

Bioindicative Assessment of Water Quality in Sariqamish Lake and Adjacent Fish Ponds Based on Zooplankton

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Abstract

Water quality of Sariqamish Lake and adjacent fish ponds (Beshariq district, Fergana region, Uzbekistan) was assessed using zooplankton indicator species. The Pantle–Buck saprobity index, the Shannon–Wiener diversity index and the Rotifera/Cladocera species ratio were calculated and related to hydrochemical parameters. Lake water was found to be cleaner than pond water throughout the season, whereas the organic load in the ponds increased sharply in summer, shifting them towards the α -mesosaprobic zone. The saprobity index correlated negatively with dissolved oxygen and water transparency. The Rotifera/Cladocera ratio is proposed as a simple rapid criterion for monitoring water quality in pond fish farms.

Keywords: Bioindication, zooplankton, saprobity index, indicator species, Shannon–Wiener index, water quality, Sariqamish Lake.

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1. Introduction

Hydrochemical analysis alone is insufficient for assessing the ecological state of water bodies, since it reflects conditions only at the moment of sampling. Bioindication, in contrast, accounts for the response of biological communities to long-term environmental impacts and thus provides an integral assessment of water quality [1, 2].

Zooplankton offers several advantages as a bioindicator: its organisms have short life cycles and respond rapidly to environmental change, the saprobic valencies of many species are well established, and sampling and analysis are relatively simple [3, 4].

In fish ponds, fertilisation, supplementary feeding and high stocking densities increase the organic load, which leads to oxygen deficiency and a higher risk of fish disease. Since Sariqamish Lake serves as the water source for the adjacent ponds, a joint assessment of lake and pond water quality is of considerable practical importance. To date, no zooplankton-based bioindication studies have been carried out in these water bodies.

Aim of the study: to assess the water quality of Sariqamish Lake and the adjacent fish ponds on the basis of zooplankton indicator species and to determine the relationship between bioindicative and hydrochemical parameters [5, 6].

Scientific novelty. For the first time, the water quality of Sariqamish Lake and adjacent ponds was assessed seasonally using zooplankton indicator species; the relationships of the saprobity index with dissolved oxygen and water transparency were established; and a rapid assessment criterion based on the Rotifera/Cladocera ratio was proposed for fish ponds.

2. Methods

Samples were collected from April to October in 2024–2026 at 10 stations in Sariqamish Lake and 7 stations in the adjacent ponds. Quantitative samples were obtained by filtering 50–100 L of water through an Apstein plankton net (mesh size 64 μm) and fixed in 4% formalin [7].

Water temperature, pH, dissolved oxygen (O_2 , mg/L), Secchi disk transparency and permanganate oxidisability were measured simultaneously. Species were identified using standard keys [8].

The saprobity index was calculated according to Pantle and Buck using the indicator values of Sládeček [1, 2]:

$$S = \Sigma(s \cdot h) / \Sigma h,$$

where s is the indicator (saprobie) value of a species and h is its frequency of occurrence (scored 1, 3, 5, 7 or 9). Index values of 0.5–1.5 were classified as oligosaprobic, 1.51–2.5 as β -mesosaprobic and 2.51–3.5 as α -mesosaprobic. Species diversity was evaluated with the Shannon–Wiener index (H), and the trophic state with the ratio of Rotifera to Cladocera species numbers [9]. Relationships between parameters were assessed with Pearson's correlation coefficient (r), and differences with Student's t -test ($P \leq 0.05$) [10].

3. Results and Discussion

Of the 13 species identified, 5 (38%) are recognised saprobity indicators (Table 1). The β -mesosaprobic *Keratella quadrata* occurred both in the lake and in the ponds. The α -mesosaprobic cladocerans *Daphnia magna* and *Moina macrocopa* were recorded mainly in the ponds in summer, and the β - α -mesosaprobic *Brachionus angularis* was also confined to the ponds, whereas the oligo- β -mesosaprobic *Bosmina longirostris* was characteristic of the lake.

Table 1. Zooplankton indicator species by saprobic zone

Saprobic zone	Indicator species	Predominant habitat
α - β (1.50–1.65)	<i>Bosmina longirostris</i>	Lake
β (1.75–2.00)	<i>Keratella quadrata</i>	Lake and ponds
β - α (2.30–2.50)	<i>Brachionus angularis</i>	Ponds
α (3.00–3.20)	<i>Daphnia magna</i> , <i>Moina macrocopa</i>	Ponds (summer)

Seasonal analysis showed that in the lake, the saprobity index remained within the β -mesosaprobic zone in all seasons, whereas in the ponds it approached the α -mesosaprobic zone in summer. This is attributed to the accumulation of organic matter during the period of pond fertilisation and fish feeding.

