River corridors are global hotspots of microplastic pollution

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Motivation:
Global Plastic Pollution

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A catchment perspective on plastic fate and transport:

Fig 1: *Micro-plastic fate and transport mechanisms in river catchments*

Plastic myths:

The majority of plastic waste is accumulated in the world's oceans

River (catchments) are merely conduits for plastic transport

Residence times in rivers / catchments are too short for significant particle degradation

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Predicting Global Plastic Accumulation in Rivers

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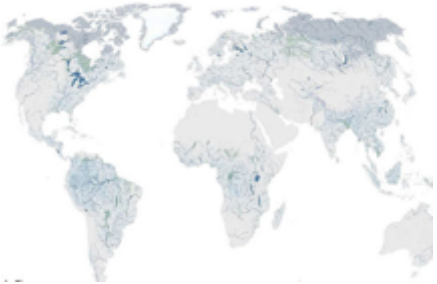
Where?



How much?

For how long?

Source activation of microplastics in urban river catchments

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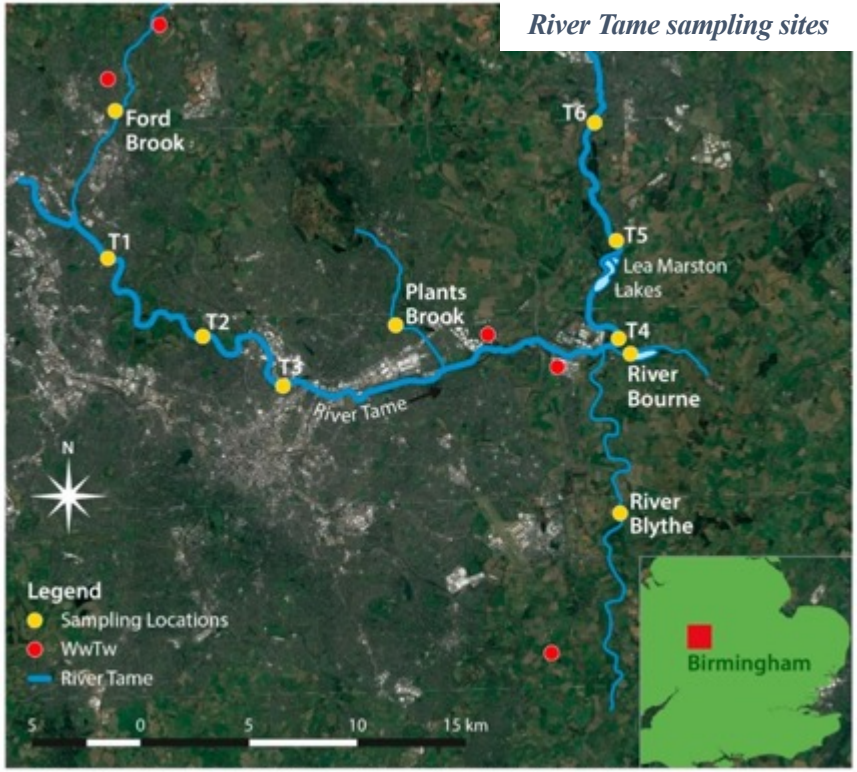
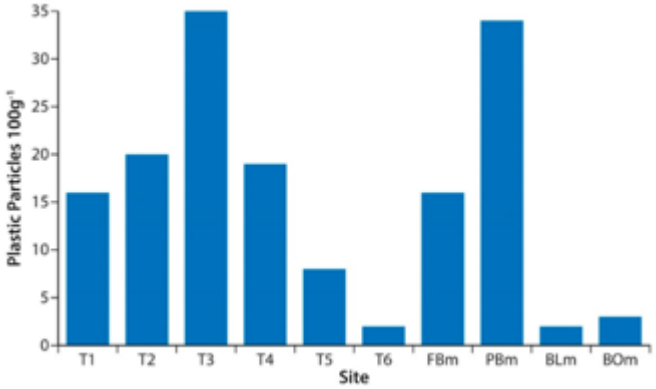
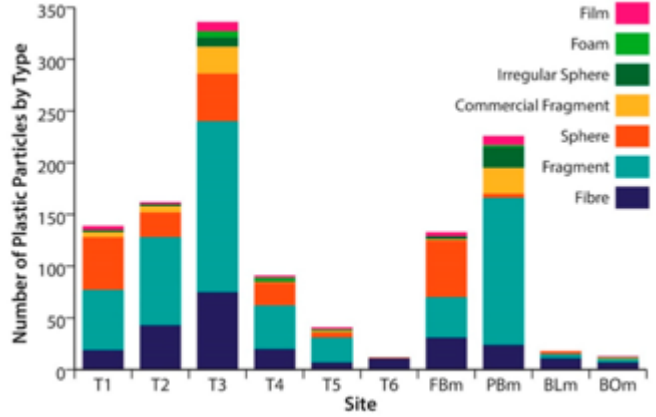
River Tame – Birmingham, UK







Tibbets et al., 2018

River Contributions to Global Plastic Pollution

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Lack of data / method inter-comparability!

