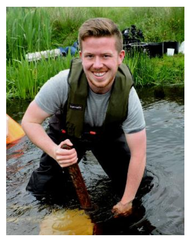

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Potential pathways, trophic transfer and bioindicators of microplastics in freshwater systems

Microplastic (MP) polymers, 0.1 µm – 5 mm in size, are ubiquitous within aquatic environments[1,2]. Due to their small size there is a risk that they may infiltrate and transfer within aquatic food webs[3,4]. Though a limited number of laboratory studies can facilitate our understanding of species susceptibility, the lack of field data from freshwater environments means that the spatiotemporal patterns governing MP exposure, as well as their associated dynamics within the freshwater environment are not well understood.

There is a need therefore to assess MP exposure in Irish waters in order to identify potential pathways and transfer rates for MPs within the freshwater food web. This will, in turn, assist to identify potential bioindicators for monitoring purposes, with a view to informing relevant policy on best practice guidelines for management actions and measures for improving water quality.

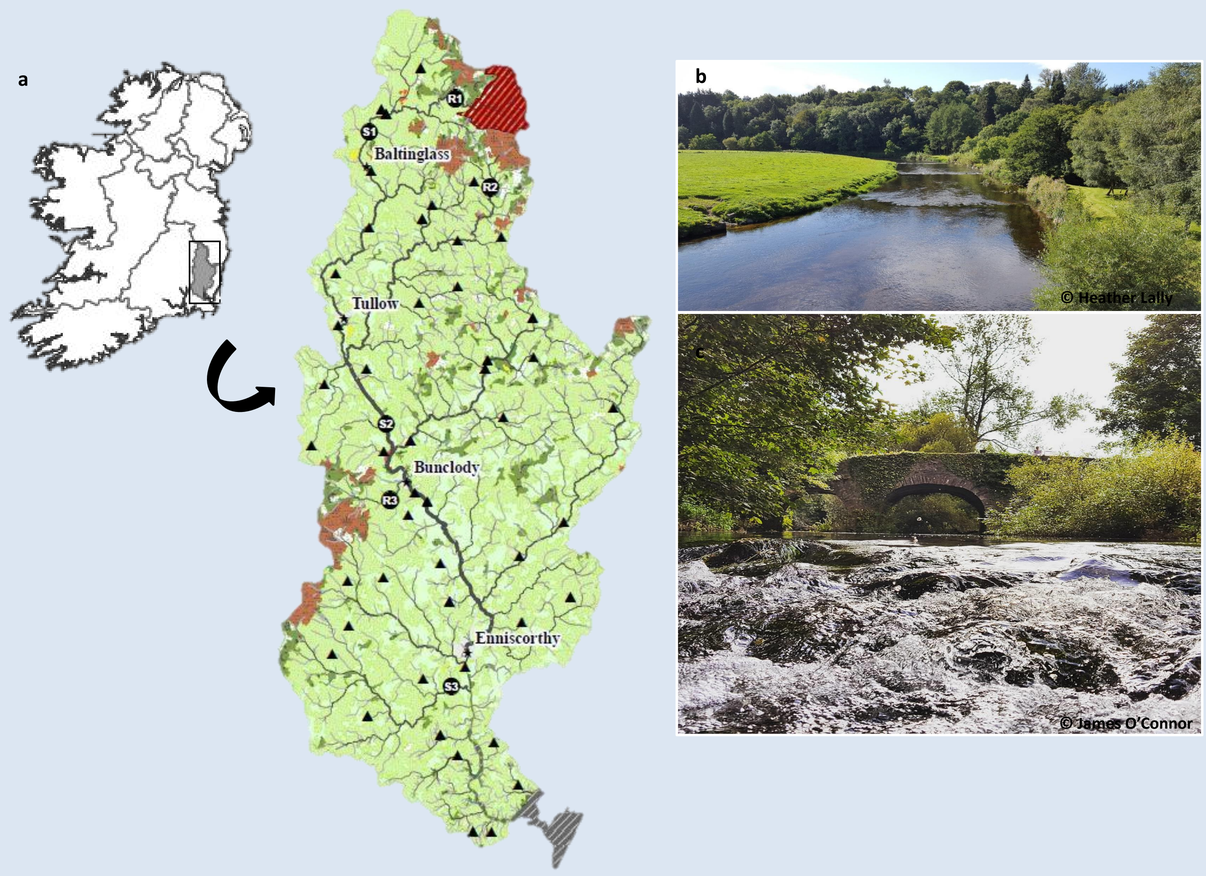

Figure 1: (a) Map of the River Slaney catchment outlining sampling sites (R = Reference sites, S = 'High Exposure' sites, Black triangles indicate locations of urban waste water treatment plants (UWWTPs)), (b) Downstream view of Kilcarry Bridge, Co. Carlow (S2), (c)Upstream view of Ballynapierce Bridge, Co. Wexford (S3)

