

Where do all the Microplastics go?

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Galway-Mayo Institute of Technology

Just because you can't see it, doesn't mean it isn't there!



Microplastics:

Finding a consensus on the definition

- Thompson (2004) – **microscopic** plastic particles
- Browne *et al.*, (2001) – **<1mm** in diameter
- Arthur *et al.*, (2009) – **<5mm** in diameter
- Cole *et al.*, (2011) – **primary** or **secondary** origin

*“any **synthetic**, solid particle or polymeric matrix with regular or irregular shape, a size ranging from **1 μ m to 5 mm**, of either primary or secondary origin, which is **insoluble** in water”.*

Frias and Nash, 2019
Marine Pollution Bulletin



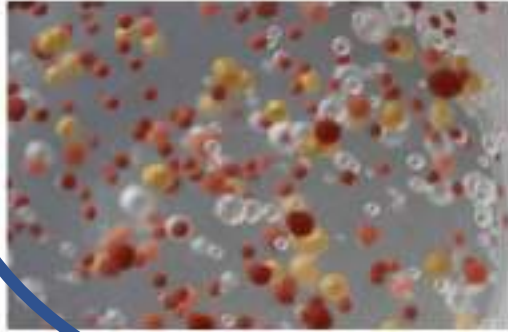
Photo credits: João Frias

Origin?

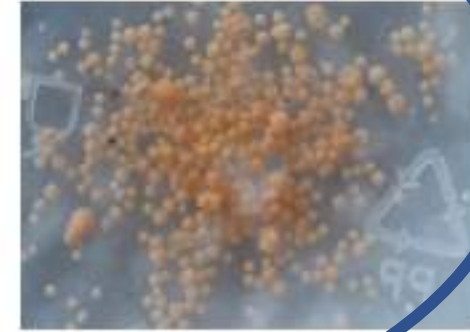
∴ Primary microplastics

Derive from plastic production and are **designed to have specific dimensions** (microbeads in toothpaste, exfoliants, etc)

MICROBEADS (Scrub)



MICROBEAD (Detergent)



NURDLES (Pellets)



Photo credits: Boomerang Alliance

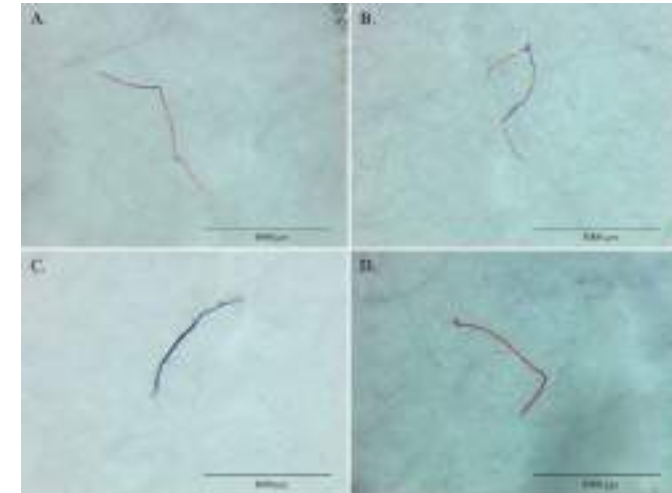
[Prohibition of Certain Products Containing Plastic Microbeads Bill 2018]

∴ Secondary microplastics

Result from the **breakdown of larger plastic items**, while exposed to weathering conditions (Photo-oxidation by UV radiation); both at sea and on land and interactions with animals, abrasion e.g. debris from tyres etc.

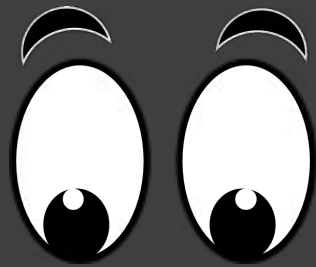


Photo credits: João Frias, Darragh Doyle



What are we doing in GMIT?

Looking to see where
all the microplastics
have gone!

