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MICROPLASTIC CONTAMINATION IN FISH FROM THE LOWER REACHES OF THE NORIN RIVER AND ITS ORGAN-SPECIFIC DISTRIBUTION

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Abstract

Microplastics are widespread anthropogenic pollutants in freshwater ecosystems, and their occurrence in aquatic organisms has become an important environmental research concern. In recent years, studies investigating microplastic pollution in Uzbekistan and Central Asia have reported microplastics in river water, bottom sediments, and freshwater fish. In particular, research has documented microplastic contamination in tributaries of the Syr Darya River, rivers of the Fergana Valley, and the digestive tracts of fish inhabiting rivers within the Syr Darya basin. However, further investigation is needed to characterize microplastic contamination across different anatomical compartments of fish. This study aims to establish a scientific and methodological framework for investigating microplastic contamination in fish from the lower reaches of the Norin River, assessing the distribution of particles among the gills, digestive tract, and muscle tissue, and examining biological and environmental factors associated with their distribution. The planned methodology includes microscopic examination and Fourier-transform infrared spectroscopy (FTIR) for the morphological characterization and polymer identification of suspected microplastic particles. The anticipated findings are expected to provide baseline information on microplastic contamination in fish from the lower Norin River and contribute to future freshwater pollution monitoring.

Keywords: microplastics, Norin River, freshwater fish, contamination, organ-specific distribution, gills, digestive tract, muscle tissue, FTIR.

Introduction

The increasing use of plastic materials and the release of plastic waste into the environment have made microplastic pollution a significant concern for freshwater ecosystems. Microplastics are generally defined as plastic particles smaller than 5 mm. They may originate from the fragmentation of larger plastic items or from materials manufactured at microscopic dimensions. Their distribution in aquatic environments depends on particle size, shape, density, polymer composition, and hydrological conditions [1, 2].

Rivers play an important role in transporting plastic waste from terrestrial environments into aquatic ecosystems and redistributing plastic particles within river systems. Microplastic concentrations in water and bottom sediments may vary according to flow conditions, particle characteristics, sediment interactions, and the location of anthropogenic pollution sources. Consequently, investigating microplastic contamination in aquatic organisms, alongside water and sediment analysis, is important for assessing the ecological distribution of these pollutants [1, 3].

An important early contribution to microplastic research in Uzbekistan was made by Frank and colleagues in 2023. Their study investigated microplastics in water and bottom sediments from the Karadarya and Chirchiq rivers, which are tributaries of the Syr Darya River. The researchers used visual

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examination and Raman spectroscopy to characterize microplastic contamination [4]. This work established an important regional basis for further investigations of microplastic pollution in the Syr Darya basin.

Subsequently, Khusanov and colleagues investigated the characteristics of microplastic pollution in rivers of the Fergana Valley. Their research examined the abundance, morphological characteristics, and polymer composition of particles in water samples [5]. Microplastic contamination has also been investigated in a tributary of the Zarafshan River in the Samarkand and Navoi regions of Uzbekistan, further demonstrating the relevance of this issue to the country's freshwater ecosystems [6].

Research on freshwater fish in Central Asia has also advanced. In a study published in 2026, Frank and colleagues investigated microplastics and viscose fibers ingested by several freshwater fish species inhabiting rivers of the Syr Darya basin. Their research focused on particles recovered from the digestive tract and included an assessment of potential ecological risks associated with the identified polymers [7]. This study provides direct regional evidence of microplastic ingestion by freshwater fish.

International research indicates that microplastic occurrence may differ among fish organs and exposure pathways. A critical review by Gao and colleagues, published in 2025, analyzed 78 studies and examined the accumulation of microplastics in freshwater fish in relation to exposure pathways and biological characteristics [8]. However, differences in sampling procedures, particle extraction techniques, and analytical methods can complicate comparisons between studies [9].

Against this background, investigating microplastic contamination in fish from the lower reaches of the Norin River would extend existing regional research by examining the distribution of suspected microplastic particles across several anatomical compartments.