Project Objectives

- Characterise and quantify MPs present in an Irish freshwater system.
- Identify pathways and transfer rates of MP exposure through analysis of a freshwater food web.
- Evaluate ecological implications of MP uptake under realistic exposure conditions.
- Explore the use of using bioindicator species for monitoring purposes.

Material and Methods

Study area includes three 'reference' sites and three 'high exposure' sites within the River Slaney catchment (see Figure 1).

Water and Sediment Sampling

- Water samples obtained using 200 µm & 100 µm Neuston nets (volume reduced)
- Sediment samples obtained from depositing marginal and pool areas (five per site)
- Both matrices analysed in order to characterise MPs and quantify MP abundance within the catchment

Biological Analysis to identify Pathways and Transfer Rates of MPs

- Presence and characterisation of MPs in macroinvertebrates (primary consumers), fish (secondary consumers) and spraints from otters *Lutra lutra* (top level consumers)
    - Benthic macroinvertebrates collected from each site using 10 x 1 min kick samples
    - Otter spraints collected from within catchment during routine sampling sessions

Evaluating Bioindicator Species for Monitoring

- Eurasian otter, fish and macroinvertebrates being assessed as potential bioindicators
- Ongoing nationwide collection of otter spraints by NPWS staff and citizen science
- Presence and characterisation of MPs among benthic macroinvertebrates currently being undertaken

Lessons Learned

Water Sampling

- Neuston nets found to be quite cumbersome for water sampling
- Bridges required for deployment with enough suitable access downstream
- Labour intensive: Enough man power required to hold nets in moderate to fast flow and hoist nets upon collection of sample
- Issues with biosecurity in transferring nets from one site to the next
- Currently exploring the use of 1 Litre grab samples for sampling water under recommendations for monitoring

Biological Analysis of Benthic Macroinvertebrates

- Processing of macroinvertebrate kick samples requiring a considerable amount of time due to difficulties with digestion
    - Identifying taxa to family level
    - 24 hour desiccation
    - 48 hour digestion in 30% H_2O_2[5]
    - Filtering onto GF/C Whatman filter paper

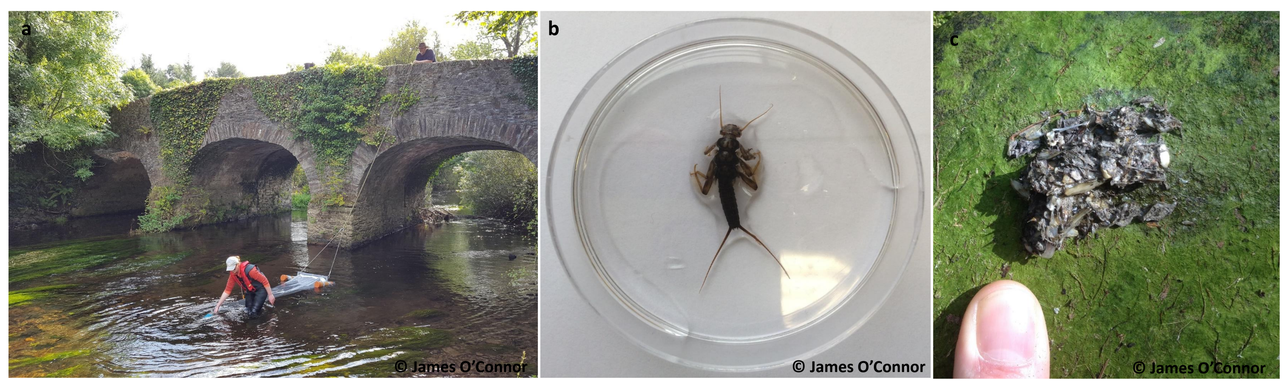

Figure 2: (a) Water sampling using neuston net, (b) *Perla bipunctata* (Pictet, 1833) (common stonefly) , (c) Otter spraint showing dietary remains

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