

Microplastic Pollution in Freshwater systems: *Current knowledge and future perspectives*

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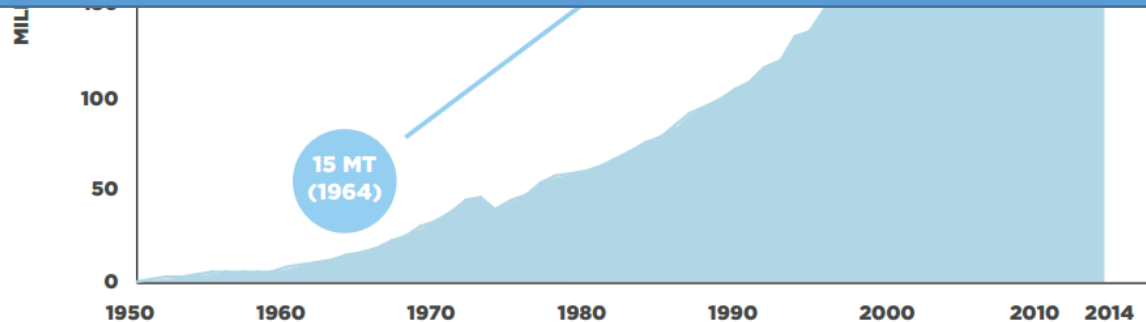
Background Microplastics

Growth in Global Plastics Production 1950–2014

350

311 MT
(2014)

G7 Summit, June 2015 Plastic litter was referred to as a “Global challenge, directly affecting marine and coastal life and ecosystems and potentially human health”



Plastics Europe, 2013

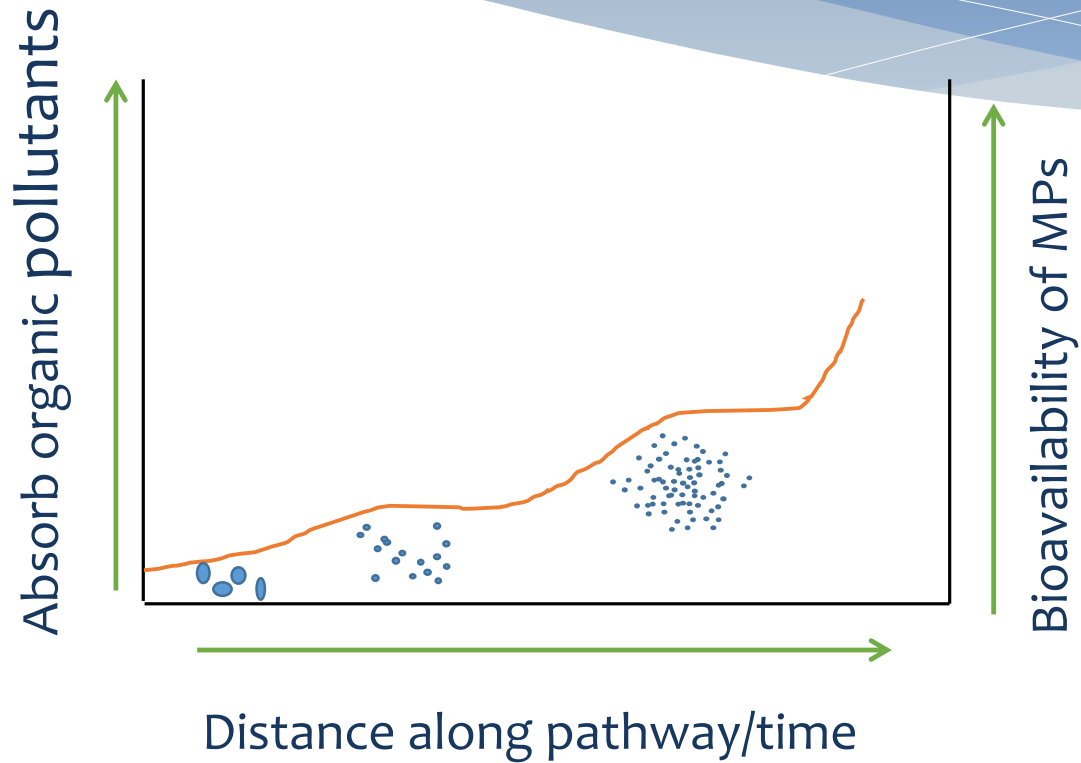
Background Microplastics

Microplastics (MPs) - Small plastics (1 μ m to 5mm)

Primary MPs - Plastic pellets, beads (plastics converting Industry, cosmetics, sandblasting..)

Secondary MPs – Fragmentation of plastics (Mechanical shearing, UV degradations)

Why the concern?