The saprobity index showed a significant negative correlation with dissolved oxygen ($r = -0.54$) and transparency ($r = -0.49$), and a positive correlation with permanganate oxidisability ($P \leq 0.05$). The Shannon–Wiener index was higher in the lake than in the ponds, indicating a more ecologically stable community in the lake.

An increase in the Rotifera/Cladocera species ratio coincided with an increase in organic load. This ratio can therefore be used as a simple criterion for rapid water quality assessment in pond fish farms. These results are

consistent with the findings of similar studies in other regions [4, 9].

4. Conclusions

Saprobiological analysis showed that the water of Sariqamish Lake belonged mainly to the β -mesosaprobic (moderately polluted) zone throughout the season and was ecologically more stable and cleaner than that of the adjacent fish ponds. In the ponds, the increase in organic load in summer shifted the saprobity level towards the α -mesosaprobic state. The significant negative correlation of the saprobity index with dissolved oxygen and transparency confirms that zooplankton composition and abundance can serve as an effective bioindicator in water quality monitoring. Accordingly, monitoring of pond zooplankton every 10–15 days during summer and reducing fertiliser application when the Rotifera/Cladocera ratio increases are recommended to

stabilise the ecological state of the ponds and improve fish farming efficiency.

References

1. Pantle R., Buck H. Die biologische Überwachung der Gewässer und die Darstellung der Ergebnisse. Gas- und Wasserfach, 1955, vol. 96, p. 604.
2. Sládeček V. System of water quality from the biological point of view. Archiv für Hydrobiologie, Beiheft Ergebnisse der Limnologie, 1973, vol. 7, pp. 1–218.
3. Makrushin A.V. Biologicheskii analiz kachestva vod [Biological analysis of water quality]. Leningrad: ZIN AN SSSR, 1974. 60 p. (in Russian)
4. Abdinazarov X.X., Madumarov M.J., Haydarov S.M. Zooplankton of Sarikamish Lake (Uzbekistan). Open Access Library Journal, 2019, vol. 6, no. 3, e5288, pp. 1–8. <https://doi.org/10.4236/oalib.1105288>
5. Abdinazarov X.X., Kuzmetov A.R., Mirabdullayev I.M., Madumarov M.J. Farg'ona vodiysi suv havzalari zooplanktoni [Zooplankton of the water bodies of the Fergana Valley]: Monograph. Tashkent: Printing house of the Main Library of the Academy of Sciences of Uzbekistan, 2022. 122 p. (in Uzbek)
6. Abdinazarov X.X., Xalilov Sh.X. Baliqchilik hovuzlaridagi zooplankton organizmlar va ularning baliqlar oziqlanishidagi ahamiyati [Zooplankton organisms in fish ponds and their role in fish nutrition]. O'zMU xabarleri [Bulletin of the National University of Uzbekistan], 2018, no. 3/1, pp. 7–10. (in Uzbek)
7. Metodicheskie rekomendatsii po sboru i obrabotke materialov pri gidrobiologicheskikh issledovaniyakh na presnovodnykh vodoymakh. Zooplankton i ego produktsiya [Guidelines for the collection and processing of materials in hydrobiological studies of freshwater bodies. Zooplankton and its production]. Leningrad: GosNIORKh, 1984. 33 p. (in Russian)
8. Alekseev V.R., Tsalolikhin S.Ya. (eds.) Opredelitel' zooplanktona i zoobentosa presnykh vod Evropeyskoy Rossii. T. 1. Zooplankton [Key to zooplankton and zoobenthos of fresh waters of European Russia. Vol. 1. Zooplankton]. Moscow; St. Petersburg: KMK, 2010. 495 p. (in Russian)
9. Andronikova I.N. Strukturno-funktsional'naya organizatsiya zooplanktona ozernykh ekosistem raznykh troficheskikh tipov [Structural and functional organisation of zooplankton in lake ecosystems of different trophic types]. St. Petersburg: Nauka, 1996. 189 p. (in Russian)
10. Shitikov V.K., Rozenberg G.S., Zinchenko T.D. Kolichestvennaya gidroekologiya: metody sistemnoy identifikatsii [Quantitative hydroecology: methods of system identification]. Tolyatti: IEVB RAN, 2003. 463 p. (in Russian)