

**PML**

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Listen to the ocean

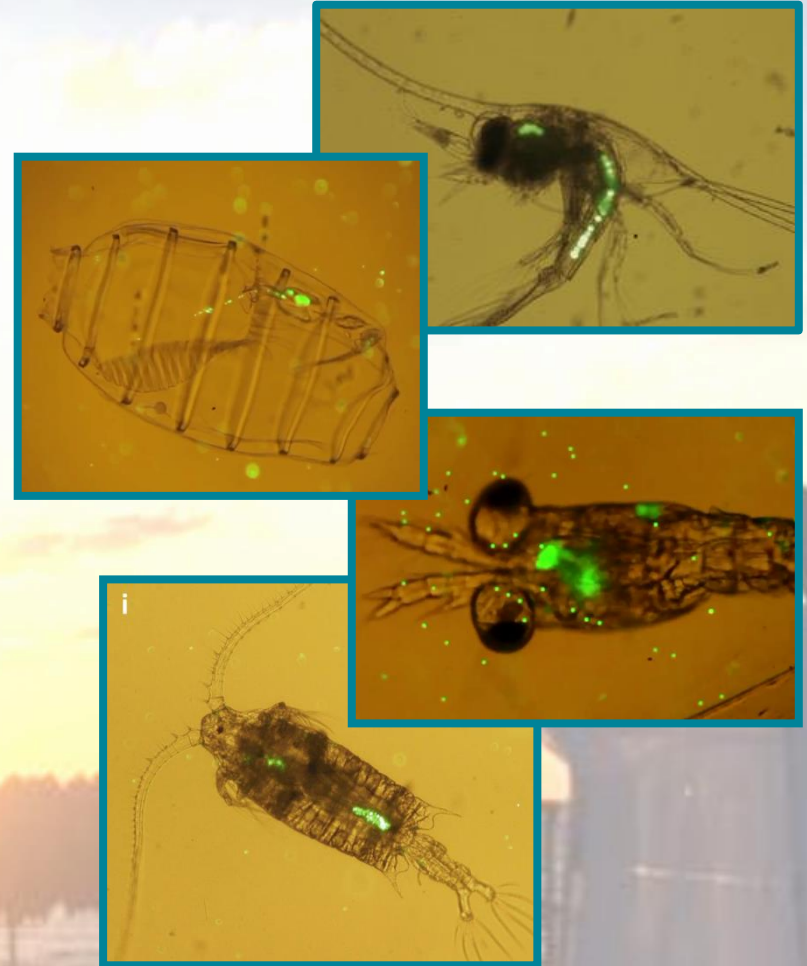
## **Ingestion of microplastics by zooplankton in the western English Channel**

**Alice Wilson McNeal<sup>1</sup>; Matthew Cole<sup>2</sup>; James Clark<sup>1</sup>; Pennie Lindeque<sup>1</sup>**

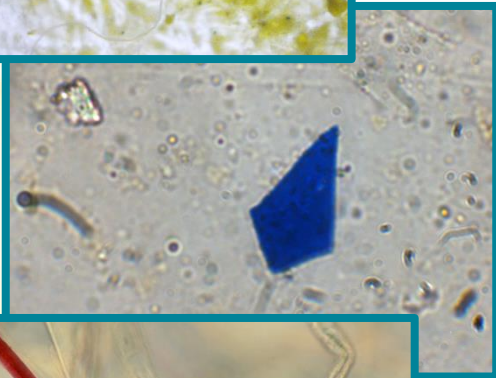
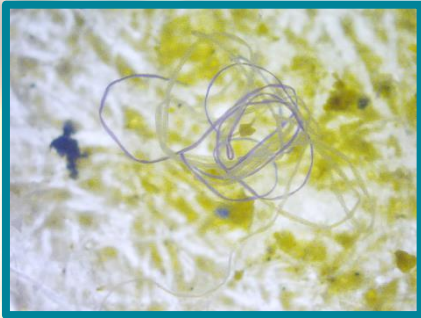
**1. Plymouth Marine Laboratory. 2. University of Exeter.**

## Microplastic ingestion by zooplankton: what we know

- Occurs in a range of taxa under laboratory conditions
- Significantly reduces algal feeding in many groups
- Negatively affects feeding behaviour, fecundity and mortality in the copepod *Calanus helgolandicus*
- Suspected to have negative impacts on other ecologically and commercially important species

