

Briefing

Microplastic pollution in Wales

Submission to the Climate Change, Environment and Rural Affairs Committee | Y Pwyllgor Newid Hinsawdd, Amgylchedd a Materion Gwledig

Summary

- Microplastic pollution is widespread and comprises many forms and sources.
- Understanding of the impact on wildlife is rapidly developing but examples of harm are already well documented. There is potential for serious damage at ecosystem level, and human health is also at risk.
- Research and action most focus on prevention of plastic pollution through radical reduction of use of most plastics.
- A better understanding of plastic pollution sources and their pathways to and through the environment is also required, but there are immediate steps that can be taken reduce pollution from Wales.
- Wales should consider legislation committing to a pathway to near-zero plastic pollution, and classing plastic as a pollutant.

1. To what extent are microplastics, including synthetic microfibers, a problem within Wales' aquatic environment? How does this impact on environmental and human health?

- 1.1. The rapidly growing evidence base for microplastic pollution in aquatic environments indicates widespread prevalence. It would be reasonable to assume a broadly similar picture across all parts of the UK, including Wales, for reasons outlined in the response to Question 2.

- 1.2. The dispersibility of microplastics means they have been found in surface water, shallow waters, beaches and sediment in many different areas of the world.^{1,2}
- 1.3. It is important that nanoplastics (generally classed as smaller than 100nm) are considered and studied too because similar, if not worse, concerns are beginning to be expressed as apply to microplastics³.
- 1.4. Ways in which microplastics can cause environmental harm include:
 - 1.4.1. **Ingestion** - marine life at the bottom of the food chain, including plankton and small crustaceans, mistake microplastic for food. When eaten, these creatures transfer plastic and associated chemicals up the food chain.
 - 1.4.2. **Toxicological effects** - plastics often contain toxic chemicals added to lend useful features such as flexibility, and plastic debris can adsorb persistent organic pollutants (POPs) that are present in the oceans from other sources. These substances can become highly concentrated on the surface of the plastic. If ingested, these toxic chemicals in plastics could be transferred to marine organisms and cause serious harm.^{4,5}
 - 1.4.3. **Habitat impacts** - microplastics provide habitats for bacterial colonisation⁶ and rafting insects,⁷ acting as vectors for invasive species and disease. They can also affect the temperature and oxygen concentration of marine sediments,⁸ increase disease in coral and sea grass, and block light necessary for photosynthesis in these organisms.^{9,10}
 - 1.4.4. **Climate change** -Recent research¹¹ has revealed that plastic releases methane under the action of sunlight, meaning plastic pollution could

¹ Barnes, D.K.A., Galgani, F., Thompson, R.C., and Barlaz, M. (2009) Accumulation and fragmentation of plastic debris in global environments, *Philosophical Transactions of the Royal Society B: Biological Sciences*, Vol.364, No.1526, pp.1985–1998

² Song, Y.K., Hong, S.H., Jang, M., Kang, J.-H., Kwon, O.Y., Han, G.M., and Shim, W.J. (2014) Large Accumulation of Micro-sized Synthetic Polymer Particles in the Sea Surface Microlayer, *Environmental Science & Technology*, Vol.48, No.16, pp.9014–9021

³ Rios Mendoza, L.M., Karapanagioti, H., and Álvarez, N.R. (2018) Micro(nanoplastics) in the marine environment: Current knowledge and gaps, *Current Opinion in Environmental Science & Health*, Vol.1, pp.47–51

⁴ Teuten, E.L., Saquing, J.M., Knappe, D.R.U., et al. (2009) Transport and release of chemicals from plastics to the environment and to wildlife, *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, Vol.364, No.1526, pp.2027–2045

⁵ Hirai, H., Takada, H., Ogata, Y., et al. (2011) Organic micropollutants in marine plastics debris from the open ocean and remote and urban beaches, *Marine Pollution Bulletin*, Vol.62, No.8, pp.1683–1692