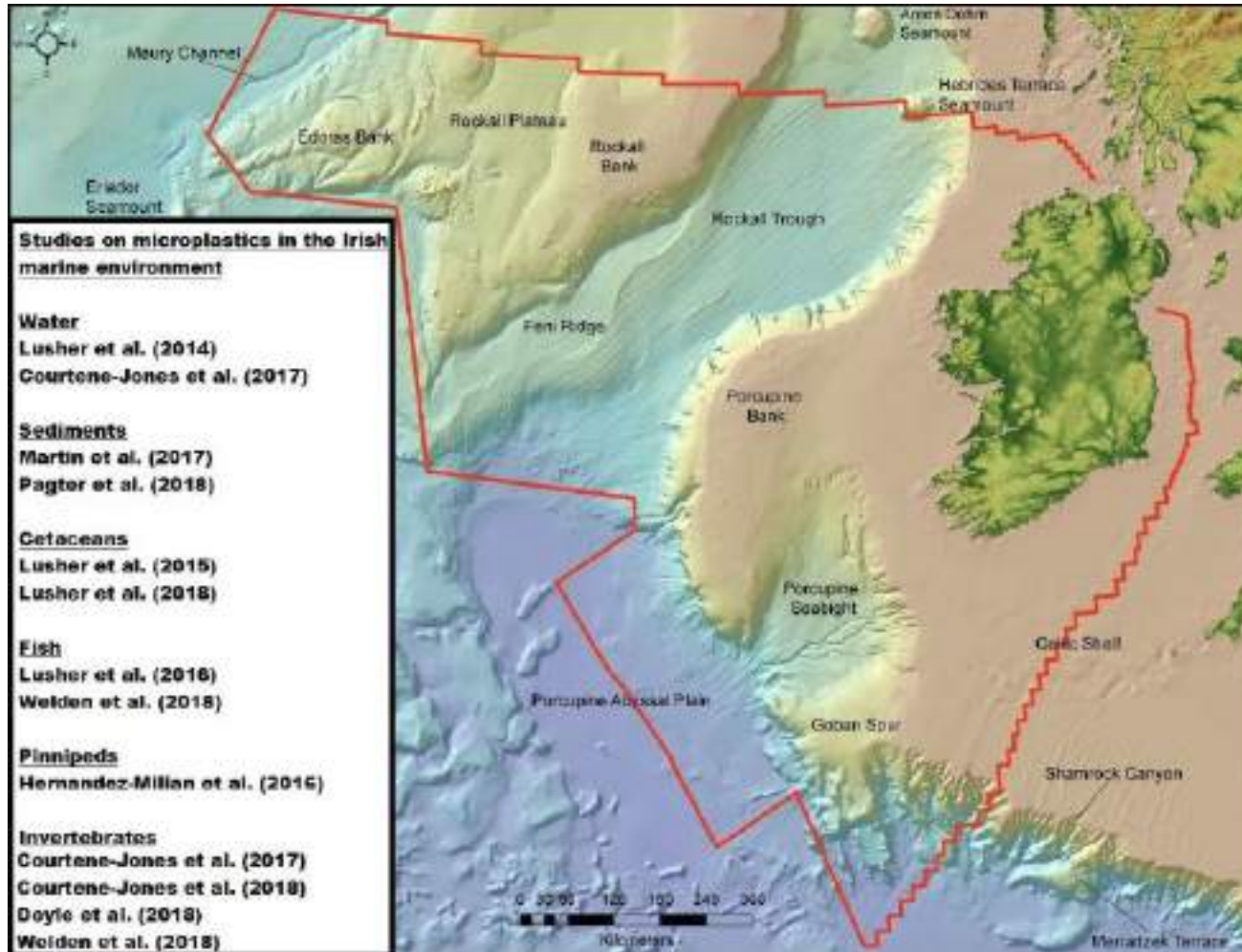


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An Irish Context



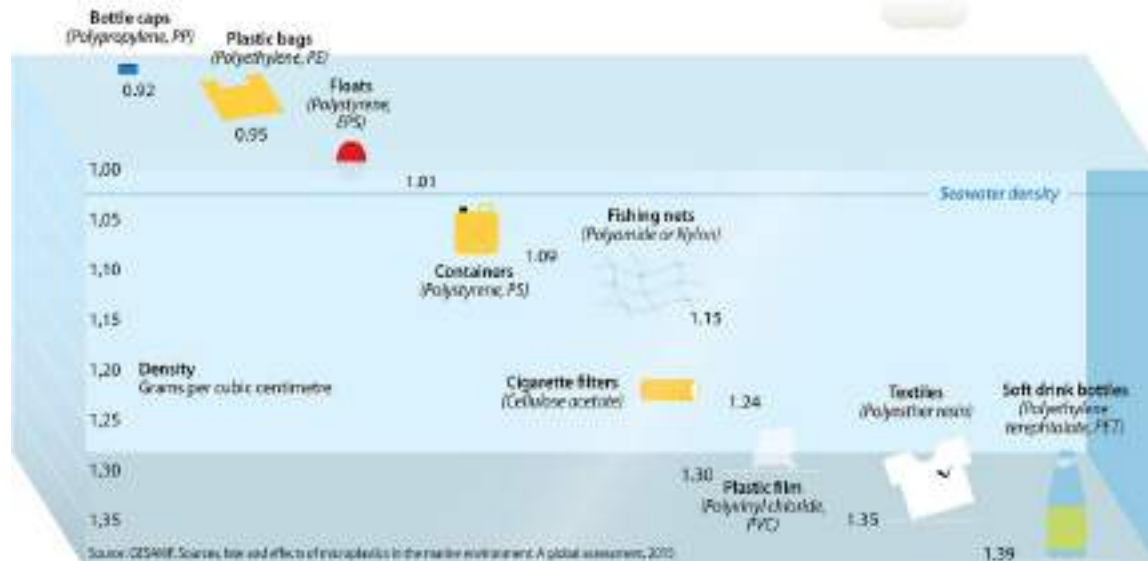
Adapted from the Marine Institute 2018

GMIT – Focused on:
Analytical **Methodologies, Identification and Quantification** of MPs
in seawater, sediments and biota

- Build a **knowledge base** (Ireland)
- Comparative/standardised **methodologies**
- (Irish) **Commercial species**
- **Ecosystem based approach**(Irish case studies)

Microplastics - Polymer types

Which plastics float and which sink in seawater?

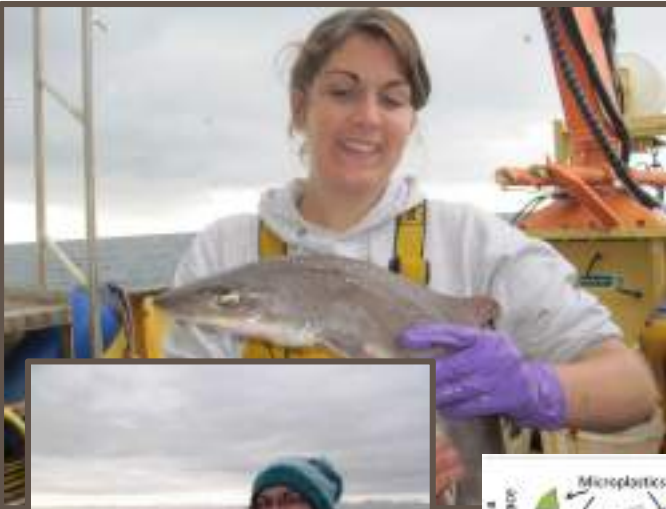


1	2	3	4	5	6	7
PETE	HDPE	PVC	LDPE	PP	PS	OTHER
polyethylene terephthalate	high-density polyethylene	polyvinyl chloride	low-density polyethylene	polypropylene	polystyrene	other plastics, including acrylic, polycarbonate, polyadic fibers, nylon, fiberglass
soft drink bottles, mineral water, fruit juice containers and cooking oil	milk jugs, cleaning agents, laundry detergents, bleaching agents, shampoo bottles, washing and shower soaps	bags for sweets, fruit, plastic packing (bubble foil) and food to-is to wrap the foodstuff	crushed bottles, shopping bags, highly-resistant sacks and most of the wrappings	furniture, consumer, luggage, toys as well as bumpers, lining and external borders of the cars	toys, food packing, refrigerator trays, cosmetic bags, costume jewellery, audio cassettes, CD cases, vending cups	an example of this type is a polycarbonate used for CD production and baby feeding bottles

