Uptake and impact of microplastics on native and invasive amphipods
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Microplastics are tiny plastic fragments which originate from the decomposition of plastic products such as bottles and textiles or which are intentionally used in other products including cosmetics. They have been monitored mainly in the marine environment but work in freshwaters is only just beginning (Kay et al., 2018; Wagner et al., 2014; Eerkes-Medrano et al., 2015). Most importantly, very little is known about uptake of microplastics by aquatic organisms and subsequent effects on them.

Amphipod Crustacea are keystone species in freshwater and coastal habitats. They shred dead leaf, making this key, but unpalatable resource available to lower order consumers. However, they also predate other macroinvertebrates whilst being consumed by fish and bird predators. Their shredding activities are likely to expose them to microplastics which accumulate in coastal and freshwaters, whilst their position mid-food chain makes them a likely conduit for the transmission of microplastics to higher order predators.

Amphipods are sensitive to a range of anthropogenic stressors, and are used for ecotoxicological assessment. However, little is known about the potential uptake of microplastics by amphipods, their effects on amphipod fitness, or their passage to animals higher up the food chain. Aquatic pollutants have been linked to intersex development and reduced fertility in amphipods (Short et al 2014). Endocrine disruptors (EDs) used in plastics manufacture lead to reduced fertility in mammals (Chianese et al 2018) including humans (Fucic et al 2018). Whilst amphipods have been found to ingest microplastics, little is known about their impact. We predict that endocrine disruptors in microplastics will lead to reduced fertility in amphipods, potentially leading to decreased population sizes with cascading effects for predators that rely on this food source.

Invasive species are one of the main drivers of biodiversity loss globally. The invasive amphipod *Dikerogammarus villosus* is listed as one of the EUs 100 worst invaders. It is a physiologically tolerant species which has invaded fresh and brackish water habitats in Europe (Rewicz et al 2014) reaching densities 10-fold higher than the native species (Laverty et al 2017). *D. villosus* is characterised by a fast development time and a high reproductive rate, producing 50 eggs per brood, compared with 15 eggs for native *Gammarus pulex.* The high densities, feeding and growth rates of this invader suggest that it may accumulate microplastics at a higher rate than native species.

The studentship will investigate the uptake and impact of environmental microplastics on the behaviour, fitness and fertility of native and invasive amphipods in the UK.

Objectives

- Investigate the presence and mass of microplastic particles in native and invasive amphipods collected from contaminated and non-contaminated field sites.

- Compare the behaviour, fitness and fertility of amphipods from contaminated and non-contaminated sites

- Investigate the fate of fluorescently labelled beads following ingestion: do microplastics pass through the gut, or do they accumulate in the tissues?

- Explore the effects of laboratory exposure to microplastic contaminants on amphipod behaviour (diet preference, sexual mate guarding, mating) and reproduction (fertility).

- By using both native *G. duebeni* and *G pulex* and invasive *D. villosus* in these experiments the student will compare the uptake and impact of microplastics on native vs invasive species

Training. The student will be supervised by Dr Alison Dunn FBS and Dr Paul Kay, SoG. They will receive training in field work, experimental design and analysis, animal behaviour environmental toxicology and biological invasions. They will join the Ecology & Evolution research group and water@leeds research community

Fit to NERC Science
This research fits with NERC's research areas Terrestrial and Freshwater Environments (sub-theme water quality) and Pollution, Waste and Resources (sub-theme ecotoxicology). It also aligns with NERC's Ecology, Biodiversity and Systematics research area (subtheme conservation ecology).

Chua et al. 2014 *Environ. Sci. Technol.* DOI: 10.1021/es405717z
Chianese et al 2018 Int J Environ Res & Public Health DOI 10.3390/ijerph15061229
Rewicz T, et al 2014 Aquatic Invasions 9.
Short s et al. Environmental Science and Technology 48, 13520-13529
Eerkes-Medrano et al 2015 *Water Research*, *75*, 63-82.
Kay, P. et al 2018 *Environmental Science and Pollution Research*, 1-4.
Wagner, M et al *Environmental Sciences Europe*, *26*(1), 1-9.