⁶ Carson, H.S., Nerheim, M.S., Carroll, K.A., and Eriksen, M. (2013) The plastic-associated microorganisms of the North Pacific Gyre, *Marine Pollution Bulletin*, Vol.75, No.1–2, pp.126–132

⁷ Goldstein, M. (2012) *Abundance and ecological implications of microplastic debris in the North Pacific Subtropical Gyre*, 2012

⁸ Carson, H.S., Colbert, S.L., Kaylor, M.J., and McDermid, K.J. (2011) Small plastic debris changes water movement and heat transfer through beach sediments, *Marine Pollution Bulletin*, Vol.62, No.8, pp.1708–1713

⁹ Lamb, J. B. et al. (2017) Plastic Waste Associated with Disease on Coral Reefs, *Science*, Vol 359, Issue 6374, pp. 460–462

¹⁰ <https://www.blastic.eu/knowledge-bank/impacts/smothering/>; Fitzpatrick, J., & Kirkman, H. (1995). Effects of prolonged shading stress on growth and survival of seagrass *Posidonia australis* in Jervis Bay, New South Wales, Australia. *Marine Ecology Progress Series*, 127, 279–289.

¹¹ <https://www.bbc.co.uk/news/science-environment-45043989>

potentially be a significant driver of climate change. Additionally, significant greenhouse gas emissions are associated with production of plastic which almost entirely derives from oil and, increasingly, from gas obtained through fracking.

- 1.5. The evidence base for human impacts is small but concerns have been raised, not least because of the evidence of harm to wildlife. Humans are exposed to micro- and nanoplastics and associated chemicals through inhalation, ingestion with food and drink and absorption through the skin.

2. What are the main sources of microplastic pollution, including microfibres?

- 2.1. The major sources of plastic pollution are shown in Figure 1, taken from a forthcoming report for Friends of the Earth by Eunomia. It is notable that the major microplastic pollutants comprise a greater portion of the total than the larger 'macroplastic' portion.
- 2.2. The estimate for microplastic pollution from vehicle tyres is particularly surprising to most people, as is the revelation that plastic pollution stems significantly from clothing and paints.
- 2.3. Microplastics can result from the fragmenting of larger plastic items as they are subjected to UV radiation and physical abrasion in the sea. Much plastic from items such as bottles, plastic bags and fishing nets will contribute to this.
- 2.4. The UK generated 4.9 million tonnes of plastic waste in 2014. Eunomia estimates, based on forward projections, 2018 waste arisings to be around 5.2 million tonnes, increasing by 20% to 6.3 million tonnes by 2030.
- 2.5. Eunomia estimates that the UK releases 14,500 tonnes of this plastic to the sea annually.
- 2.6. In the same forthcoming report Eunomia estimates the UK generates 18,000 tonnes of microplastics from the following four main sources:
 - 2.6.1. **Vehicle tyres:** Eunomia estimates the UK generates 60,000 tonnes per year of microplastics through tyre wear, 12,000 tonnes of which enters surface waters. Tyre dust is also estimated to contribute up to 10% of airborne particulates¹² known to cause respiratory and other illnesses.
 - 2.6.2. **Synthetic clothing:** Eunomia estimates that 4,000 tonnes of microfibres are released from synthetic clothing in the UK annually. Of these, 1,600 tonnes per year, equivalent to 4 trillion individual polyester fibres, could pass through wastewater treatment into rivers and estuaries.
 - 2.6.3. Fibres have been found in tap water, beer and table salt¹³, and comprise a significant portion of the estimated 3-10 tonnes of plastic settling annually over Paris.¹⁴

¹² <http://publications.jrc.ec.europa.eu/repository/bitstream/JRC89231/jrc89231-online%20final%20version%202.pdf>

¹³ Kosuth, M., et al. (2018) *Anthropogenic contamination of tap water, beer, and table salt* Plos One vol. 13(4) <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0194970>

¹⁴ Dris, R., et al. (2016) *Synthetic fibers in atmospheric fallout: A source of microplastics in the environment?* Marine Pollution Bulletin vol. 104 pp 290-293