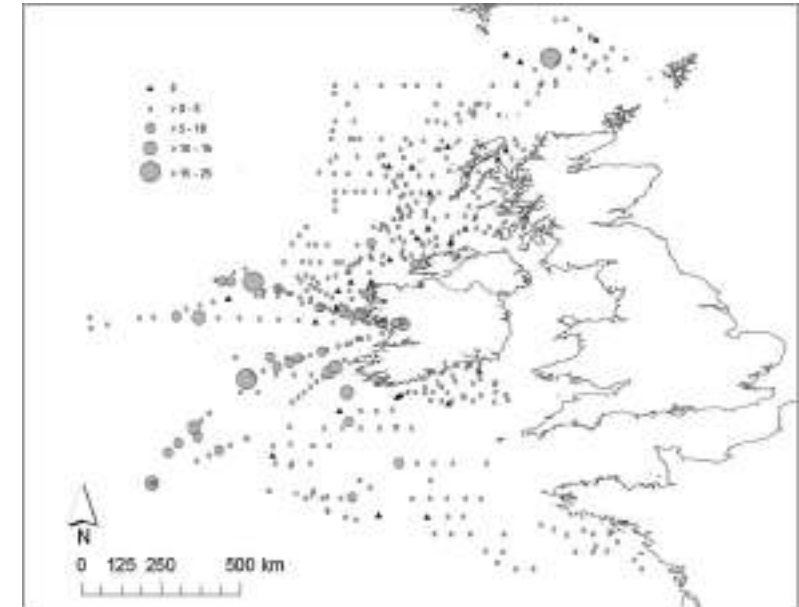
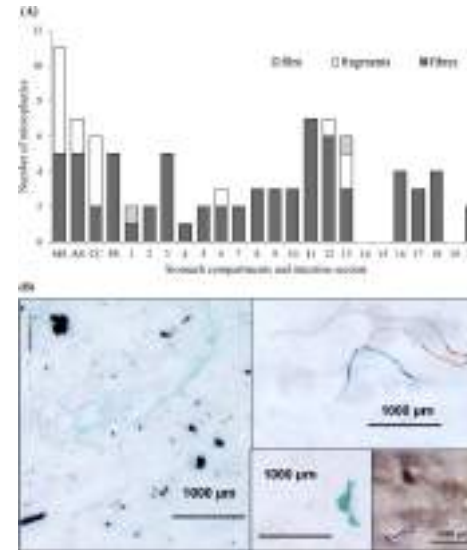
Photo credits: Polystarusa.com

PhD – Building on MP Knowledge base

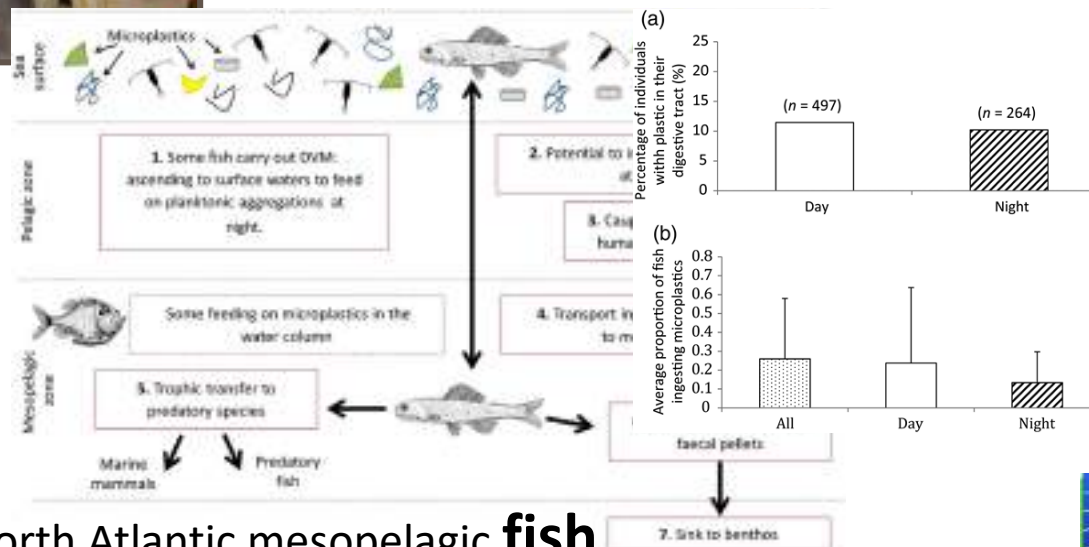
Dr Amy Lusher



True's beaked whale
(*Mesoplodon mirus*)

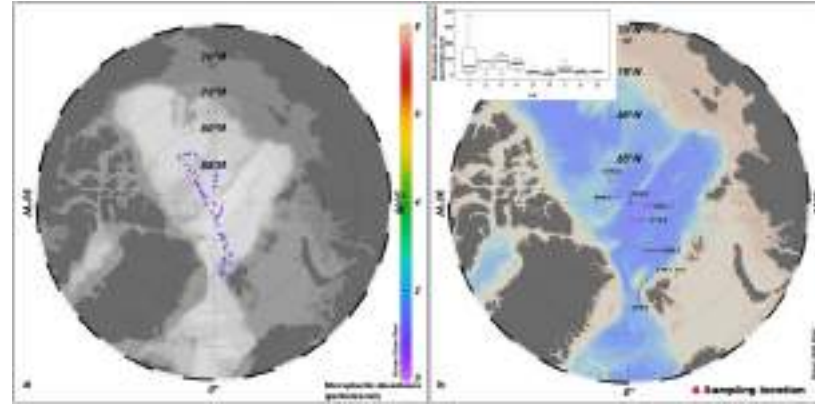


Microplastics m^{-3}
(470 samples - 2000 L of
seawater)