Impacts to Biota

Mytilus edulis (edible blue mussel)



Inflammation-
cross over to
circulatory system

Common Gobi



Confusion with prey
items Reduced fitness
affecting predatory
Performance,
Sá et al., 2015

Short-tailed shearwater



Gut transfer of PBDE
(polybrominated diphenyl
ethers) flame retardants from
plastic material to fatty tissue

Tanaka et al., 2013

Occurrence in Freshwater systems

Europe Lake Garda, Italy
 Lake Geneva, Switzerland / France
 Danube, Austria
 Tamar estuary, UK
 Lough Corrib, Galway, Ireland

America/ Canada
 St Lawrence River,
 Lakes superior, Huron, Erie, USA, Canada
 Los Angeles River, USA
 San Gabriel River, USA
 Channel of Chicago, USA

Asia Lake Hovsgol, Mongolia

Background

2015- EPA funded MP research at GMIT

Scope, fate, risks & impacts of microplastic pollution in Irish freshwater systems – Desk study (2014-HW-DS-2)

Quantification of microplastic pollution - Small scale study (2015-CCRP-SS-6)

Main Outcomes

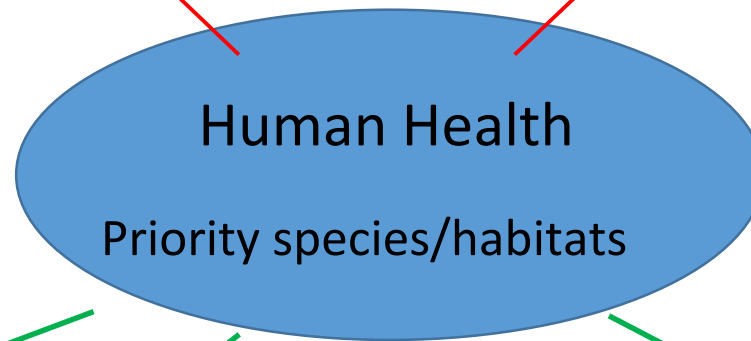
- * WWTPs are receptors for MPs from other sources
- * MPs are concentrated within the sewage sludge
- * Treatment of sewage sludge has implications for MPs abundance and size
- * Industry involved in the machining of polymers produce high amounts of microplastics

Source class	Sampling point	No. of particles/ range*	Comparable result from literature	Source
WWTPs (Moycullen)	Influent	97,000 m ⁻³	15,000±225 m ⁻³ (Sweden)	Magnusson & Norén, 2014
	Post-secondary treatment	10,000 m ⁻³	8.25±0.85 m ⁻³ (Sweden) 85 m ⁻³ (Scotland)	Magnusson & Norén, 2014 Murphy et al., 2016
	Post- reed bed	5,000 m ⁻³	NCA	
	WWTP sludge	2,742 – 15,385 kg ⁻¹ dry weight	16,700±1,960 kg ⁻¹ dry weight	Magnusson & Norén, 2014
Landfill (waste water)	boreholes	2500 – 26,000 m ⁻³	NCA	-
Industry (waste water)	Polymer production (sewer)	51, 400 m ⁻³	NCA	-
	Recycling (sewer)	661,000 m ⁻³	Borealis, Austria 200 g day ⁻¹	Lechner et al., 2015
Other	Well water	6,500 m ⁻³	NCA	-
	Mains	1,500 m ⁻³		-

Legislative implications

EU Bathing water directive (2006/7/EC)

European Drinking Water directive (98/83/EC)



The habitats Directive (92/43/EEC)

The birds Directive (2009/147/EC)

The Water Framework Directive (WFD 2000/60/EC)

Marine strategy Framework Directive (MSFD 2008/56/EC)

Recommendations – address knowledge gaps

Pathways to freshwater

- Pathways of MPs in land-spread biosolids, construction?
- Is agricultural land a sink for MPs?
- What mechanisms influence leaching/translocation?
- Potential for surface run-off and vertical translocation?

Recommendations – address knowledge gaps

Pathways within freshwater systems

- Environmental influences on fate of MPs in rivers/lakes?
- Under what conditions could monitoring be effective?
- Are MPs bio-accumulating in freshwater food webs?
- Given abundances in water abstraction locations and efficacy of treatment regimes - what are the risks of human consumption?
- Are there impacts of MPs on human health?



Current project

Sources, Pathways and Environmental fate of MPs commenced January 2017

Aim Inform policy through improved understanding of MP sources, pathways and environmental fate in freshwater

Objectives

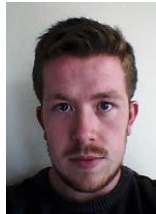
- Characterise MP sources
- Describe movement of MPs from sources to aquatic receptors
- Determine factors affecting dispersal mechanisms
- Identify pathways & transfer rates for MPs within food webs
- Model critical source areas for MPs and their potential impact
- Inform policy and make recommendations for monitoring

Project Website:

<https://freshwatermicroplastics.com/>



Team



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