- 2.6.4. The IUCN estimates¹⁵ that 52% of microplastics remain on land (much from sewage sludge) whilst 48% head out to sea. Once applied on land, microfibrils and other microplastics accumulate. They have been detected in soils 15 years after the last sludge application.¹⁶
- 2.6.5. During this time they may also be ingested by creatures above and below ground and retain the potential to be washed into streams and rivers.¹⁷
- 2.6.6. **'Nurdles'**, which are pre-production plastic pellets shipped by plastic producers, are a major source of microplastic pollution due to frequent spillage in transit. Based on industry figures¹⁸, Eunomia estimates a UK loss rate to surface waters of 1,600 tonnes annually.
- 2.6.7. **Paints on buildings and road markings** contain plastic that escapes to the environment with weathering. Eunomia estimates these generate around 2,500 tonnes per year of microplastic pollution in the UK annually.
- 2.7. Other sources of microplastics include:
- 2.7.1. **Cosmetics and skincare including sunscreen:** Though increasingly subject to bans, these bans are at best limited to rinse-off products like shampoos, toothpastes and shower gels, and misleadingly limit the interpretation of 'microplastic' ingredients to 'beads'. Excluded products known to contain microplastics include sunscreens, makeups, hand creams and deodorants¹⁹.
- 2.7.2. **City Dust:** The IUCN proposes this composite group as another important category of microplastic pollution. City Dust comprises sources such as abrasion dust from shoe soles, carpets, synthetic cooking utensils, and artificial turfs that are relatively small on their own but that amount to a significant portion in total.

https://www.researchgate.net/profile/Rachid_Dris/publication/290182589_Synthetic_fibers_in_atmospheric_fallout_A_source_of_microplastics_in_the_environment/links/569f935708ae4af52546b675.pdf

¹⁵ IUCN (2017) *Primary Microplastics in the Oceans: a Global Evaluation of Sources*.

<https://portals.iucn.org/library/sites/library/files/documents/2017-002.pdf>

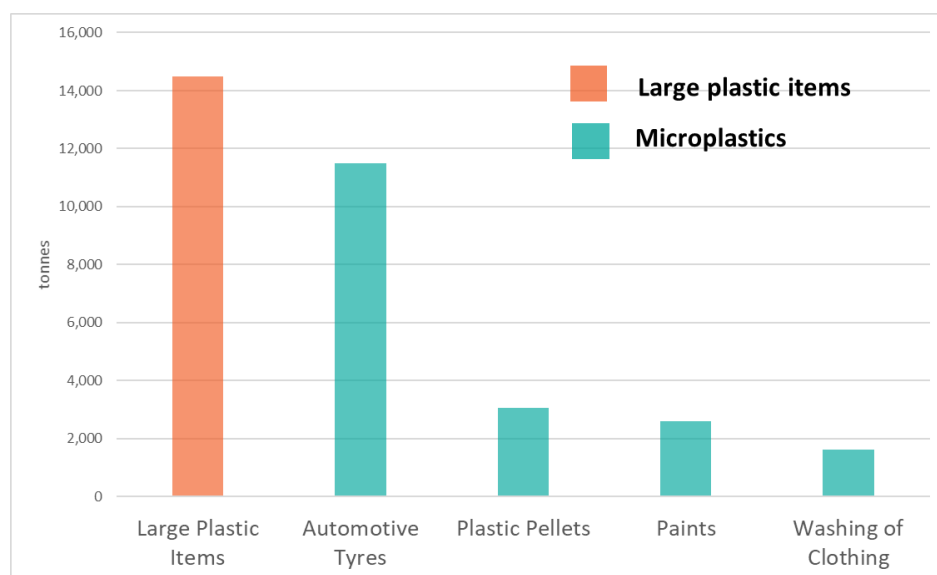
¹⁶ Zubris, K.A.V., and Richards, B.K. (2005) Synthetic fibers as an indicator of land application of sludge, *Environmental Pollution*, Vol.138, No.2, pp.201–211

¹⁷ http://wwf.panda.org/our_work/food/agriculture/impacts/soil_erosion/

¹⁸ Plastics Europe (2016) *Plastics – the Facts 2016: An analysis of European plastics production, demand and waste data*, October 2016

¹⁹ Eunomia Research & Consulting (2016) *Study to support the development of measures to combat a range of marine litter sources*, Report for European Commission DG Environment, 2016

Figure 1 – Estimates for Key Sources of Marine Plastic Pollution from the UK from land-based sources. Source: Forthcoming Eumonia report for Friends of the Earth.



