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Comparative Analysis of Water Quality in Dam Lakes of Edirne Province, Türkiye

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Abstract

Edirne Province is located in the northwestern part of Türkiye's Marmara Region. This area is classified as "Agricultural Land" because of its abundant freshwater resources and fertile soils. In the current research, the water qualities of Sultanköy and Altınyazı dam lakes were assessed and compared. Water samples were taken from the reservoir outlets in the autumn of 2024. A total of 12 physicochemical parameters were measured, including dissolved oxygen (DO), electrical conductivity (EC), pH, total dissolved solids (TDS), turbidity (Tur), salinity (Sal), suspended solids (SS), nitrite-nitrogen (NO_2-N), phosphate-phosphorus (PO_4-P), nitrate-nitrogen (NO_3-N), sulphate (SO_4), and ammonium-nitrogen (NH_4-N) using a multi-parameter meter and a spectrophotometer. The results of the study indicated that the water quality in both dam lakes was comparable, with both reservoirs demonstrating first-class water quality for DO, pH, NO_3-N, and NH_4-N parameters, second-class water quality for EC and NO_2-N parameters, and third-class water quality for PO_4-P.

Keywords: Sultanköy Dam Lake, Altınyazı Dam Lake, Water quality comparisson

Introduction

Freshwater pollution is one of the most critical environmental challenges of the 21st century, posing significant threats to aquatic ecosystems, biodiversity, and human health (Helvacıoğlu et al., 2025; Haq et al., 2023; Din et al., 2023; Muhammad et al., 2024; 2025; Tokatlı et al., 2025). Among freshwater bodies, dam lakes play a crucial role in water supply, irrigation and flood control. However, increasing anthropogenic activities, including agricultural runoff, industrial discharges, and domestic wastewater inputs, have led to the deterioration of water quality in these reservoirs (Çiçek et al., 2014; Köse et al., 2020; Varol et al., 2022; Ustaoğlu et al., 2022; Yüksel et al., 2024)

Sultanköy and Altınyazı Dam Lakes are among the most significant reservoirs in Edirne Province, Türkiye, playing a crucial role in regional water supply for both irrigation and drinking purposes. Constructed by the General Directorate of State Hydraulic Works (DSİ) to support agricultural productivity and meet the water demands of local communities, these reservoirs have become vital resources for sustaining both economic and ecological balance (http://www2.dsi.gov.tr/). However, like many freshwater ecosystems, they are increasingly subjected to anthropogenic pressures, particularly from agricultural runoff and domestic wastewater discharge, which introduce excessive nutrients, pesticides, suspended solids, and organic pollutants into the water bodies (Tokatlı et al., 2017; Tokatlı, 2019; 2020a; 2020b).

In response to these environmental challenges, this study aims to evaluate and compare the water quality of Sultanköy and Altınyazı Dam Lakes by analysing key physicochemical parameters. Through a detailed evaluation of these indicators, the research seeks to provide valuable insights into the current state of these reservoirs and contribute to the development of sustainable water management strategies to ensure the long-term protection and usability of these essential freshwater ecosystems.