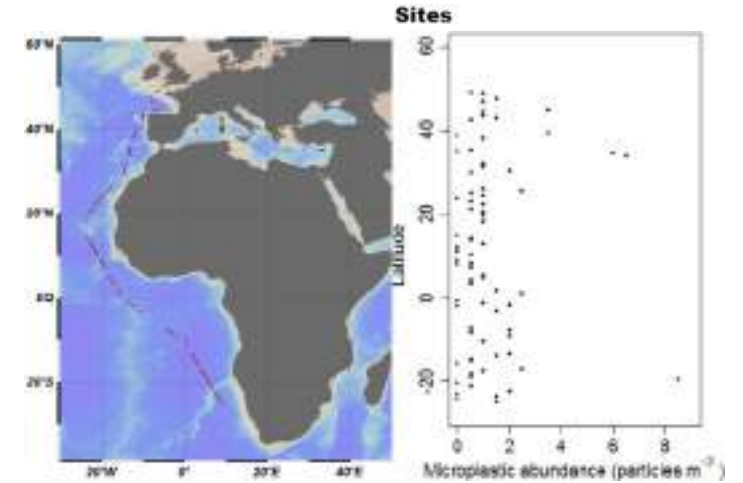
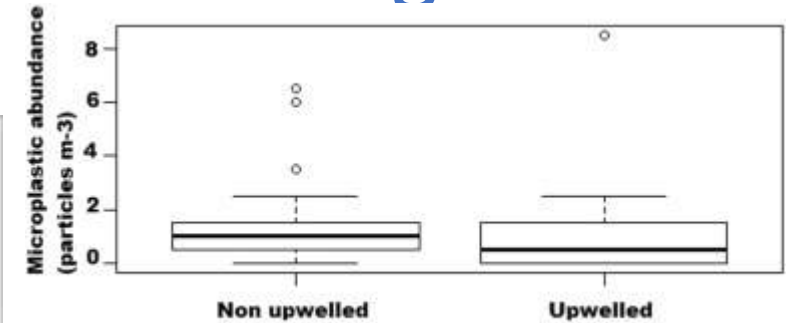
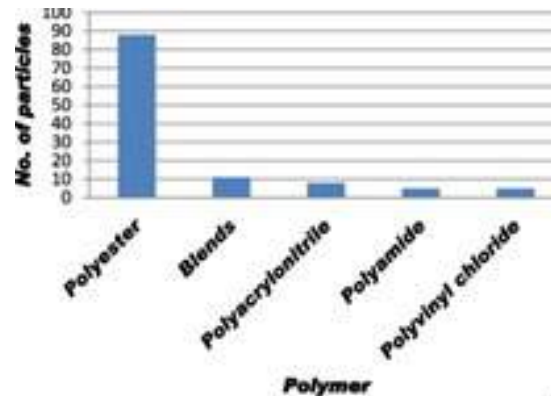


North Atlantic mesopelagic **fish**

Dr La Daana Kanhai



Microplastic abundance in the
Arctic Central Basin



Microplastic abundance,
distribution and composition
along a **latitudinal gradient** in
the **Atlantic Ocean**

PhD – Building on MP **Knowledge base** policy relevant

Implementation of OSPAR EcoQo for marine litter

- **Beach bird** and **colony surveys** – citizen science
- **Bird necroscopy** - methodologies
- **Led to policy change** – EcoQo applicability in Ireland



14 Fulmars - 93% prevalence of plastic litter.
(threshold of 0.1 g of plastic)
the current EcoQO performance for Ireland is **93%**.
Exceeds the OSPAR target of below **10%**.

PhDs – Building on MP **Knowledge base** (Seabirds)

Niall Keogh PhD Candidate



Offshore – **interactions seabirds** and **marine litter**

Seabird Distribution & Relative Abundance Survey

CSHAS 2013

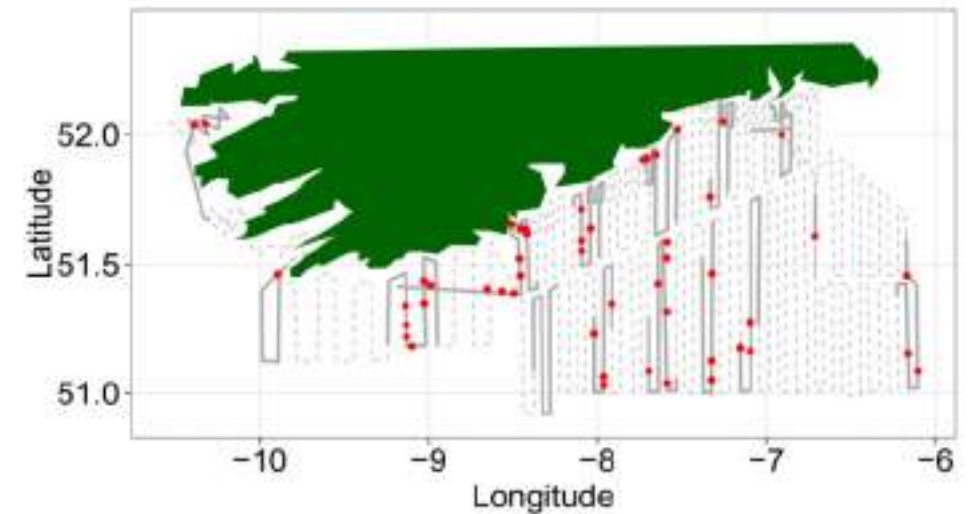


Figure 3 Litter distribution during the survey (red points). The dotted lines indicate the cruise transects, while the thick grey line show the survey effort with bird/litter observations.



Sources, Pathways and Environmental fate of MPs Freshwater Ecosystems



Research Team



For more on this project check out:

<https://freshwatermicroplastics.com/>

New Podcast on Microplastics



▶ 4:00 - 34:34

Welcome to our latest outreach endeavour – a podcast on Microplastics! About time I hear you say. You are like me and like to plug in on your commute then this may be just what you need to get a true basis on microplastics and our research. I chat to our team of biologists, bryologists and environmental engineers to find out what exactly are microplastics? why it is important to research them? and of course what they are finding?

