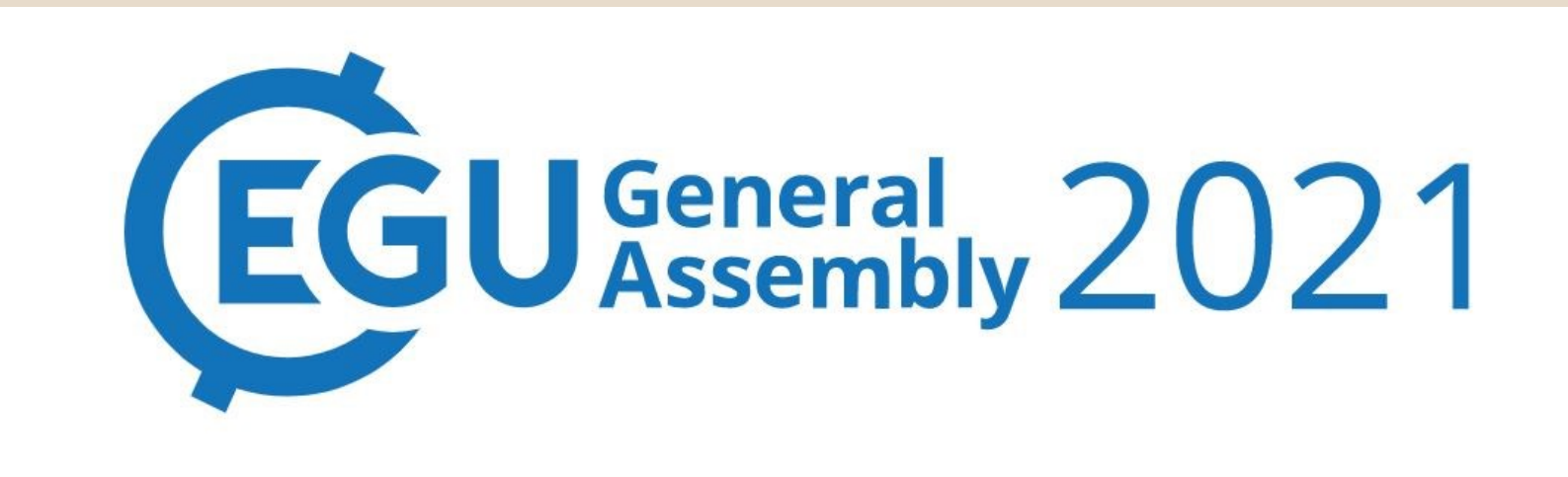
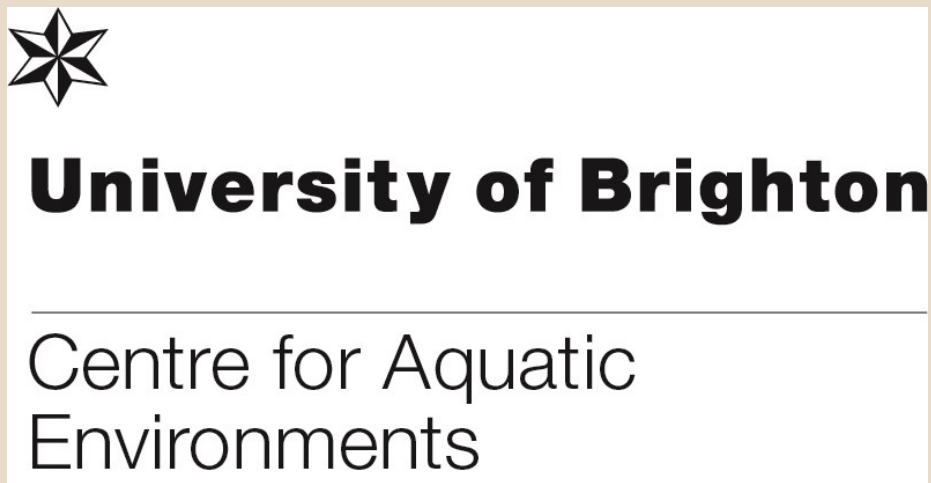


Spatio-temporal patterns in microplastic (MP) pollution of surface waters and sediments within the R. Thames (UK) and its tributaries

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1. Why do we care?