Materials and Methods
Research area and sample collection
Sultanköy and Altınyazı Dam Lakes, along with the selected sampling stations on these reservoirs, are presented in Figure 1, providing a visual representation of the study area. To evaluate the current water quality status, water samples were systematically collected from the designated stations during the autumn season of 2024, ensuring that potential pollutant influxes were accurately represented in the analysis.
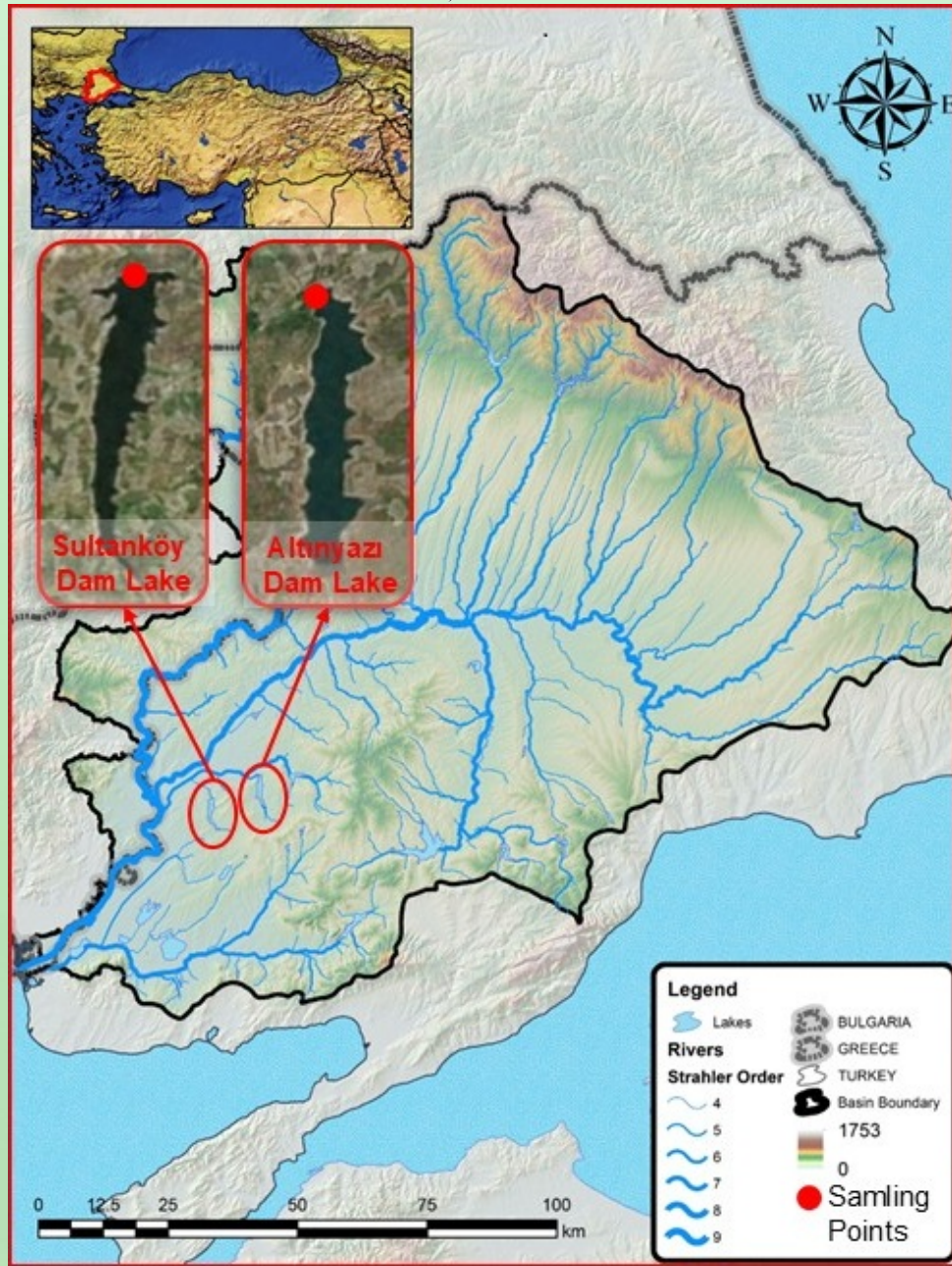
Figure 1. Meriç – Ergene Basin, investigated reservoirs and selected sampling stations

Physicochemical analysis

Dissolved oxygen, electrical conductivity, pH, total dissolved solids, salinity, and turbidity were measured on-site in the field following APHA standards (1998, 2017) using a Hach portable multi-parameter meter and a Hach turbidimeter. The concentrations of suspended solids, phosphate-phosphorus, nitrite-nitrogen, nitrate-nitrogen, ammonium-nitrogen and sulphate were analysed in the laboratory following APHA protocols (1998) using a Hach spectrophotometer and a Hach colorimeter.

