



# Plastic Pollution on the Coast of the Nizhnesvirsky Nature Reserve

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## Abstract

Plastic pollution is one of the most acute global environmental challenges of the 21st century. Despite their special protected status and restrictive human activities, protected areas (PAs) are subjects to the external plastic debris pollution. This short communication provides the preliminary research results of the study of plastic pollution on the coast of the Svir Bay within the boundaries of the Nizhnesvirsky Nature Reserve. The findings reveal a total of 109 anthropogenic litter items, with a plastic density of 0.04 items/m<sup>2</sup>, which indicates the existence of external sources of plastic pollution associated with the human activities on Lake Ladoga and confirms the relevance of the problem.

**Keywords:** plastic litter, protected area, microplastic, Nizhnesvirsky Nature Reserve.

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## 1 Introduction

Plastic pollution is one of the most pressing environmental problems of the 21st century. The rapid growth of polymer production is significantly outpacing the rate of its recycling processing. Furthermore, the ineffectiveness of existing waste management systems and traditional technologies leads to the loss of valuable resources and accompanies new secondary pollution problems [1]. If current trends continue, it is predicted that total plastic production will reach 34 Bt by 2050, with around 12 Bt of plastic litter accumulating in landfills and the natural environment [2, 3].

In the context of the large-scale presence of plastic litter pollution, research focusing on plastic debris in existing and developing protected areas (PAs) is of particular interest. PAs are special designated areas developed for the conservation of nature, maintaining and restoring biodiversity [4]. They serve as natural laboratories and are typically effective for reducing plastic litter accumulation [5]. However, PAs are vulnerable to the external human impact due to the presence of sensitive natural ecosystems. Another significant issue is the global and transboundary character of plastic pollution, which complicates the protection of these territories.

The present study focuses on the Nizhnesvirsky Nature Reserve, a natural protected area located on the southeastern coast of Lake Ladoga in the Lodeynopolsky District of the Leningrad Region. This research aims to study the current level of plastic litter pollution along the coast of the Svir Bay within the boundaries of the selected PA. The study's hypothesis posits that, despite the special protected status and restrictive human activities, the coastal ecosystems of the Nizhnesvirsky Nature Reserve are subjects to plastic debris pollution, which is formed by external sources located outside the PA.

## 2 Materials and Methods

This study was conducted on the Svir Bay, a unique ecosystem located in the southeastern Ladoga region within the boundaries of the Nizhnesvirsky Nature Reserve. Plastic litter samplings were carried out in September 2025. Debris samples were collected from a 2,500 m<sup>2</sup> beach area, from the water's edge to the back of the beach, using the OSPAR standardized methodology for monitoring marine litter [6]. Additionally, we used a Frame method to access quantity of micro (2-5 mm) and meso (5-25 mm) litter in tidal zone of the beach [7]. According to the accepted methodology, 3 sampling squares at the strandline of the beach were analyzed using a 2 mm metal sieve. All marine debris items collected during the study were bagged in marked, transparent bags for laboratory processing and analysis. The selected items were counted and measured according to their size. Then, they were classified into categories based on material and litter type, and weighed.

## 3 Results and Discussion

A total of 107 anthropogenic litter items were collected from the analyzed beach area, with a total weight of over 1,400 grams (Figure 1). The majority of the observed items were macrodebris (>25 mm), accounting for more than 68% of the total amount of litter, followed by mesodebris (5-25 mm) and microdebris (<5 mm).



**Figure 1.** Examples of anthropogenic litter items found on the coast of Svir Bay

All litter were classified into 6 groups: synthetic polymers (85.9%), metal (6.5%), glass and ceramics (2.8%), paper and cardboard (1.8%), processed wood (1.8%) and rubber (0.9%). Plastic was the most prevalent material of litter collected, with a density of 0.04 items/m<sup>2</sup> (92 items). Most of it consisted of packaging materials, such as food packets and

wrappers, as well as plastic ropes. While drink bottles ≤ 0.5 L, food containers, bags, bottle caps were collected as other plastics. Considering the Nizhnesvirsky Nature Reserve's special protected status and restrictive human activities on its territory, the obtained results may indicate that the main contribution to marine debris pollution comes from external sources associated with recreational and fishing activities on Lake Ladoga.

