

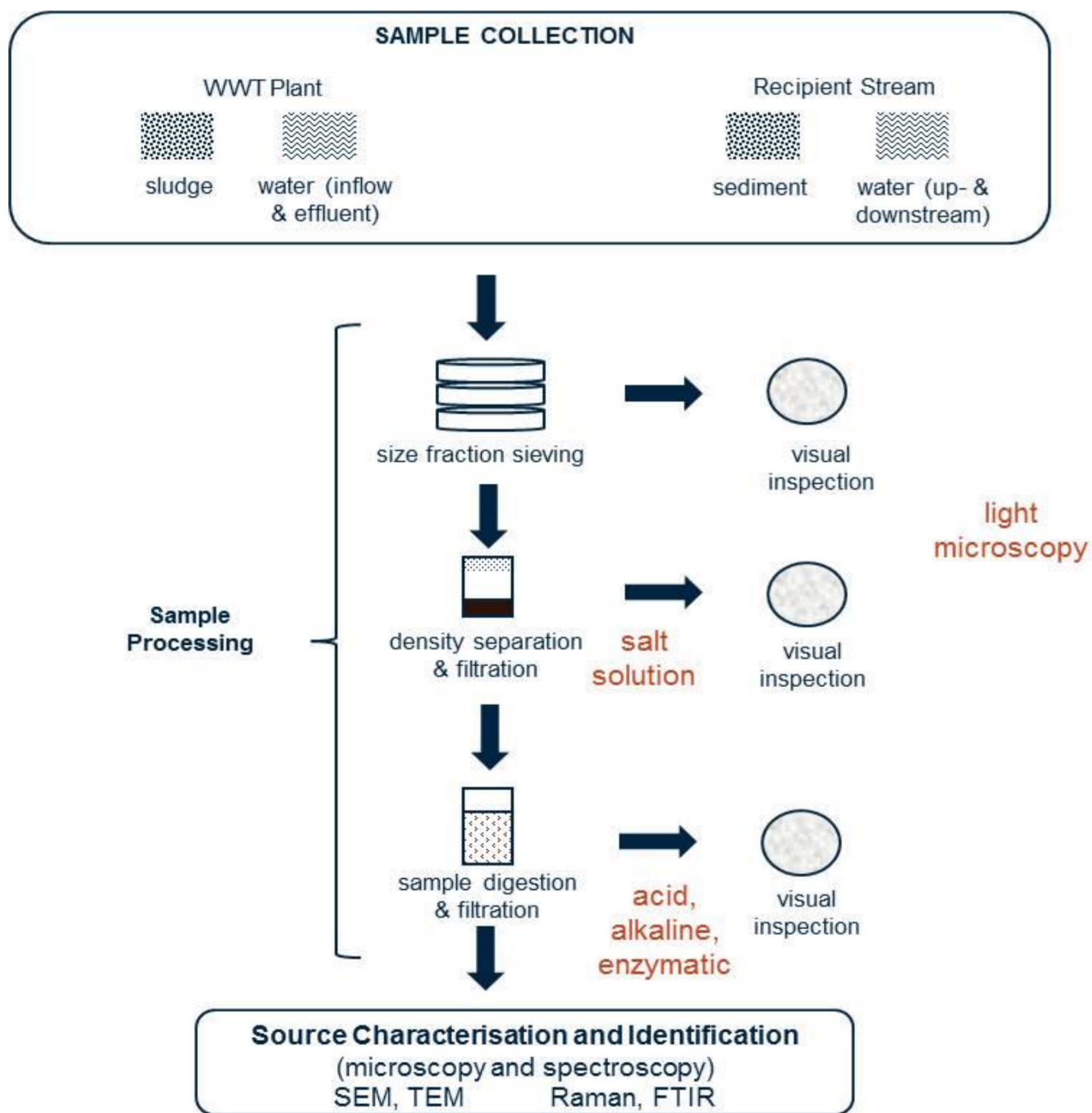
Micro- and nanoplastics in wastewater treatment systems and receiving waters

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INTRODUCTION AND AIM

- Micro- and nanoplastics (MNPs; <0.5 mm and <100 nm, respectively), derived directly from manufacturing (primary MNPs) or indirectly from fragmentation processes (secondary MNPs)^{1,2} are contaminants of emerging concern^{3,4}.
- Small sizes and lack of unified methods makes adequate quantitative and qualitative analysis and reliable risk assessment difficult.
- MNPs are well-documented in oceans^{3,5} but role of freshwaters as transport vectors of land-based inputs to sea remains largely unknown.
- **AIM:** Describe and model the behaviour of MNPs in wastewater treatment systems and natural fluvial waters in an urban catchment with close proximity to the marine environment.