Study Location	Microplastic Count	Citation
River Tame, UK	16.5 particles 100 g^{-1} (mean)	This study
River Thames, UK	35 particles 100 g^{-1} (mean)	Horton et al. [1]
Mersey/Irwell, UK	281–635 particles 100 g^{-1} (temporal range)	Hurley et al. [2]
Ottawa River	22 particles 100 g^{-1} (mean)	Vermaire et al. [30]
Rhine-Main area	22.8–376 particles 100 g^{-1} (spatial range)	Klein et al. [31]
Beijing River	17.8–54.4 particles 100 g^{-1} (spatial range)	Wang et al. [45]
Bloukrans River	0.6–16 particles 100 g^{-1} (temporal range)	Nel et al. [32]
Elbe, Mosel, Neckar, and Rhine	3.4–6.4 particles 100 g^{-1} (mean)	Wagner et al. [44]

Tibbets et al., 2018

100 Plastic Rivers Programme

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HORIZON 2020

LEVERHULME TRUST

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DFG Deutsche Forschungsgemeinschaft

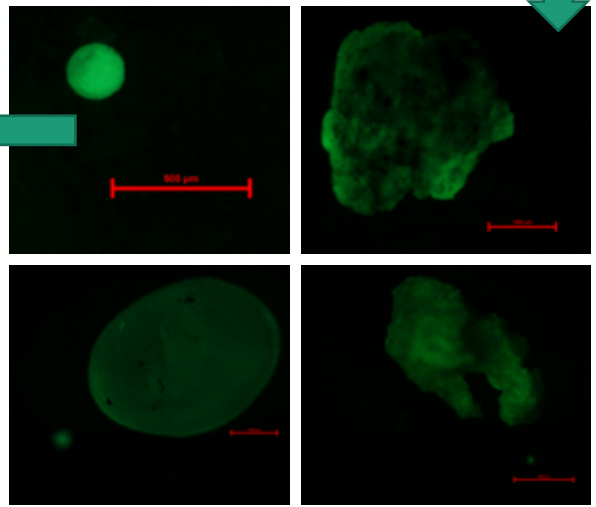
Density Separation (extraction efficiency between 85 and 100 %)

