Can specially protected areas be protected from microplastics? 334280

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In this study we compared upper-layer sediments from 5 lakes in Latvia (Baltic States, Northern Europe) representing areas of various anthropogenic load and nature conservation status (Fig.1.).

Hypothesis for the research: microplastic particles may reach even the most protected and remote natural areas at the considerable amount.

SAMPLING SITES

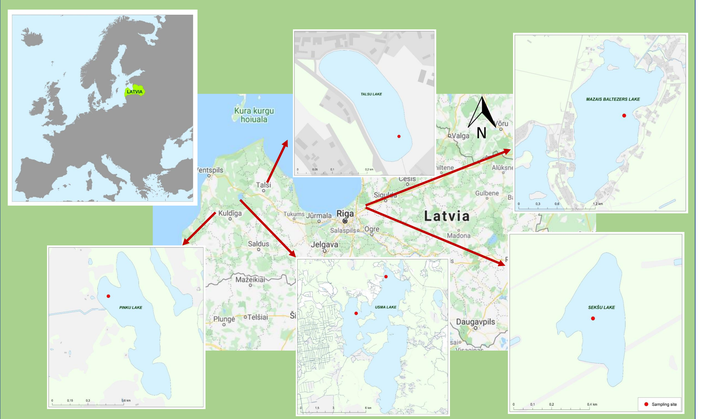

Fig. 1. Sampling sites in five lakes in Latvia.

Pinku Lake – nature park area. Mesotrophic lake with very good water quality and great transparency. Rare and important biotope with unique ecosystem (Lobelia–Isoëtes plant complex species). Surrounding area is little modified by human activities, no intensive farming takes place around the lake, access and use of lake for recreation is limited.

Lake Usma – part of it is included in the oldest protected area in Latvia, visiting the nature reserve is prohibited. There were two sampling sites one within and another outsidenature reserve.

Seksu Lake is located in the vicinity of the capital city and access to it is restricted by fence due to fact it is a part of city drinking water system. Nevertheless, the lake's ecological deterioration was intensified by water pumping station activities when it received replenishment water for more than 10 years from a eutrophic lake (Mazais Baltezers, see below) through a pipe.

Mazais Baltezers Lake is located close to the capital city and surrounded by urban areas. It is eutrophic lake, receiving domestic and industrial wastewatersfor a long time. Still, used for artificial recharge of the groundwater through infiltration basins.

Talsu Lake is located in the city of Talsi. It is hypereutrophic lake, subjected to the urban pollution from its surroundings and considered as one of the most polluted lakes in the country.

METHODS

Sediment cores were collected in 2019 using a Kayak/HTH gravity-type corer (Fig. 2. – 4.). The upper sediment layer (2 to 5 cm) was used for the further sample treatment (Fig. 5.) and analysis. Particles within the size range of 100 - 500 µm were analysed using µFTIR (Fourier Transform Infrared Spectroscopy) system Spotlight 400 (Perkin Elmer). Plastic polymers possibly introduced by sampling device were excluded from further analysis. For contamination and control – blank and control samples were treated and analysed as well.

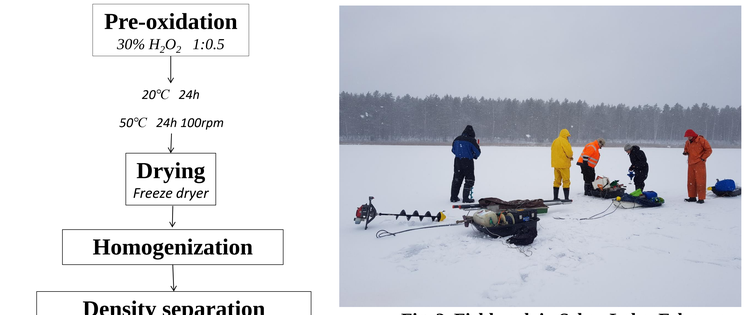

Fig. 5. Samples treatment scheme.

Fig. 2. Fieldwork in Seksu Lake, February, 2019.