We have successfully endeavored to put the podcast on several of the known platforms that host podcasts so that hopefully the one you are familiar with will have it there ready for you to access it:

[Sound Cloud](#)

[Spotify](#)

[iHeartRadio](#)

[iTunes](#)

Welcome

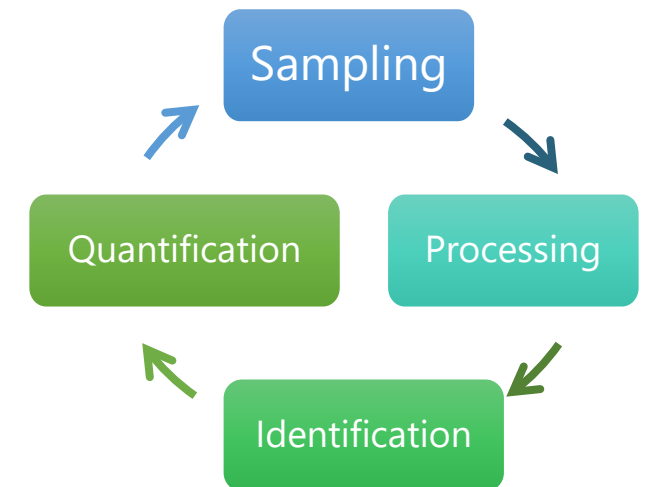
Welcome to one of the latest collaborative research projects involving the Marine and Freshwater Research Centre (MRFC), URB, the Centre for Water Resources Research (CWRR) and the Earth Institute, URB. The project is a joint venture between the University of Birmingham and the University of Birmingham. The project aims to address the development and implementation of policy to manage improved understanding of microplastic in aquatic pathways and environmental fate in Irish freshwater systems.



UCD Earth Institute



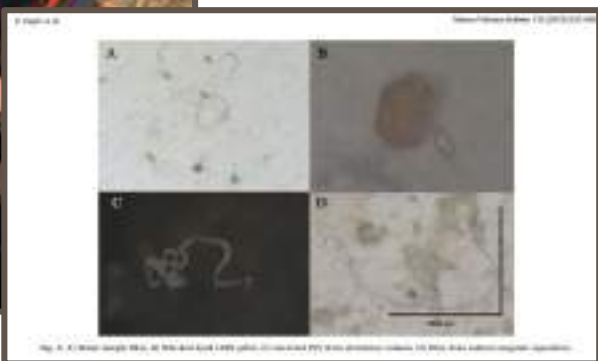
Standardised Methodologies



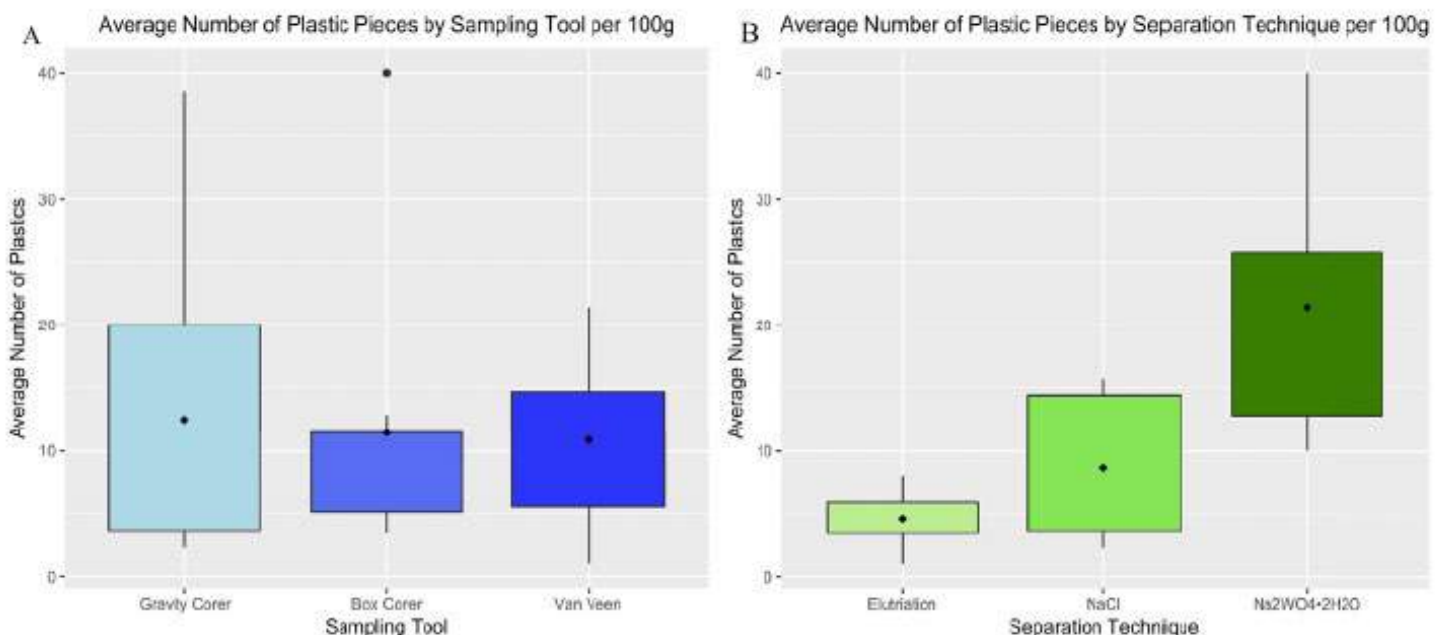
**Challenges of
implementation**



Elena Pagter MSc



MSc – Building on MP Methodologies (Comparative/standardised)