METHODS



METHOD DEVELOPMENT

- Bank sediment samples were collected from the River Kelvin near the University of Glasgow to:
- (1) test and refine protocols for extraction and characterisation of microplastics (MPs)
 - (2) obtain an initial profile of MPs in the Clyde catchment.

PRELIMINARY RESULTS

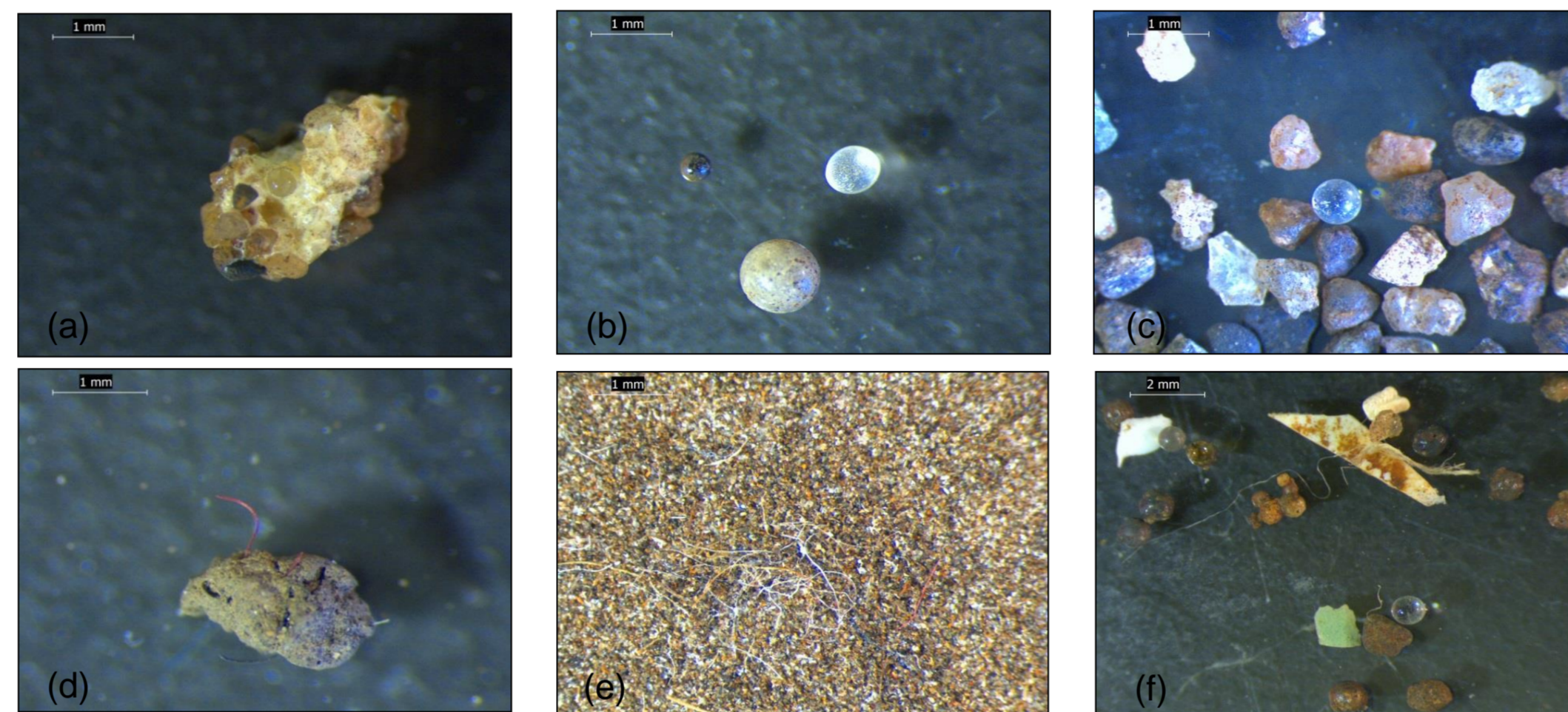


Figure 1 Suspected MPs found in River Kelvin sediment sampled December 2015 and February 2016; pellets (a-c, f), fibres (d-f) and fragments and flakes (f).