Extraction

Digestion

Nile Red Staining

Morphological Characterisation



Chemical Specification

Nel et al., 2019 MethodsX; Nel et al., in review

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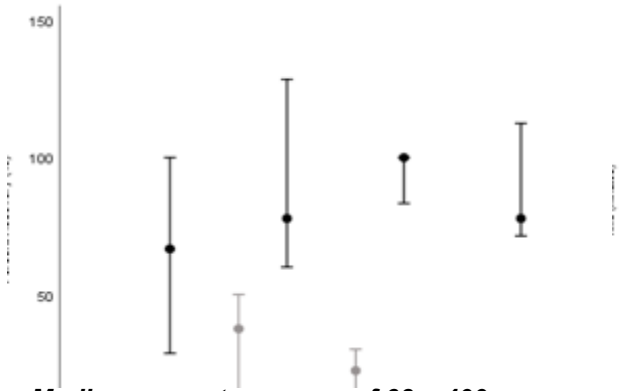
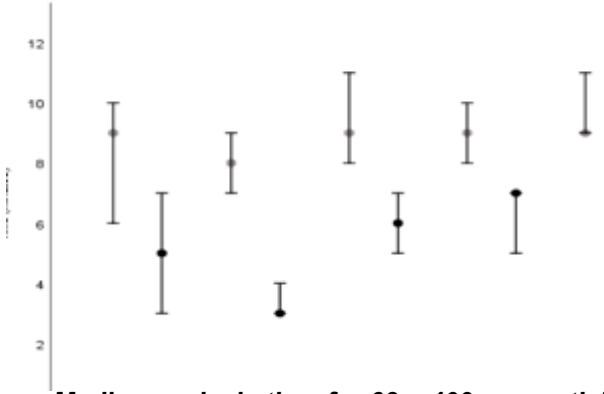
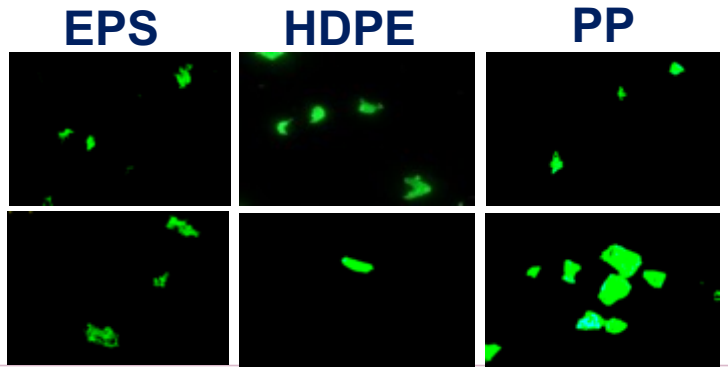
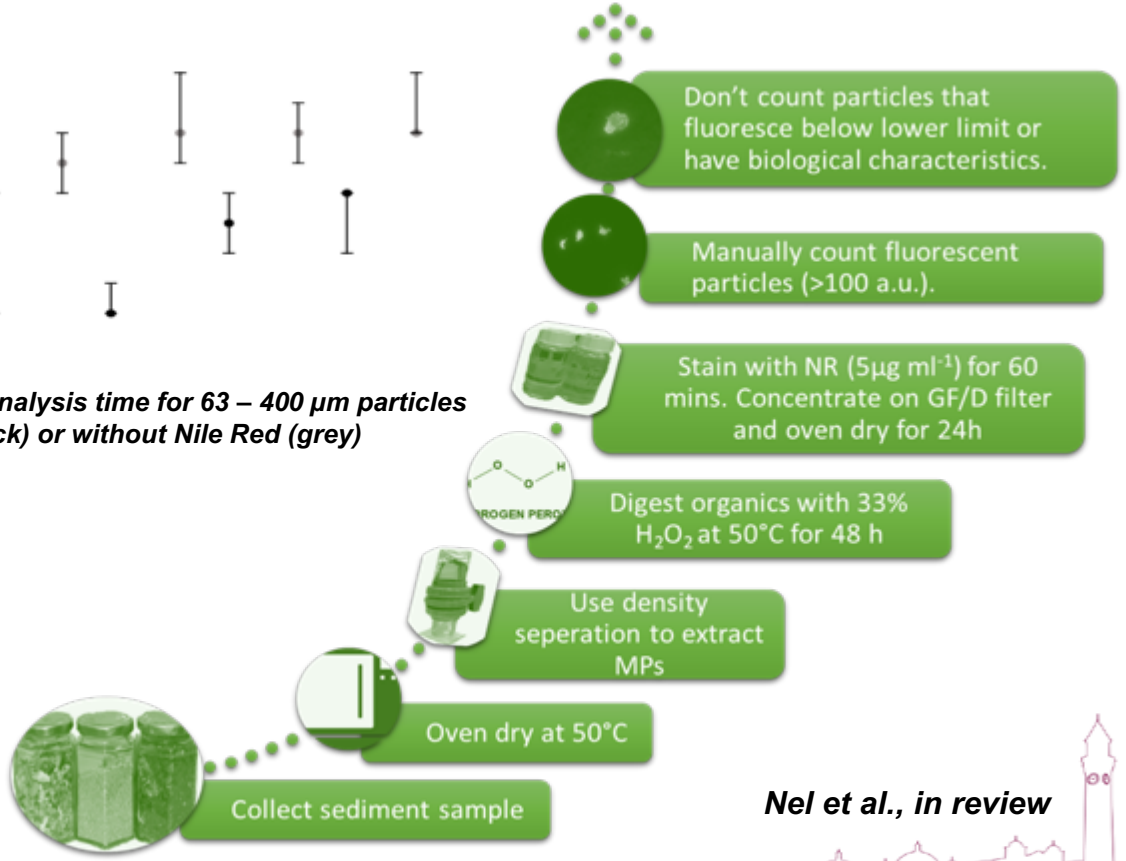


Median percent recovery of 63 – 400 µm particles with (black) or without Nile Red (grey)



Median analysis time for 63 – 400 µm particles with (black) or without Nile Red (grey)





Nel et al., in review

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175–1104 particles kg^{-1}

River Fowey (N=4)

Plymouth Sound (N=2)

121–411 particles kg^{-1}

The River Fal (N=4)

150–628 particles kg^{-1}

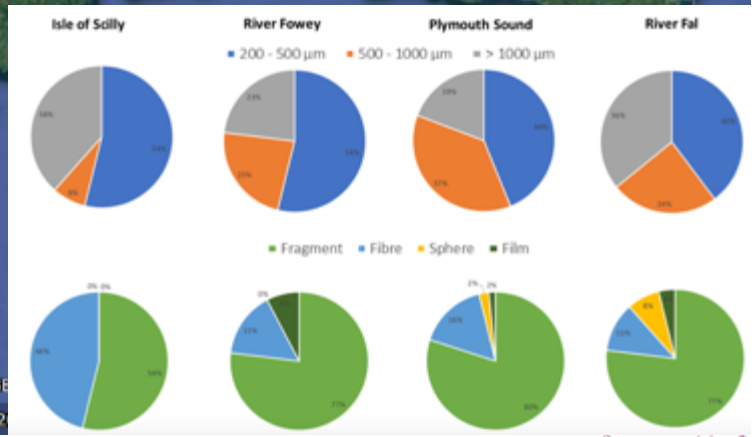
Isles of Scilly (N=2)

127–281 particles kg^{-1}

Image Landsat / Copernicus

Data SIO, NOAA, U.S. Navy, NGA, GE

Imagery Date: 12/14/2



Watch this space:
Plastic Evolution along Large River Networks

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Thank You!

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