Research on MPs in Commercial species

MSc – Building on MP **Methodologies** and **Knowledge**

Jenevieve Hara MSc

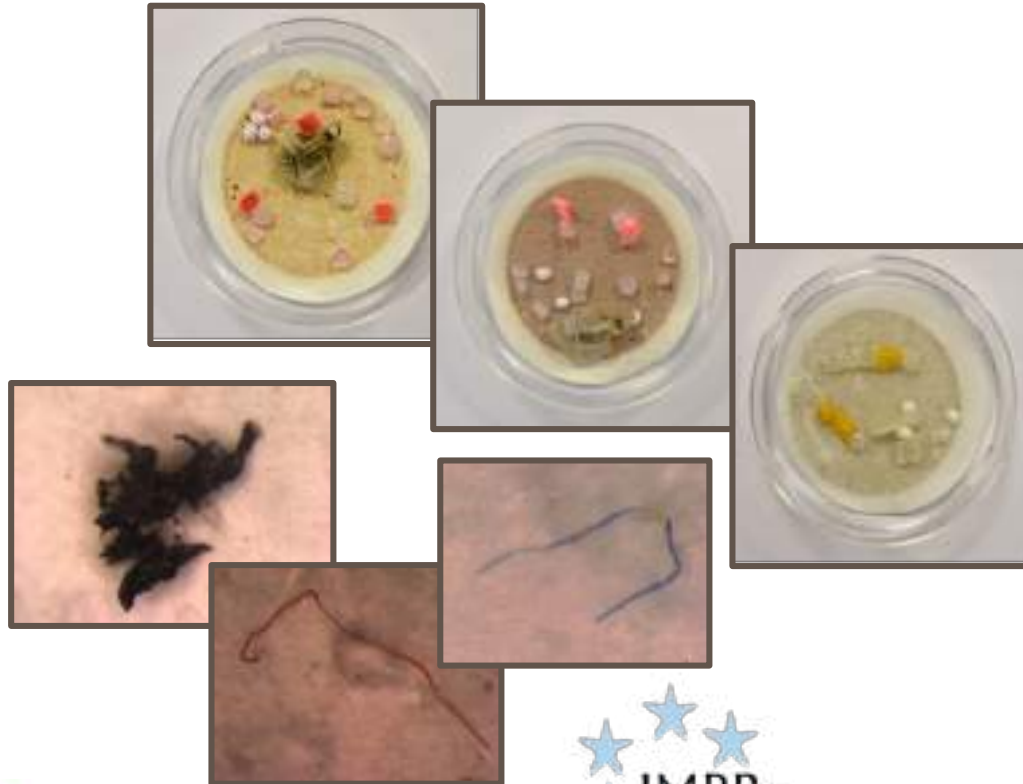
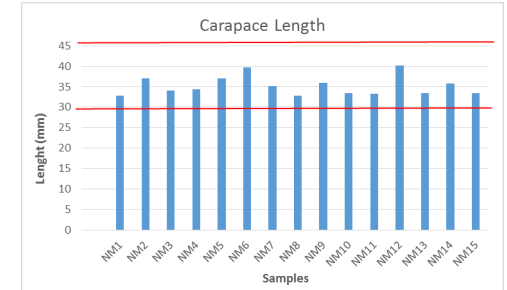


“Quantification of Microplastic Ingestion by the Decapod Crustacean *Nephrops norvegicus* from Irish Waters”
Accepted (Marine Pollution Bulletin 2019)



Dublin Bay Prawn (*Nephrops norvegicus*)

(C) Paul Kay



Research on MPs in Commercial species

Alexandar Hahn MSc



MSc Thesis: Characterisation and quantification of microplastics ingested by Seabass from two Estuaries



Research on MPs in Commercial species



Darragh Doyle
PhD Candidate



Common Periwinkle (*Littorina littorea*)



Current environmental microplastic levels do not alter emergence behaviour in the intertidal gastropod *Littorina littorea*
Submitted (Marine Pollution Bulletin 2019)

Marine Pollution Bulletin (2019) 141, 1–6

Contents lists available at ScienceDirect

Marine Pollution Bulletin

Journal homepage: www.elsevier.com/locate/marpolbul

Low levels of microplastics recorded from the common periwinkle, *Littorina littorea* on the west coast of Ireland

Darragh Doyle^a, Martin Garmann^a, John Finn^a, Gráinne Griffin^a, Eóinínn Walsh^a

^aMarine and Fisheries Research Centre, Department of Natural Sciences, Galway-Mayo Institute of Technology, Galway, Ireland

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ABSTRACT

Microplastics (MPs) are an environmental pollutant of increasing concern. However, little research has assessed MP levels in intertidal gastropods. The authors explored MP abundances in the gastropod *Littorina littorea* from

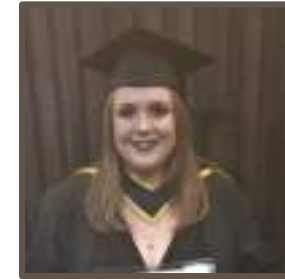
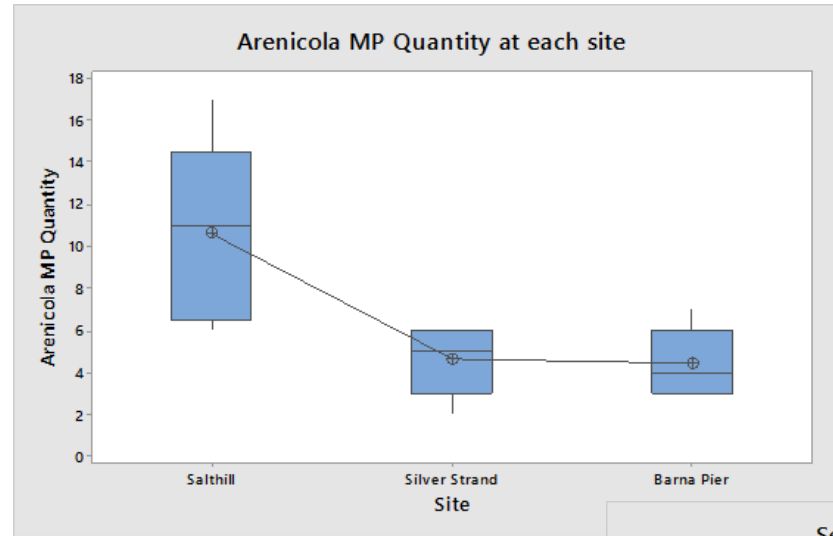


