

Original Research

**MICRO AND MESOPLASTIC PARTICLES IN WATER AND SEDIMENT IN
SPECIAL NATURE RESERVE “OBEDSKA BARA”**

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Abstract

Microplastic pollution is an emerging environmental issue affecting freshwater ecosystems, including protected areas. This study provides a preliminary assessment of microplastic occurrence in abiotic components (water and sediment) of the Special Nature Reserve “Obedska bara”, a wetland of high ecological importance within the Danube River Basin. Samples were collected from two localities, followed by density separation and microscopic identification. Microplastics were detected in all water samples and in one sediment sample, with a total of nine particles identified. Fibres were dominant (eight particles), while one fragment was recorded. Particle lengths ranged from 0.5 to 16 mm, with white, red, and black fibres prevailing. The predominance of fibres suggests inputs from domestic wastewater, textile sources, and local anthropogenic activities. Although the detected abundance was low, the presence of microplastics in this protected ecosystem highlights their widespread distribution and potential ecological relevance. These findings represent a preliminary baseline and emphasize the need for further research involving increased sampling intensity, seasonal monitoring, and advanced analytical techniques to better understand microplastic dynamics in freshwater systems.

Keywords: freshwater, abiotic components, microplastic, fibres.

INTRODUCTION

There is increasing scientific and public concern over the presence of microplastics in the natural environment. Plastic pollution represents a complex transboundary environmental problem that requires coordinated cross-border initiatives and broad-based awareness-raising efforts among diverse stakeholders at local, national, and global levels. Microplastics have been detected in a wide range of aquatic environments, including freshwater systems such as rivers and lakes, transitional systems such as estuaries, and marine ecosystems [1].

Freshwater ecosystems are increasingly recognized as important pathways and sinks for microplastic pollution. Microplastics may negatively affect biodiversity, ecosystem

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functioning, food security, and potentially human health. Although marine systems have been extensively studied, research on freshwater microplastics has gained momentum only in recent years [1,2].

Microplastics are commonly defined as plastic particles smaller than 5 mm [3]. These particles vary widely in shape, size, and polymer type.

The Special Nature Reserve (SNR) “Obedska bara” (Ramsar site No. 136) is one of the oldest protected areas in Europe, having been under protection since 1874. It is characterised by high biodiversity and ecological importance within the Danube River Basin [4]. Despite its protected status, this ecosystem is exposed to various anthropogenic pressures.

The aim of this study was to detect and analyse the presence of microplastics in abiotic components (water and sediment) of the SNR “Obedska bara”, as a preliminary assessment of microplastic pollution in this protected freshwater ecosystem.

MATERIALS AND METHODS

Abiota samples were collected from two locations of the SNR “Obedska bara”, Krstonošića okno (N 44.737054, E 20.044319), and Vok canal (N 44.735653, E 20.042796) (Figure 1).

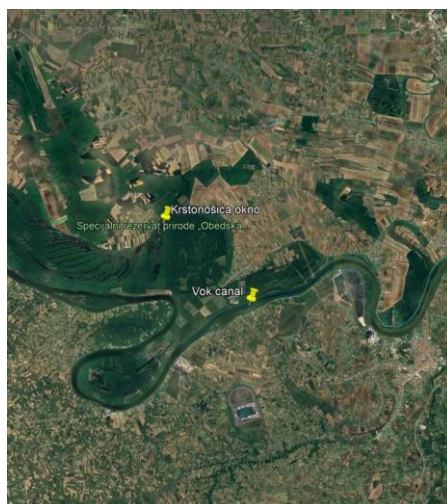


Figure 1 Map of the sampling locations, SNR “Obedska bara”

Basic physico-chemical water parameters were measured at both sites. The parameter values are shown in Table 1.

Table 1 Physico-chemical water quality parameters

	Krstonošića okno	Vok canal
temperature (°C)	19.8	22.5
O ₂ (mg/l)	8.14	7.08
saturation (%)	92.8	84.3
conductivity (µS/cm)	422	436
pH	7.698	8.029
transparency (m)	1.5	2.8
NO ₂ ⁻ (mg/l)	<0.01	0.02
NO ₃ ⁻ (mg/l)	0.31	0.94

At each site, three water and three sediment samples were collected. Water samples were collected using a planktonic net (mesh size 200 μm) along a 30 m transect, while sediment samples were collected with a Van Veen grab (Figure 2). Water samples were filtered directly, while sediment samples were processed using density separation.