Results and Discussion

The detected variables are given in Figure 2. Significant spatial differences in levels of investigated parameters were not recorded and the water qualities of both investigated reservoirs were quite similar. The data of the measured variables in waters of Sultanköy and Altınyazı Dam lakes as follows respectively: 9.62 – 9.40 mg/L for DO; 8.04 – 8.18 for pH; 359 – 313 mg/L for TDS; 734 – 643 µS/cm for EC; 0.36 – 0.31 ‰ for salinity; 47 – 286 NTU for turbidity; 32 – 188 mg/L for SS; 0.021 – 0.023 mg/L for NO_2-N; 0.80 – 0.05 mg/L for NO_3-N; 0.85 – 0.44 mg/L for NH_4-N; 0.30 – 0.21 mg/L for PO_4-P; and 83 – 95 mg/L for SO_4. It was also determined that both reservoirs exhibited first-class water quality in terms of DO (> 8 mg/L), pH (6 – 9), NO_3-N (< 3 mg/L) and NH_4-N (< 0.2 mg/L) parameters, second-class water quality in terms of EC (400 – 1000 µS/cm) and NO_2-N (0.01 – 0.06 mg/L) parameters, and third-class water quality in terms of PO_4-P (> 0.16 mg/L) parameter (TSWQR, 2021). Elevated phosphate levels can lead to eutrophication, a process where excessive nutrients stimulate algal blooms, depleting oxygen levels and disrupting the aquatic food web. In reservoirs, high phosphate concentrations may arise from agricultural runoff containing phosphate fertilizers, wastewater discharge, and soil erosion. Agricultural activities, particularly the use of phosphate-rich fertilizers, contribute significantly to phosphate influx, while wastewater and industrial discharges further augment nutrient loading (Mutlu et al., 2021a; 2021b; Tokatlı et al., 2023; 2024). It is thought that the quite high phosphate values detected in the waters of both investigated dams, which are quite close to residential areas, are caused by agricultural activities and domestic waste.

Conclusions

In conclusion, the water quality data collected from Sultanköy and Altınyazı Dam lakes reveal generally similar characteristics across both reservoirs, with some variations in specific parameters. Both reservoirs exhibit first-class water quality for several critical parameters, including dissolved oxygen (DO), pH, and nitrate-nitrogen (NO_3-N)while they exhibit second-class water quality for electrical condictivity (EC) and nitrite-nitrogen (NO_2-N). However, elevated phosphate levels observed in both lakes suggest a potential risk for eutrophication, which may result from agricultural runoff and domestic waste, given the proximity of these reservoirs to residential areas. Despite their overall good water quality, the higher concentrations of phosphate in both dams indicate that agricultural activities and domestic effluents may contribute significantly to nutrient loading, potentially threatening the long-term ecological balance of these aquatic ecosystems.
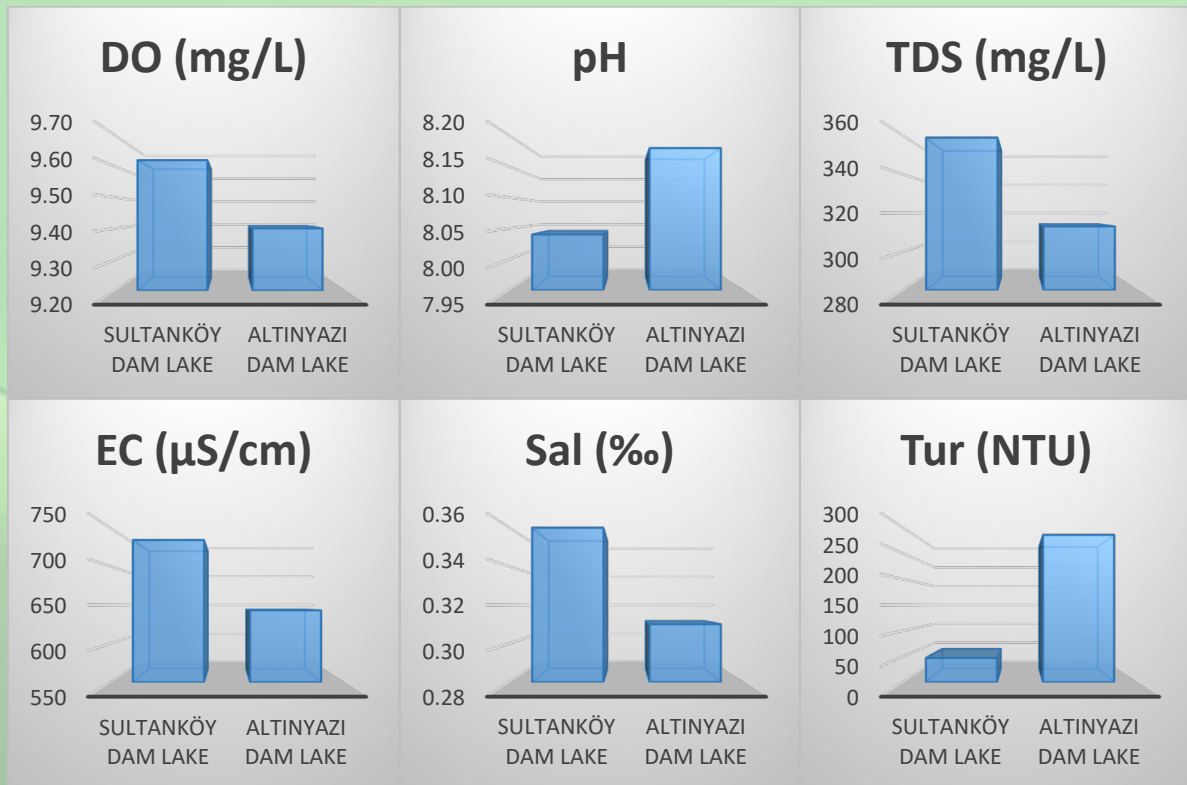