Fig. 3. Sediment cores sampling.

Fig. 4. Sampling in Talsu Lake, August, 2020.

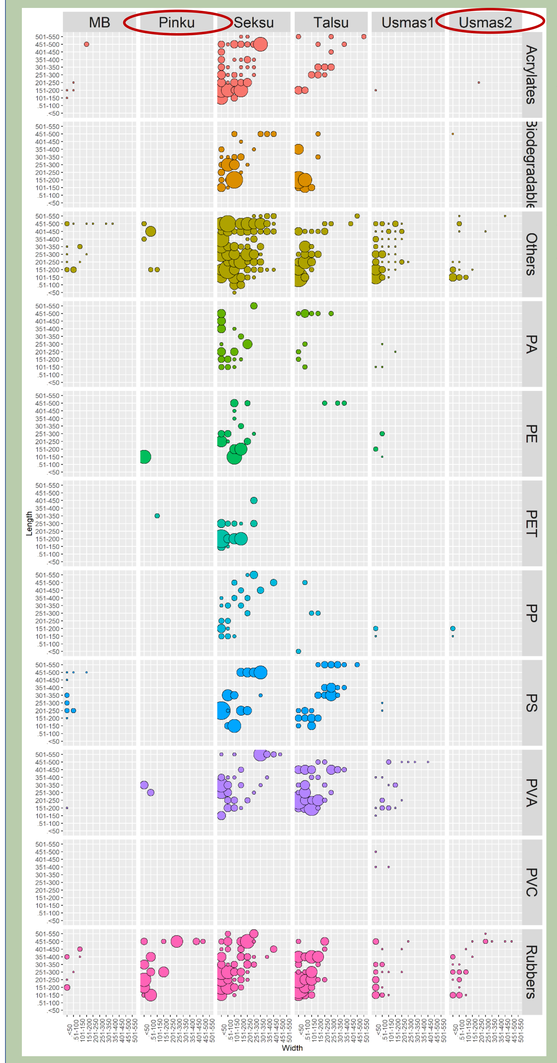

Fig. 6. Variation in size distribution (size class step – 50 µm, everything below 50 µm was removed from further data analysis due to possible contamination in laboratory) of different microplastic groups among lakes. Oval sign for protected areas. Mazais Baltezers Lake (MB) results most likely represent sediment disturbance. PVP and viscose is included in group «Others».

PRELIMINARY RESULTS

A high variety of polymer groups was detected, however it was considerably lower in remote, specially protected areas where the access to water is prohibited or restricted (5 polymer groups) compared to lakes located in a city or vicinity of a large city (up to 11 polymer groups were detected).

Nevertheless, the most common microplastic group found in lakes both from urban and protected areas was rubbers (from 15.6 to 49.7%) dominating in protected lakes. Other dominant groups were polyvinylpolypyrrolidone (PVP), i.e. from 6.4% to 13.6 %, viscose, polyvinylacetate (PVA), polystyrene (PS) and polyethylene (PE) comprising from 18.3% to 43.2%.

The abundance of total microplastic particles in dry sediments ranged from 22 to 1648 particles/g (average 409 particles/g) (Fig. 6. – 7.).

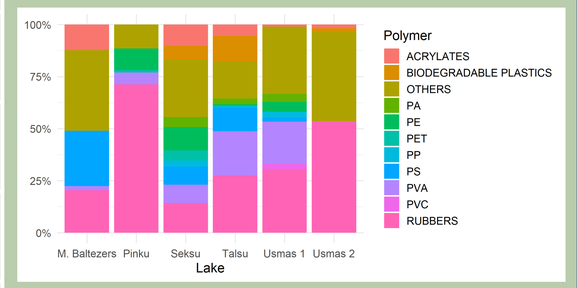

Fig. 7. Microplastic groups and their composition among lakes.

Remote location same as access restrictions may limit ecosystems exposure to microplastic pollution as far as it is related to direct anthropogenic contribution. Protected, remote areas are not safe from plastic pollution such as atmospheric tranpsort, inflow from drainage basin.

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