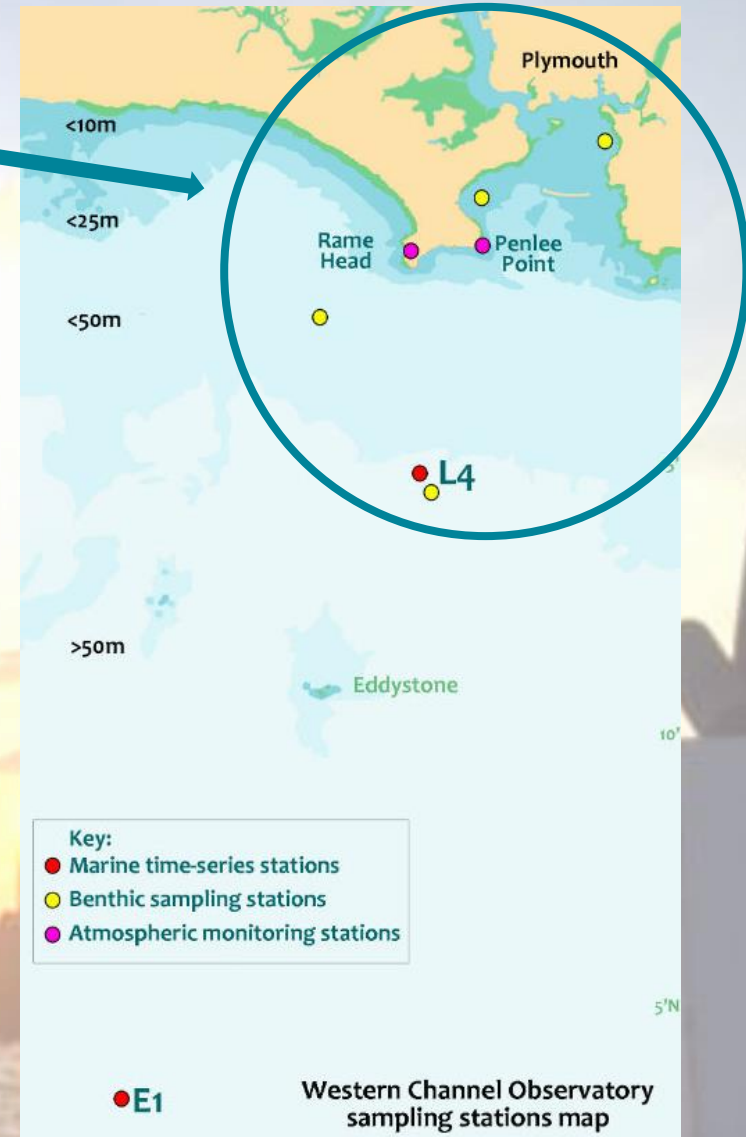
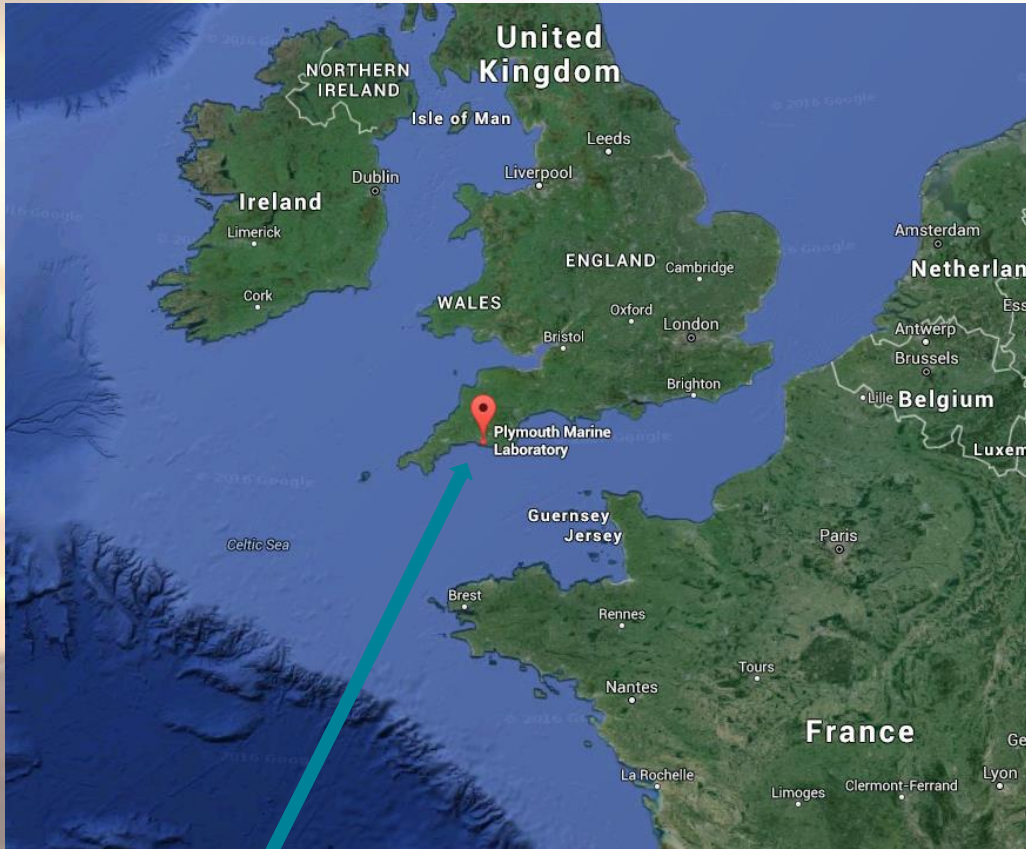