Microlitter items were observed at all 3 sampling squares within the tidal zone. A total of 16 items were discovered, with a density of 21.3 items/m<sup>2</sup>. During the optical microscopy analysis, all these particles were classified as synthetic polymers categorized as microplastics (MPs). Morphology analysis showed 2 different types of shape classes: fragments (62.5%) and foams (37.5%). The predominant colors observed were white, transparent and gold.

The results obtained should be considered as preliminary data. However, it is evident that the Svirskaya Bay of Lake Ladoga is an area of significant accumulation of plastic litter and MPs. The presence of these pollutants indicates the existence of external sources and confirms the relevance of the problem. Future research directions will include a seasonal monitoring of plastic litter in the selected area to determine the spatial distribution and dynamics of pollution. Additionally, the study will involve the application of optical microscopy during the analytical analysis, which will enhance the reliability and comparability of the results obtained.

## 4 Conclusions

The present study was conducted as a first part of comprehensive monitoring and analysis of anthropogenic pollution of the Nizhnesvirsky Nature Reserve. The preliminary research results presented in this short communication demonstrate the relevance of the problem of plastic pollution in the coastal area of the Svir Bay and emphasize the need for further research. The objective of this monitoring is to develop scientifically based recommendations for reducing and preventing plastic pollution in selected PA.

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**Data Availability Statement:** All data supporting the findings of this preliminary research results are available within the article.

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**Conflicts of Interest:** The authors declare no conflicts of interest related to this study.

## Abbreviations

The following abbreviations are used in this manuscript:

PAs Protected areas  
 MPs Microplastics

## References

- [1] Pan, D., Su, F., Liu, C., & Guo, Z. (2020). Research progress for plastic waste management and manufacture of value-added products. *Advanced Composites and Hybrid Materials*, 3(4), 443-461. [Scopus]
- [2] Kibria, M. G., Masuk, N. I., Safayet, R., Nguyen, H. Q., & Mourshed, M. (2023). Plastic Waste: Challenges and Opportunities to Mitigate Pollution and Effective Management. *International journal of environmental research*, 17(1), 20. [Scopus]
- [3] Geyer, R., Jambeck, J. R., & Law, K. L. (2017). Production, use, and fate of all plastics ever made. *Science Advances*, 3(7). [Web of Science]
- [4] Sinclair, J. S., Stubbington, R., Welti, E. A. R., Aroviita, J., Baker, N. J., Cañedo-Argüelles, M., Csabai, Z., Cunillera-Montcusí, D., Domisch, S., Ferréol, M., Floury, M., Forio, M. A. E., Goethals, P. L. M., González-Ferreras, A. M., Huttunen, K. L., Johnson, R. K., Kuglerová, L., Larrañaga, A., Muotka, T., Paavola, R., ... Haase, P. (2025). Current protected areas provide limited benefits for European river biodiversity. *Nature communications*, 16(1), 11146. [Web of Science]
- [5] Ribeiro, V. V., Costa, L. L., Rangel, D. F., & Castro, Í. B. (2025). Influence of protected areas and socioeconomic development on litter contamination: A global analysis. *Journal of hazardous materials*, 500, 140422. [Scopus]
- [6] Wenneker, B., & Oosterbaan, L. (2010). *Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area*. Edition 1.0. [Scopus]
- [7] Haseler, M., Schernewski, G., Balciunas, A., & Sabaliauskaite, V. (2018). Monitoring methods for large micro-and meso-litter and applications at Baltic beaches. *Journal of Coastal Conservation*, 22(1), 27-50. [Web of Science]



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