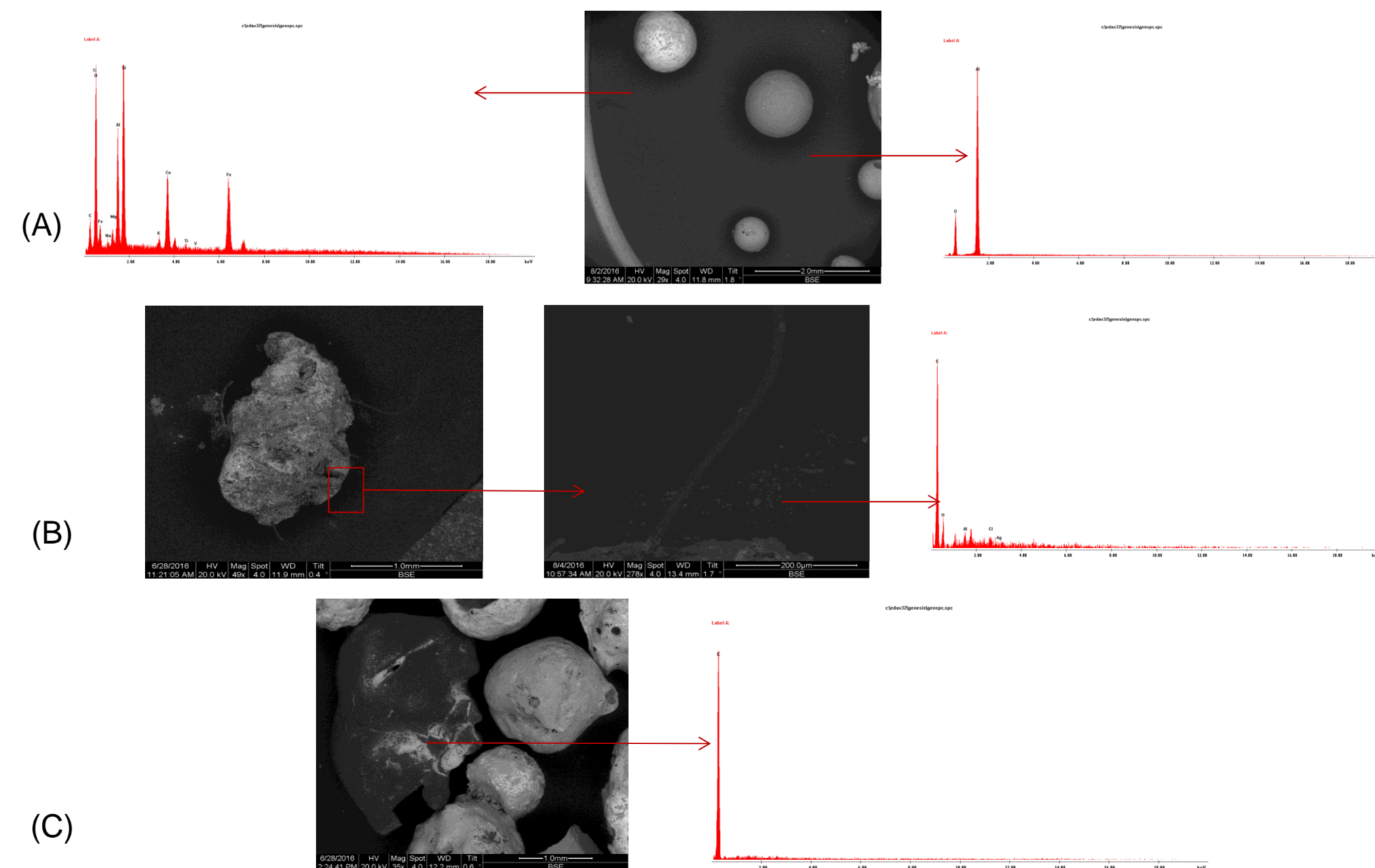


Figure 2 Scanning electron microscopy (SEM) backscatter electron (BSE) images and elemental analysis spectra for common MP types in River Kelvin sediment samples, showing that fibres and fragments are likely polymeric materials while pellets are not; (A) spherical pellets, (B) fibres, (C) fragment.