## What we don't know



- Is microplastic of a size bioavailable to zooplankton present in the ocean?
- Are zooplankton ingesting microplastics in their natural environment?
- Is this happening frequently enough to be worthy of concern?

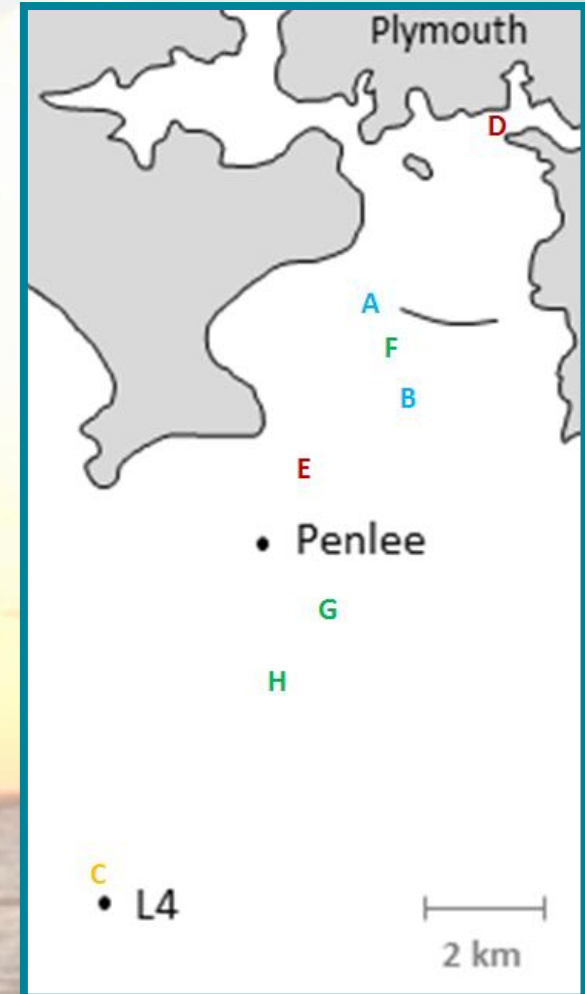
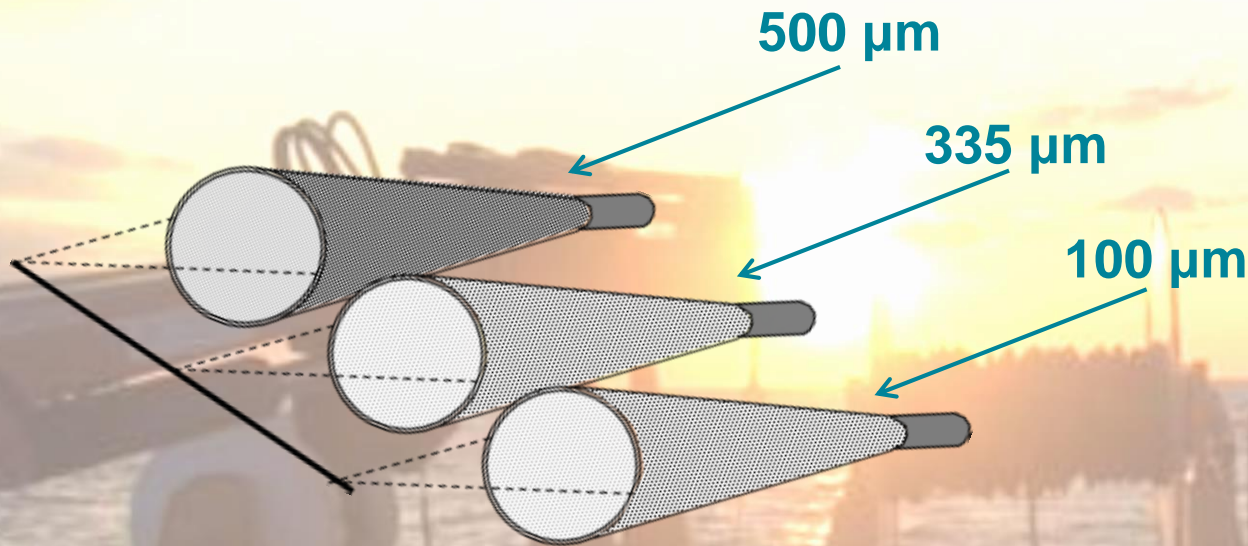
# Sampling area