Figure 2 Collecting of abiota samples

Approximately 200 g of wet sediment was mixed with 500 mL of saturated NaCl solution in a glass container. The suspension was left to settle for 24 hours, after which the supernatant was filtered. Filtration was performed using cellulose membrane filters (pore size 8 μm ; diameter 47 mm). Filters were examined under a stereomicroscope (Carl Zeiss Stemi 508), and suspected microplastic particles were identified based on visual characteristics such as colour, shape, and flexibility. Preventive measures were applied to minimize contamination, including the use of glassware and careful handling of samples.

RESULTS AND DISCUSSION

Microplastics were detected in all analysed water samples and in one sediment sample. A total of nine particles were identified, including eight fibres and one fragment. Although the total number of detected particles was relatively low, the results provide important preliminary insight into microplastic contamination in this area. Fibres were white (8), red (1), and black (1), with lengths ranging from 0.5 to 16 mm. The types and length ranges of plastic particles found in water and sediment are shown in Table 2.

Table 2 Types and length ranges of plastic particles

Water samples		Sediment samples	
type	length range (mm)	type	length range (mm)
white fibres	1 – 16	black fibres	0.5
red fibres	5		
red fragment	0.5		

The dominance of fibres among the detected particles is consistent with numerous studies conducted in freshwater environments, where fibres are frequently reported as the most abundant type of microplastics [3]. Fibres are commonly associated with domestic wastewater, synthetic textiles, fishing activities, and the degradation of larger plastic materials [5–7]. Their prevalence in this study may indicate the influence of nearby anthropogenic activities, including recreational use of the area and potential inputs from surrounding settlements.

The relatively low number of detected particles may be attributed to several factors, including limited sampling effort, small sample size, and methodological constraints related to visual identification. It is also possible that seasonal variation and hydrological conditions at the time of sampling influenced microplastic distribution and detectability. Therefore, the obtained results should be interpreted as a preliminary assessment rather than a comprehensive evaluation of microplastic pollution [8].

The presence of microplastics in water, contrasted with their limited occurrence in sediment, may be explained by particle characteristics and environmental conditions. Fibres, which dominated the samples, typically exhibit low density and high surface area, allowing them to remain suspended in the water column for extended periods [9]. Additionally, hydrodynamic conditions such as water flow, turbulence, and sediment composition may influence the deposition and accumulation of microplastics in sediments.

Furthermore, the ecological condition of the SNR “Obedska bara” has been affected by multiple anthropogenic pressures, including hydrological modifications, eutrophication, and sedimentation processes. These factors may indirectly contribute to the transport, redistribution, and retention of microplastics within the ecosystem. The detection of microplastics in such a protected area highlights the widespread nature of plastic pollution and its ability to reach even relatively preserved habitats [10]. In addition, anthropogenic pressures such as hydrological alterations, eutrophication, and land-use changes may contribute to the introduction and redistribution of microplastics within the reserve.

Although the abundance of microplastics was low, their presence raises concerns due to their potential ecological impacts. Microplastics can act as carriers of pollutants, facilitate the transport of invasive microorganisms, and be ingested by aquatic organisms, potentially leading to adverse biological effects. Therefore, even low concentrations of microplastics may be ecologically relevant, particularly in sensitive and protected ecosystems [11].

Future studies should aim to increase sampling intensity, include seasonal monitoring, and apply more advanced analytical techniques, such as spectroscopic identification, to confirm polymer types and improve the accuracy of microplastic detection. Integrating abiotic and biotic compartments would also provide a more comprehensive understanding of microplastic dynamics in freshwater ecosystems.

CONCLUSION

Microplastics were detected in water samples from the SNR “Obedska bara”, indicating that even protected freshwater ecosystems are not exempt from plastic pollution. The predominance of fibres suggests textile-related sources as a major contributor. Although the

detected abundance was low, this study provides a preliminary insight into the occurrence of microplastics in this ecologically important area. Further research with increased sampling effort and more advanced analytical techniques is needed to better understand the distribution, sources, and ecological implications of microplastics in freshwater protected areas.

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