Aim and Objectives

The aim of this study is to investigate microplastic contamination in fish from the lower reaches of the Norin River, assess the distribution of particles among different organs and tissues, and examine the biological and environmental factors associated with this distribution.

The specific objectives are:

1. To collect fish specimens from the lower reaches of the Norin River and document their biological characteristics.
2. To investigate suspected microplastic particles in the gills, digestive tract, and muscle tissue.
3. To characterize the particles according to their size, shape, and color and identify their polymer composition using FTIR spectroscopy.

2. 4. To compare microplastic abundance and distribution among the examined anatomical compartments.

5. To examine statistical associations between microplastic contamination and selected factors, including fish species, body size, and sampling location.

Materials and Methods

Fish specimens collected from the lower reaches of the Norin River will constitute the study material. Sampling locations will be selected according to river hydrology and the potential influence of anthropogenic activities. Geographic coordinates, sampling dates, and available environmental characteristics will be recorded for each sampling location.

Fish species, body length, and body mass will be documented. In the laboratory, the gills, digestive tract, and muscle tissue will be separated and examined independently using standardized procedures.

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Analyzing these compartments separately will allow comparisons between particles associated with direct contact with the aquatic environment, ingestion-related exposure, and the muscle tissue intended for evaluating possible tissue contamination [8].

Microplastic extraction from biological material will involve appropriate digestion of organic matter, filtration, and, where necessary, density separation. The selected procedures will be evaluated to minimize damage to the target polymers and reduce contamination during sample processing [9].

Recovered particles will initially be examined microscopically and classified according to their size, shape, and color. Polymer identification will be performed using Fourier-transform infrared spectroscopy. The resulting spectra will be compared with appropriate reference libraries to determine polymer composition. Visual examination alone is insufficient to confirm that a suspected particle is plastic; therefore, chemical identification is important for improving analytical reliability [9, 10].

Strict contamination-control procedures will be implemented throughout sampling and laboratory analysis. These will include the use of glass or metal equipment where appropriate, cleaning laboratory surfaces, storing samples in covered containers, and analyzing procedural blanks. Potential contamination originating from reagents, filters, airborne fibers, and laboratory materials will also be considered. Such quality-control measures are essential for producing reliable results in microplastic research [9, 10].

Microplastic abundance will be expressed as the number of particles per individual fish and, where appropriate, per unit mass of the examined organ or tissue. Differences among anatomical compartments will be evaluated using statistical methods appropriate to the distribution and structure of the data. Associations between microplastic abundance and biological or environmental factors will be investigated after a sufficient number of samples has been collected.

Expected Results and Scientific Significance

The study is expected to generate baseline information on the occurrence, morphological characteristics, and polymer composition of microplastics in fish from the lower reaches of the Norin River. Separate examination of the gills, digestive tract, and muscle tissue will allow a comparative assessment of organ-specific contamination patterns.

Because Frank and colleagues have already investigated microplastics ingested by freshwater fish in rivers of the Syr Darya basin, the scientific contribution of the proposed study should extend beyond simply confirming the presence of microplastics in fish [7]. Its potential contribution lies in the comparative examination of three anatomical compartments, polymer identification using FTIR, and the assessment of associations between microplastic abundance and selected biological and environmental factors.

The resulting data may provide a preliminary characterization of microplastic contamination in fish from the lower Norin River and support the development of future monitoring studies in freshwater ecosystems.

Conclusion

The literature indicates that microplastic pollution in freshwater ecosystems is an emerging research area in Uzbekistan and Central Asia. Previous studies have documented microplastics in water and bottom sediments from tributaries of the Syr Darya River, in rivers of the Fergana Valley, and in the digestive tracts of fish inhabiting rivers within the Syr Darya basin. Nevertheless, a comparative

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assessment of microplastic contamination in the gills, digestive tract, and muscle tissue of fish from the lower reaches of the Norin River represents an important direction for further investigation.

The planned combination of microscopic examination, FTIR-based polymer identification, and contamination-control procedures is expected to provide a methodological basis for investigating organ-specific microplastic distribution. The findings may contribute to regional baseline data and inform subsequent research on anthropogenic pollution in freshwater ecosystems.

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