FUNDING & REFERENCES

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1. Thompson et al. 2004
2. Arthur et al. 2009
3. GESAMP 2015
4. Hartl et al. 2015
5. Wagner et al. 2014

- ▣ Pellets
- Fibres
- Fragments
- Other

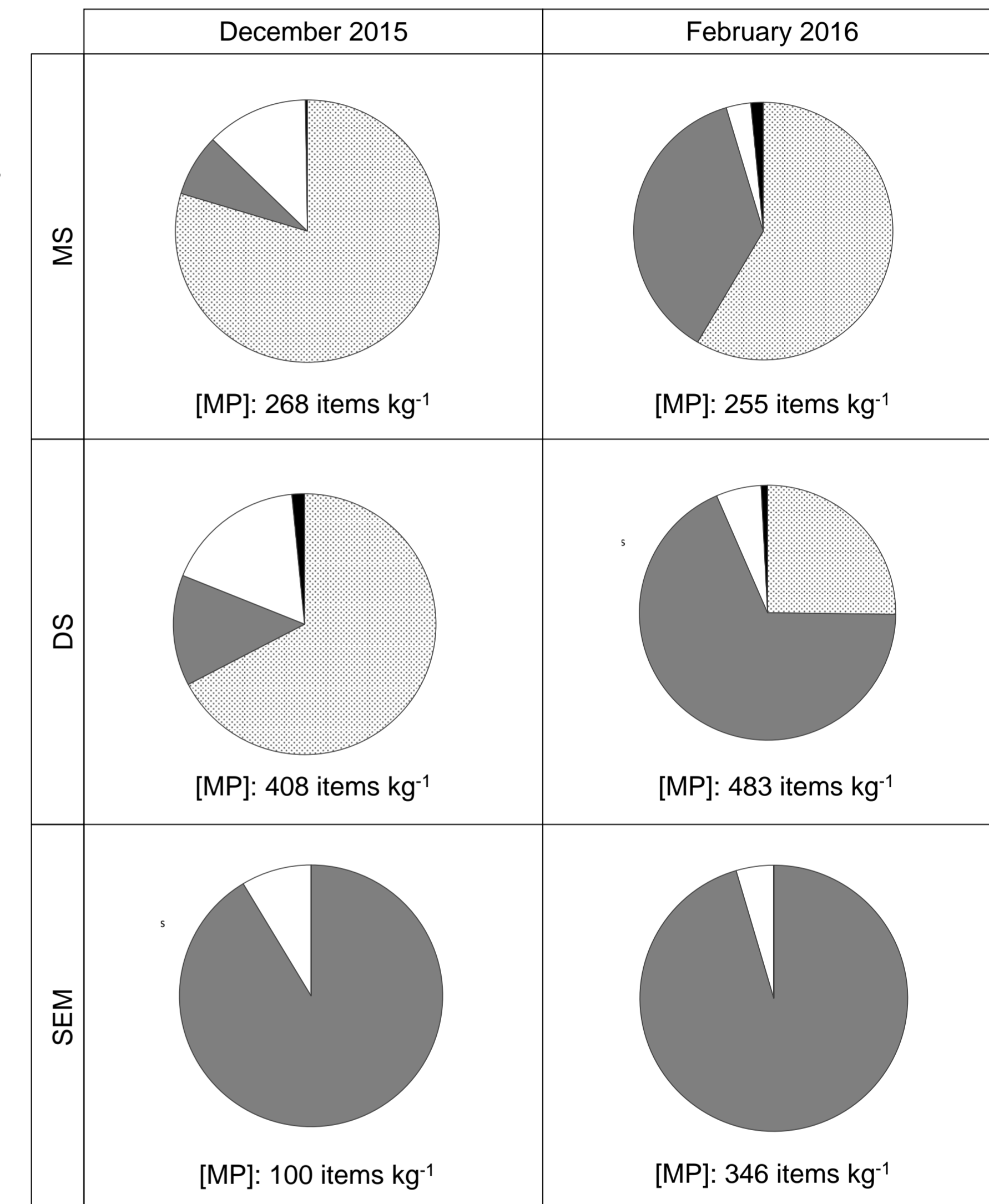


Figure 3 Microplastic concentrations ([MP] in River Kelvin sediment sampled December 2015 and February 2016. [MP] were based on visual counts after manual separation (MS), density separation (DS) with a saturated NaCl solution ($\rho \sim 1.3 \text{ g cm}^{-3}$), and SEM analysis (SEM).

CONCLUSIONS & FUTURE WORK

- DS allowed for extraction of fibres and smaller fragments and flakes, resulting in higher [MP].
- Changes in [MP] after SEM analysis compared to initial MS and DS estimates highlight the need to implement forensic approaches (e.g., SEM, Raman, FTIR) to improve accuracy and relevance of results.
- Next step is to isolate MPs from wastewater treatment processes
- This research is relevant to Hydro Nation goals, to generate incisive understanding of the distribution and behaviour of MNPs in freshwaters, and for development of effective mitigation and control measures.