- Currently little knowledge about MP transfer within the environment (Horton et al., Sci. Total Environ., 2017)
- Rivers deliver most land-based plastic items (including MP) into the seas and oceans (Jambeck et al., Science, 2015)
- Floods can remobilise MP from riverbeds (Hurley et al., Nat. Geosci., 2018)
- Climate change predicted to increase flood frequency and magnitude = higher MP loads entering adjacent seas (Ockelford et al., Sci. Rep., 2020)

2. Research questions

- What mechanisms control MP deposition in (and erosion from) river sediments?
- How do seasonal changes to river flow influence MP accumulated within river sediments?
- How are MP distributed across different spatial scales?

3. Sample collection

- Previous studies confirmed high numbers of MP in surface waters and sediments of the R. Thames (Rowley et al., Sci. Total Environ., 2020; Horton et al., Mar. Pollut. Bull., 2017)
- Sediment and water samples collected from 12 sites (urban, rural and industrial) located within the R. Thames catchment (Fig. 1) on a seasonal basis (summer-winter)
- Triplicate sediment samples taken across the river transect using manual extraction
- One bulk 5L water sample collected from every site each season
- Additional plankton net (500um) samples collected in Aug 2020

4. Sample analysis

- Bulk liquid samples vacuum filtered; MP extracted from plankton net samples using density flotation with ZnCl₂
- Sediment separated into 0.5phi fractions and MP extracted:
 - Manually (1—5mm fraction)
 - Using density separation with NaCl (63µm—1mm fraction)
- Samples investigated under a stereomicroscope
- Compositional analysis using FTIR/µFTIR: TBC

5A. Results: MP extracted from sediment

- MP shapes included fragments (52%) (Fig. 2a), fibres (22%) (Fig. 2b) and beads (26%) (Fig. 2c)
- Lower numbers (<1%) of other particles, e.g. fibreglass (Fig. 2d) and glitter (Fig. 2e)
- 95% of particles <1mm in size
- Some evidence of MP aggregation (Fig. 2f)

5B. Preliminary results: Spatio-temporal variations in MP abundance in the R. Thames sediments

- Mean MP levels in sediments ranging from <LD (Limit of Detection) to 2,917 MP·kg⁻¹ d.w. across all seasons (n = 59 samples)
- MP abundance in sediments lower in winter 2020 compared to summer 2019 and 2020 (mean 70 vs. 91 and 316 MP·kg⁻¹ d.w., respectively) (Fig. 3a-c)
- MP shapes likely pointing at local contamination sources (e.g. microbeads and fibreglass abundant at industrial sites) (Fig. 3a-c)
- MP concentrations lower at rural sites relative to urban and industrial across all seasons (Fig. 4a-c)

5C. Results: Intra-site variations in MP accumulation (Aug 2020)

- Preferential accumulation of MP at inner banks (i.e. accumulation zones) (Fig. 5a)
- MP less abundant at outer banks (i.e. erosion zones)
- MP levels higher near drains discharging sewage/industrial effluents (Fig. 5b)

5D. Results: MP concentrations in surface water—bulk sampling vs. plankton net

- MP concentrations <LD in 85% of bulk samples (<LD - 16 MP·L⁻¹ range, n = 48 samples), 76% MP below 500µm
- MP detected in 83% of plankton net samples (<LD - 48 MP·m⁻³ range in Aug 2020, n = 12 samples) (Fig. 6); values correlated with mean concentrations found in sediment (r = 0.87; p<0.05)
- Plankton net samples better represent the occurrence of MP across the catchment; however, abundance of MP <500µm likely underestimated