface to avoid surface contamination. All samples were properly labeled and transported to the laboratory for analysis.

Result and Discussion

Water Temperature

Water temperature is very important for all life processes and influences the rate of biochemical reactions, gas solubility (especially dissolved oxygen), and the metabolic activities of aquatic organisms (Kalff, 2002) [7]. Temperature changes can alter stratification and affect species distribution in freshwater bodies. Water temperature was measured in situ using a calibrated mercury thermometer immersed directly into the lake water until the reading stabilized. In the present investigation water temperature was varied between 20.5-21.3° C which was slightly lower than as compare to observed byJaroli(2025) [6].

pH (Hydrogen Ion Concentration)

pH indicates the acidic or alkaline nature of water. Extremes of pH can be harmful to aquatic biota, affecting enzyme activity, respiration, and nutrient availability. pH also influences solubility and toxicity of metals (Wetzel, 2001; Chapman, 1996) [3, 16]. The higher pH is also caused by sewage discharged (Bedwal and Mathur,2015) [2]. In the present study pH varied between 8.7-9.0.

Total Dissolved Solids (TDS)

TDS represents the sum of dissolved inorganic salts and small organic molecules in water. Elevated TDS can indicate pollution, influence water taste, and affect aquatic life by altering osmotic balance (Sawyer & McCarty, 1978) [13].TDS reduces the solubility of gases in water (Choudhary *et al.,*2014).In the present work the TDS was found between 131.8-575.2mg/l. Whereas average TDS value 334.13 mg/l was observed.

Dissolved Oxygen (DO)

Dissolved oxygen is an essential indicator of water health; sufficient oxygen is crucial for aerobic aquatic life. Low DO levels often result from organic pollution and eutrophication (Mulholland, 1996) [10]. The concentration also decrease with increase the salinity (Verma and Khan,2015) [15].The dissolved oxygen is an index of physical and biological processes (Jaroli,2025) [6]. They found average dissolved oxygen in Gundolav was5.07 mg/l whereas in current work dissolved oxygen is 6.55 observed in lake.

Chlorides

Chlorides originate from natural weathering of rocks and anthropogenic sources like sewage, industrial effluents, and agricultural runoff. High chloride concentrations may impair freshwater organisms and indicate pollution (Hem, 1985) [5]. It may be due to sewage mixing and increased temperature and evaporation of water (Vijayvergia *et al.,* 2007; Verma and Khan,2015;Jaroli,2025) [6, 15]. In present research work the average chloride was 102.70 mg/l estimated.

Total Alkalinity

Alkalinity reflects the buffering capacity of water (its ability to neutralize acids). It is primarily contributed by bicarbonates, carbonates, and hydroxides and helps maintain stable pH levels in aquatic systems (Sawyer & McCarty, 1978) [13]. The changes in alkalinity thus indicates either an addition or precipitation of carbonates and bicarbonates (Jaroli,2025) [6]. In current research the alkalinity observed in Gundolav lake varied between 503-513 mg/l.

Transparency

The depth of visibilityor transparency is inversely proportional to turbidity related with suspendedorganic and inorganic matters present in water (Jaroli,2025) [6]. Transparency indicates water clarity, which affects light penetration, primary productivity, and overall ecological condition. Lower transparency often suggests higher

suspended solids or algal growth from nutrient enrichment (Wetzel, 2001) [16]. In present work the average transparency value of Gundolav lake was 41.85 cm observed

Turbidity

Turbidity measures the degree of water cloudiness due to suspended particles, sediments, or plankton. Higher turbidity reduces light penetration, alters thermal structure, and may be associated with erosion or pollution (Davies-Colley & Smith, 2001) [4]. In current research work the turbidity of water 6.84 observed in Gundolav lake.

Table- Average monthly physico- chemical Parameters of Gundolav Lake.

S No.	Parameters	Krishna Ghat (site1)	Shiv Ghat (site2)	Bhairav Ghat (site3)	Average
1.	Water temperature ºC	20.8	20.5	21.3	20.8
2.	Transparency(cm)	36.8	37.56	51.2	41.85
3.	Turbidity	6.58	5.94	8.0	6.84
4.	pH	8.9	8.12	8.02	8.3
5.	Chloride(mg/l)	96.38	94.18	117.56	102.70
6.	Total Alkalinity(mg/l)	513	503	509	508.33
7.	Dissolved O_2(mg/l)	7.66	6.04	5.96	6.55
8.	Total Dissolved solid (mg/l)	575.2	295.4	131.8	334.13

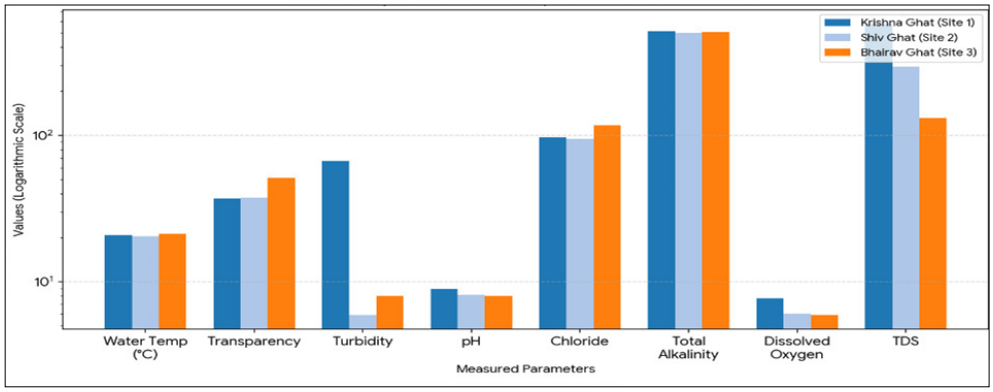

Fig 2: Comparative study of average monthly physicochemical properties of different station of Gundolav lake

Conclusion

The present investigation on Gundolav Lake revealed that the lake ecosystem is undergoing gradual ecological deterioration due to increasing anthropogenic activities. Analysis of physico-chemical parameters from the three study stations indicated noticeable variations in water quality during the study period from September 2024 to February 2025. Parameters such as pH, total alkalinity, turbidity, chlorides, dissolved oxygen, and total dissolved solids showed moderate fluctuations influenced by domestic activities, sewage discharge, agricultural runoff, and human interference around the lake.

Among the three stations, Krishna Ghat (Site I) showed comparatively higher pollution levels due to intensive bathing, washing, and religious activities, whereas Bhairav Ghat (Site III) exhibited relatively better water quality conditions. Elevated alkalinity and nutrient enrichment indicate the beginning of eutrophic conditions, which may adversely affect aquatic biodiversity and ecological stability if preventive measures are not adopted.

The study highlights the urgent need for regular monitoring and scientific management of Gundolav Lake. Proper sewage treatment, control of agricultural runoff, restriction of waste disposal, and public awareness programs are essential for conserving the ecological health of the lake. The data generated through this study can serve as baseline information for future ecological assessments and sustainable conservation planning.

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