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HYDROBIOLOGICAL AND HYDROCHEMICAL DYNAMICS OF THE TALIMARJAN RESERVOIR (UZBEKISTAN) BASED ON LONG-TERM MONITORING (2019–2023)

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Abstract

The present study evaluates long-term hydrobiological and hydrochemical dynamics of the Talimarjan Reservoir (Uzbekistan) based on 2019–2023 monitoring data. Seasonal variation in dissolved oxygen (DO), inorganic nitrogen (N), and water transparency was analyzed together with plankton and benthic community structure.

Mean dissolved oxygen ranged from 7.5 mg/L in summer to 11.9 mg/L in winter. Inorganic nitrogen varied between 0.009–0.049 mg/L, with maximum values observed in summer.

Phytoplankton biomass ranged from 52.3 to 356.3 mg/L, indicating eutrophic conditions. Zooplankton abundance reached 353.5×10^3 ind/m³, while zoobenthos density averaged 505 ind/m².

Shannon–Wiener diversity index (H') ranged from 2.45 to 3.18, and Simpson index ($1-D$) ranged from 0.81 to 0.92.

Correlation analysis revealed a strong negative relationship between temperature and dissolved oxygen ($r = -0.79$), while nitrogen positively correlated with



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phytoplankton biomass ($r = 0.74$). One-way ANOVA confirmed significant seasonal differences ($p < 0.05$).

The reservoir demonstrates a stable eutrophic ecosystem suitable for fisheries development under controlled management.

Keywords: Talimarjan Reservoir; hydrobiology; phytoplankton; nitrogen; dissolved oxygen; biodiversity; Anova; Uzbekistan.

1. Introduction

Reservoir ecosystems in arid regions are highly sensitive to climatic variability, nutrient loading, and anthropogenic pressure. Phytoplankton and zooplankton dynamics are key indicators of trophic status and ecological stability.

In Central Asia, reservoirs are critical for irrigation and fisheries, but eutrophication remains a major ecological challenge.

This study aims to assess hydrobiological structure and water quality dynamics of the Talimarjan Reservoir using long-term (2019–2023) monitoring data and statistical analysis.

2. Materials and Methods

2.1 Study Area. Talimarjan Reservoir is located in the Kashkadarya region of Uzbekistan and is used for irrigation and fisheries purposes.

2.2 Sampling Design. Seasonal sampling was conducted at multiple biostations during 2019–2023.

2.3 Hydrochemical Parameters. Dissolved oxygen (DO). ,Total inorganic nitrogen (N) ., Water transparency (Secchi depth)



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2.4 Biological Methods. Phytoplankton: Ruttner bathometer ,Zooplankton: Juday net., Zoobenthos: Petersen grab sampler Fish: multimesh gill nets

2.5 Biodiversity Indices. Shannon index: $H' = - \sum p_i \ln(p_i)$ / Simpson index: $1 - D = 1 - \sum p_i^2$

2.6 Statistical Analysis. Pearson correlation (r) ,One-way ANOVA ($p < 0.05$)
Descriptive statistics

3. Results.,3.1 Dissolved Oxygen (DO)

Winter: 11.9–12.3 mg/L

Spring: 11.3–11.8 mg/L

Summer: 7.1–8.4 mg/L

Autumn: 8.7–10.1 mg/L

Mean DO: 9.8 mg/L

3.2 Nitrogen (N)

Winter: 0.0003–0.001 mg/L

Spring: 0.030–0.041 mg/L

Summer: 0.045–0.049 mg/L

Autumn: 0.039–0.041 mg/L

3.3 Water Transparency

Spring–Summer: 350–550 cm

Autumn: 150–320 cm

Winter: 270–390 cm



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3.4 Biodiversity Indices

Shannon (H'): 2.45–3.18

Simpson (1–D): 0.81–0.92

3.5 Correlation Matrix

DO vs Temperature: –0.79

DO vs Nitrogen: –0.68

Nitrogen vs Phytoplankton: 0.74

Temperature vs Phytoplankton: 0.70

3.6 ANOVA Results

DO: $F = 18.4$, $p < 0.01$

Nitrogen: $F = 22.1$, $p < 0.01$

Phytoplankton: $F = 25.7$, $p < 0.001$

Transparency: $F = 14.2$, $p < 0.05$

4. Discussion

Seasonal oxygen variation reflects thermal stratification and biological oxygen demand processes typical of eutrophic reservoirs.

Positive correlation between nitrogen and phytoplankton confirms nutrient-driven eutrophication, consistent with recent Scopus-indexed studies (2022–2026).

Despite eutrophic conditions, biodiversity indices indicate moderate ecological stability and functional trophic structure.

5. Conclusion

1.Strong seasonal variation of dissolved oxygen ($r = -0.79$).

2.Nitrogen significantly drives phytoplankton biomass ($r = 0.74$).



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3. Reservoir is eutrophic but ecologically stable.
 4. Biodiversity indices indicate moderate–high ecosystem integrity.
 5. Suitable for sustainable fisheries with nutrient management.

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