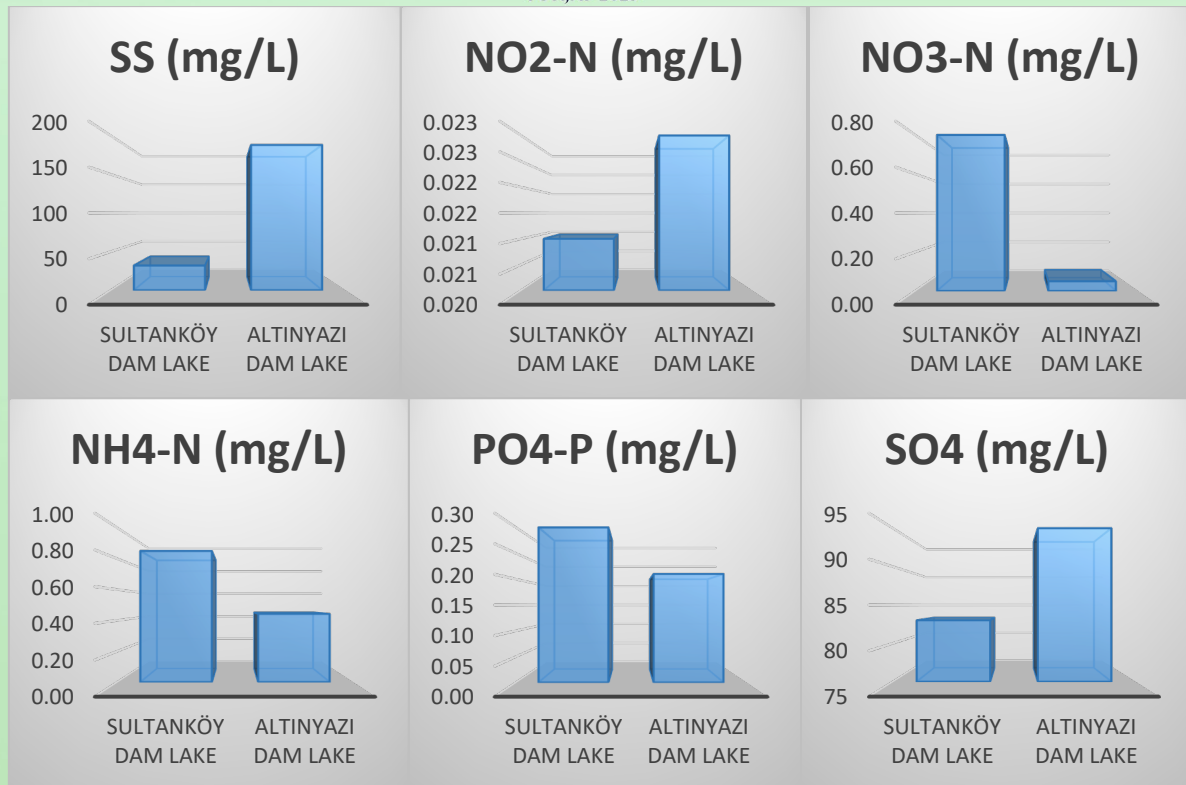Figure 2. Investigated limnological parameters

Figure 2. Investigated limnological parameters (continued)

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