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The Influence Of Environmental Factors On The Phenotypic Variability Of Common Bream (Abramis Brama) In The Lower Reaches Of The Zarafshan River Basin

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Abstract: The article investigates the phenotypic plasticity of common bream (Abramis brama) in the lower reaches of the Zarafshan River under conditions of anthropogenic and environmental transformation. The study reveals the impact of changes in the hydrological regime, water mineralization levels, and the food base on body morphometry. The results clarify the adaptation mechanisms of the species to extreme conditions.
Keywords: Abramis brama, Zarafshan River, phenotypic plasticity, ecological gradient, morphometry, hydrological regime, water mineralization, adaptation, bioresources, anthropogenic pressure, ichthyofauna, ecomorphology.

Introduce

Food security and the rational use of natural resources have been at the center of state policy in the years of independence of the Republic of Uzbekistan. As emphasized by the President of Uzbekistan, Shavkat Mirziyoyev:

“In today’s conditions of ecological problems, water scarcity, and depletion of natural resources, we cannot achieve sustainable development without scientifically grounded approaches. The development of the fisheries sector based on scientific achievements is a guarantee of providing the population with high-quality and affordable protein products.” [1]

In this direction, the Resolution No. PQ-83 of January 13, 2022, titled *“On measures to further develop the fisheries sector and increase the efficiency of fishery water bodies”*, as well as the Law of the Republic of Uzbekistan *“On Fisheries”* adopted in 2023, serve as legal and economic foundations for ichthyological research. [2]

The Zarafshan River is one of the ancient and unique ecosystems of Central Asia, which has undergone significant hydrotechnical changes in recent decades. Particularly in its lower reaches (Navoi and Bukhara regions), an increase in water salinity, a decrease in flow velocity, and sharp fluctuations in water level amplitudes have been observed. Under such conditions, changes in the phenotypic characteristics of one of the dominant species of the river’s ichthyofauna, the common bream (Abramis brama), represent a survival strategy of this species.

The aim of this article is to identify the patterns of these changes and analyze their relationship with environmental factors. [5]

Materials And Methods

The studies were conducted during the spring and autumn seasons of 2024–2025 in the lower reaches of the Zarafshan River, specifically in the territories of Qiziltepa district of Navoi region and Karakul district of Bukhara region.

Sampling: A total of 78 specimens of common bream (Abramis brama) of different age groups were selected for the study. The fish were caught using nets of various mesh sizes (24–45 mm) and fishing lines.

Morphometric measurements: The classical ichthyological methodology proposed by I.F. Pravdin (1966) was applied. For each specimen, 28 plastic (e.g., body length, body height, head length, etc.) and 6 meristic (e.g., number of fin rays, number of scales) characteristics were analyzed. [3]

1. **Ecological measurements:** Water temperature, transparency, and mineralization level were recorded at each sampling point.

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2. **Statistical analysis:** The data were processed using methods of variational statistics. The coefficient of variation and the level of reliability of the traits were determined.

Analysis And Results

The lower reaches of the Zarafshan River are characterized by a specific hydrochemical regime. The mineralization level of the water varies on average from 1.8 g/L to 3.2 g/L. This indicator affects the osmoregulation processes of fish and, consequently, influences their morphology.

Analysis of plastic characteristics

The results of the study showed that the body structure of the Zarafshan common bream (Abramis brama) differs significantly compared to specimens from the middle reaches of the river (Samarkand region).

Table 1: Dynamics of plastic characteristics of the common bream

Plastic characteristics (as % of L)	Middle reach (control)	Lower reach (study)	Difference (%)
Body height (H)	33.5 ± 4	27.8 ± 0.6	-5.7
Antedorsal distance (aD)	52.1 ±0.3	55.4 ± 0.5	+3.3
Caudal length (l)	13.8 ±0.2	17.2 ± 0.4	+3.4
Head length (lc)	20.2 ± 0.1	22.5 ± 0.3	+2.3

Influence of environmental factors

In the lower reaches, the decrease in water flow velocity (a relatively calm water environment) would normally be expected to result in an increase in body height of fish. However, our study revealed the opposite pattern – body elongation was observed. This can be explained by the following factors:

Food base: Due to the reduced availability of benthic organisms (bottom food resources) in the lower reaches, the common bream (Abramis brama) is forced to migrate more actively. A longer caudal fin (17.2%) enhances the fish's ability to swim over longer distances.