Research on MPs in Commercial species

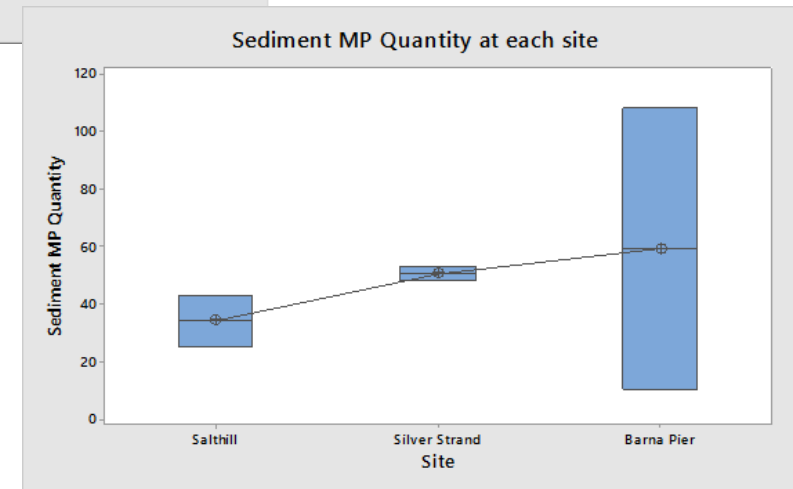
Anna Rafferty MSc



Lugworm (*Arenicola marina*)



Niamh Dalton BSc





North Hennepin
Community College

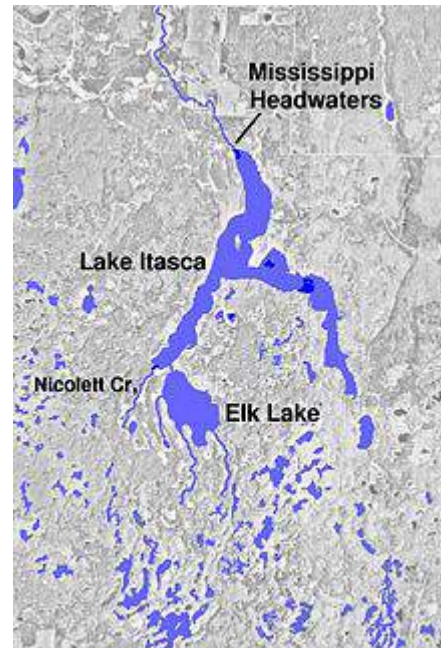


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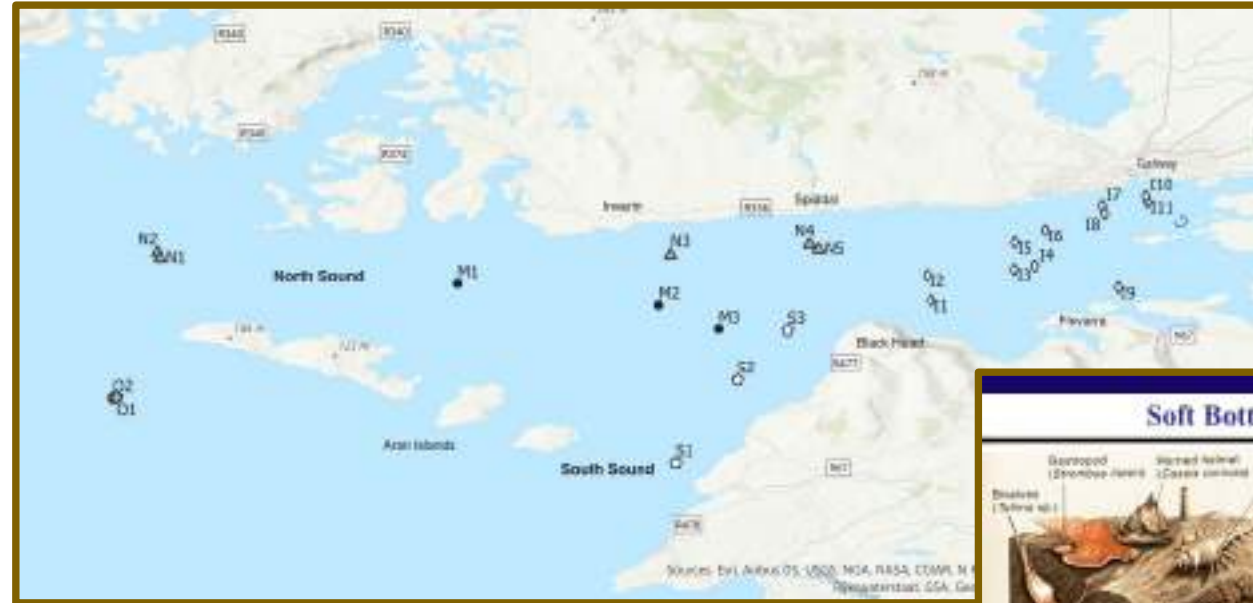
To assess the prevalence of microplastics in freshwater habitats (main river and key lakes) of the Mississippi headwaters

Dr Heather Lally & Prof Craig Longtine



Microplastics in Galway Bay: an ecosystem-based approach

Elena Pagter MSc
PhD Candidate



Microplastic abundance in benthic
sediments within Galway Bay, Ireland:
baseline data and potential hotspots.
Submitted (Marine Pollution Bulletin 2019)





IMP.act

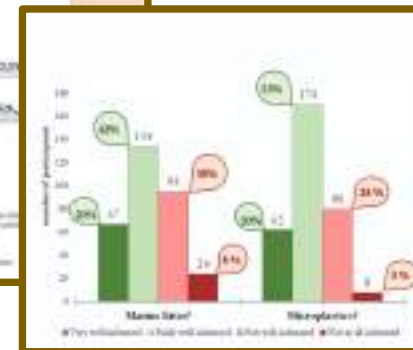
Managing for Microplastics: A Baseline to Inform Policy Stakeholders

Dr João Frias

An **ecosystem-based approach** of Galway Bay and its environs:

Intertidal & Subtidal

- Water
- Sediment
- Biota





Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann



INFOMAR
Integrated Mapping for the
Sustainable Development
of Ireland's Marine Resource



