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Temporal distribution and seasonal fluxes of microplastics in the sediments of UK rural and urban lakes

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Microplastics (<5 mm) are persistent environmental pollutants characterised by heterogeneous physico-chemical properties and a broad range of shapes, sizes, colours and composition. Microplastics may be directly released into the environment at this size (i.e. pellets and cosmetic microbeads) when they are known as primary microplastics. However, the majority of microplastics are secondary, i.e. they originate from the degradation of larger plastic items. An important source of secondary microplastics is represented by fibres released during washing of synthetic garments. Although microplastic contamination is thought to be ubiquitous in aquatic ecosystems, very little is known about the scale, the extent of inputs as well as rates of change in rivers and lakes. In particular lake sediments, may represent an important sink for microplastics as well as providing a means to assess historical trends.

To assess microplastic abundance, distribution, historical records and composition in the sediments of UK urban and rural lakes, sediment cores have been collected at representative locations in two ponds on Hampstead Heath, in the Borough of Camden, London, and in three lakes in the Norfolk Broads National Park, in eastern England. Microplastics extracted from sediment cores have been identified, and variation in polymer-type analysed through sediment chronostratigraphy. Sediment chronologies can help quantify the historical flux of microplastics from terrestrial environments to freshwaters, reflecting changes in microplastic production over time.

To highlight seasonal fluxes and variations in microplastic distribution and abundance in the lakes examined, new-design sediment traps were built at UCL Geography Laboratories and anchored to the bottom of the study sites to collect material sinking from the water column. The traps are being monitored, emptied, cleaned and redeployed every three months over about a 2-year period.

This study presents the results about temporal distribution and seasonal fluxes of microplastics in sediments from Hampstead Heath ponds in London (urban sites) and from the Norfolk Broads National Park (rural sites). The identification of plastic polymers, together with the assessment of microplastic temporal distribution and seasonal patterns of accumulation in lakes will help identify factors influencing microplastic distribution and pollution sources for lakes. The results from this project will deliver a better understanding of the number and scale of sources of microplastics in

urban and rural lakes, improving future risk assessments and prevention strategies.