Salinity: Increased water salinity accelerates metabolic processes in the fish organism. As a result, energy is directed toward maintaining homeostasis rather than increasing body height (fat accumulation).

Discussion

The analysis of our results indicates that the decrease in body height (28.2%) and the elongation of the caudal peduncle (16.8%) represent adaptive changes aimed at improving the hydrodynamic efficiency of fish. In the lower reaches of the Zarafshan River, sharp decreases in water level and increased turbidity force fish to travel longer distances in search of food.

The salinity factor accelerates metabolic processes, which contributes to the formation of a "low-bodied" phenotype. Although similar patterns have been partially observed in the ichthyofauna of other Central Asian rivers such as the Amu Darya and the Syr Darya, this process appears to be intensified in the Zarafshan common bream (Abramis brama) due to anthropogenic pressure.

Within the framework of the nationwide "Green Space" initiative proposed by Shavkat Mirziyoyev, measures aimed at strengthening riverbanks are expected to reduce river turbidity. This, in turn, may positively affect the visual capacity of fish and improve their feeding efficiency. Our study demonstrates that under conditions of ecological stress, fish attempt to occupy new ecological niches by modifying their morphological characteristics.

Conclusions And Recommendations

1. The common bream (Abramis brama) population in the lower reaches of the Zarafshan River differs from the middle reach population by a reduced body height and an elongated caudal region based on morphometric indicators.
2. Among environmental factors, the most significant influence is exerted by water mineralization and the disruption of the flow regime caused by hydraulic structures.

Practical recommendation: In developing fisheries within the Zarafshan River basin, it is necessary not only to rely on artificial reservoirs but also to preserve natural populations in the lower reaches. The identified "ecological resilience" factor should be utilized in selective breeding programs.

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It is also recommended to improve the riverbed condition and introduce water-saving technologies in order to create a favorable microenvironment for natural ichthyofauna.

References

1. Mirziyoyev Sh.M. “Yangi O’zbekiston taraqqiyot strategiyasi”. – Toshkent, „Tasvir”, 2022. – 416 b.
2. O’zbekiston Respublikasining Qonuni. “Baliqchilik to’g’risida”. – O’RQ-871, 2023-yil.
3. Pravdin I.F. “Руководство по изучению рыб (преимущественно пресноводных)”. – Москва: Пищевая промышленность, 1966. – 376 с.
4. Kamilov G.K. “Рыбы водохранилищ бассейна реки Зарафшан”. – Ташкент: Фан, 1973.
5. Sheraliev B., Peng Z. „The fish fauna of the Zarafshan River drainage in Uzbekistan”. Journal of Applied Ichthyology, 2021.
6. Wootton R.J. “Ecology of Teleost Fishes”. – London: Chapman & Hall, 1998.
7. Bakiev S.S. “Zarafshon daryosi gidrobiologiyasi va ixtiofaunasi holati”. – Buxoro, 2019. – 120 b.
8. Hutchinson G.E. “The Ecological Theater and the Evolutionary Play”. – Yale University Press, 1965.
9. Karimov B. “Ecological condition of the Zarafshan River and its impact on aquatic life”. Uzbekistan Biology Journal, 2020.
10. Kottelat M., Freyhof J. “Handbook of European Freshwater Fishes”. – Cornol, 2007. – 646 p.
11. Salgueiro P. et al. “Phenotypic and genetic variation in bream (Abramis brama)”. Environmental Biology of Fishes, 2017.
12. Gidrobiologiya masalalari. Respublika ilmiy-amaliy konferensiyasi materiallari to’plami. – Toshkent, 2023.