Marine Institute
Foras na Mara

'SeaRover' survey 2019



**An Roinn Talmhaíochta,
Bia agus Mara**
Department of Agriculture,
Food and the Marine



**European Maritime
& Fisheries Fund**



**Clár Chisti Eorpacha Struchtúrtha
agus Infheistíochta na hÉireann
2014–2020**

**Cómhaoinithe ag Rialtas na hÉireann
agus ag an Aontas Eorpach**



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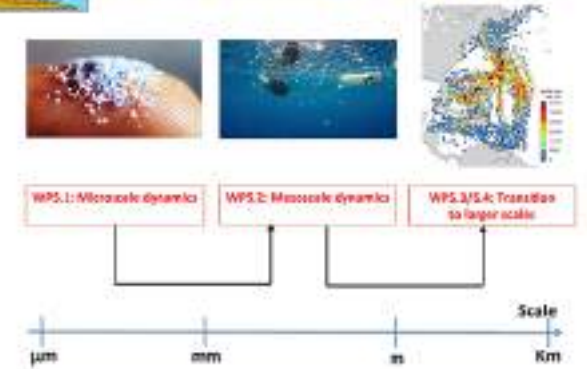
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GALWAY-MAYO INSTITUTE OF TECHNOLOGY

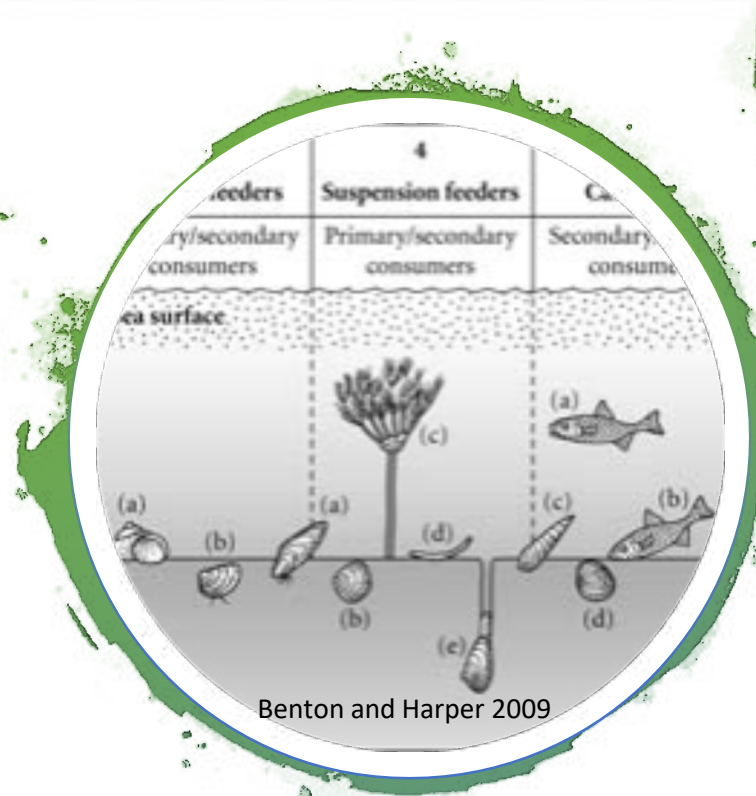
Integrated approach on the fate of Microplastics towards healthy marine ecosystems

June 2020

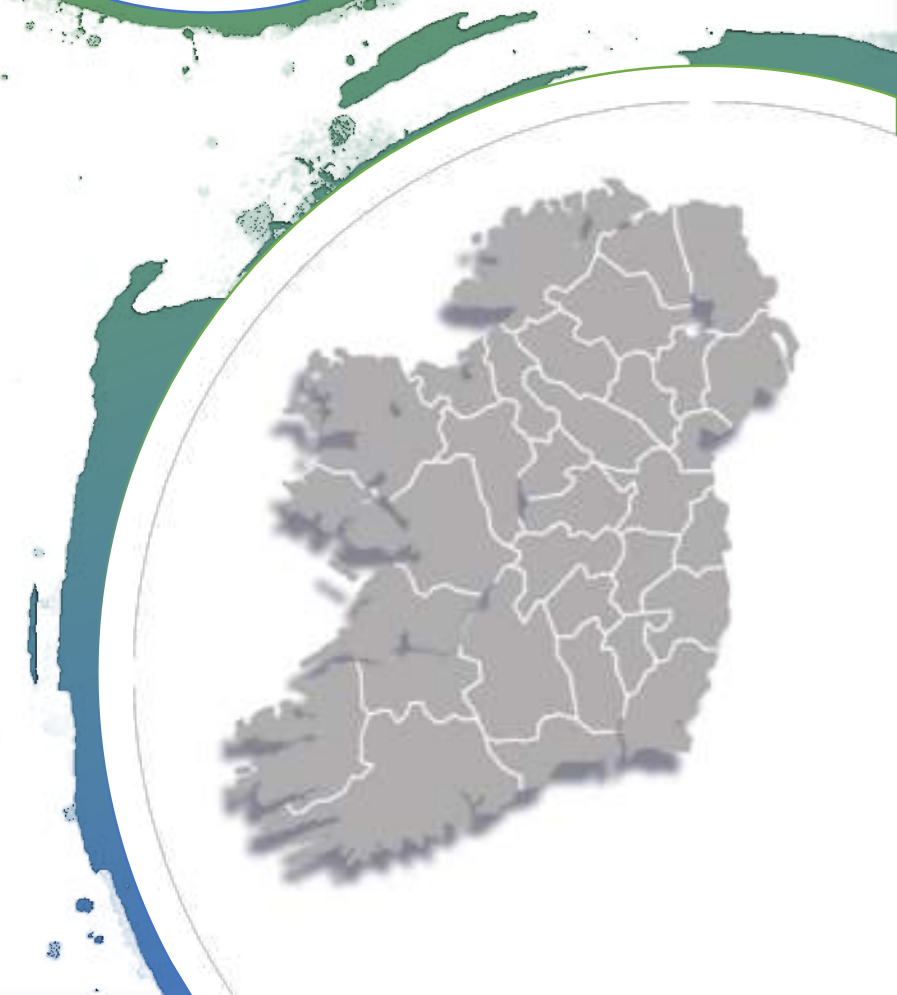


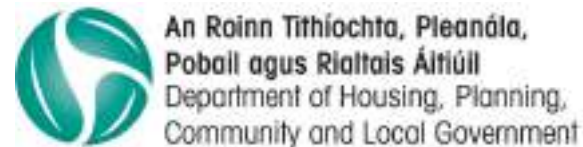
Multiscale modelling of MMPs dynamics





'Seabed Integrity'





Thank you to all our **funders** and **research partners** without them this research would not be possible

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Galway-Mayo Institute of technology

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