3. How comprehensive is our knowledge about the scale of microplastic pollution and its effects? What should the research priorities be?

3.1. It is increasingly clear that microplastic pollution is pervasive across both terrestrial and aquatic environments, on and off-shore. Less clear, and in urgent need of research, includes:

3.1.1. How much microplastic pollution is already in the environment, the rate at which more is being added, and confirmation of what the main sources are. For example, the recent study of water courses near Manchester revealed far higher microplastic pollution and output to the sea than expected²⁰;

3.1.2. The pathways by which microplastics reach and travel through the environment, including through food chains;

3.1.3. Their impacts, including that of adsorbed and other associated chemicals, on wildlife. This is especially so with regard to multi-generational impacts.

3.2. The Welsh government should work with partners to fund research into the potential health impacts of exposure to microplastic and in particular nanoplastic pollution, including across multiple generations, and how to reduce exposure.

3.3. Urgent research is needed into alternatives to plastics, including business model as well as product design changes. This must evaluate the relative impacts of alternative materials so that we do not simply substitute one environmental and social material for another with potentially worse outcomes.

²⁰ Hurley, R, Woodward, J & Rothwell, J (2018). Nature Geoscience volume 11, 251–257. <https://www.nature.com/articles/s41561-018-0080-1>

4. What is currently being done to minimise the release of microplastics into the environment? What more can be done, and by whom, to address this issue within Wales?

- 4.1. The ban on microbeads in rinse-off products is welcome, but should be extended to cover all products for which plastic is added as an ingredient, whether or not in bead form.
- 4.2. Wales leads the UK and much of the world with its achievements and future targets for recycling and composting. However recycling can only play a limited role in ending plastic pollution.
- 4.3. Wales must focus on prevention of plastic pollution from the range of sources, emphasizing reduced production and use of plastic. This includes bans on non-essential and easy-to-replace uses of plastic. Synthetic clothes makers must be required to attach filters to washing machines pre-sale to capture microfibres, and stop selling any but the least-polluting products.
- 4.4. Prevent the significant pollution caused by unmonitored combined sewage outflows (CSOs), the thousands of gates that are opened to bypass wastewater treatment plants during heavy rains.^{21,22}
- 4.5. Require clearer labelling on products that contain plastic, such as cosmetics and synthetic clothing. This should include advice as to how to minimise plastic pollution from these products.
- 4.6. Legislate to class plastic as a pollutant so that public bodies can act and be held to account.
- 4.7. Friends of the Earth recommends the Welsh government adopt legislation that would include commitments to:
 - 4.7.1. **Right now: begin the phase-out of unnecessary single-use plastics:**
Plastic items that are unnecessary, easily replaceable or difficult to recycle – such as straws, coffee cups and stirrers - should be rapidly removed from circulation. Exceptions should be made for plastics that are essential for health and well-being, such as straws for people with disabilities;
 - 4.7.2. **As soon as we can: end pollution from hard-to-replace plastics:** such as from the wear and tear of car tyres, synthetic clothes and paints, but with government support Wales' world-leading researchers and designers can plot a course to ending pollution from these too;
 - 4.7.3. **Aim for near zero plastics pollution within twenty years:**
This would align with the UK government's 25-Year Environment Plan which committed to eliminate 'avoidable' plastic by 2042, and should cover all significant sources of plastics pollution.

²¹ Water UK (2009) Combined Sewer Overflow Position Paper - Draft

²² Marine Conservation Society (2011) Combined Sewage Overflow Position Paper