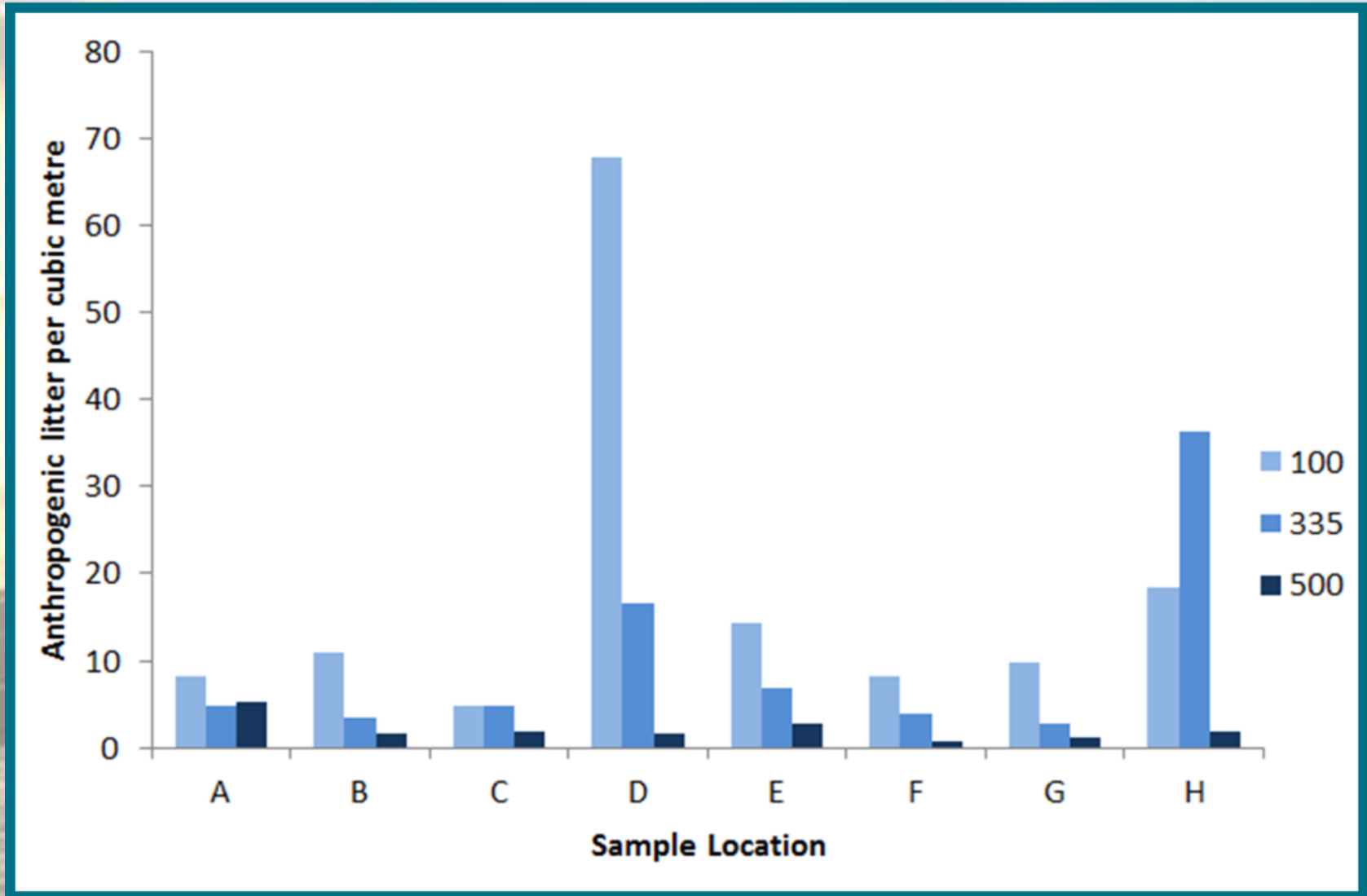
Plymouth

# Presence of ingestible microplastics in the ocean

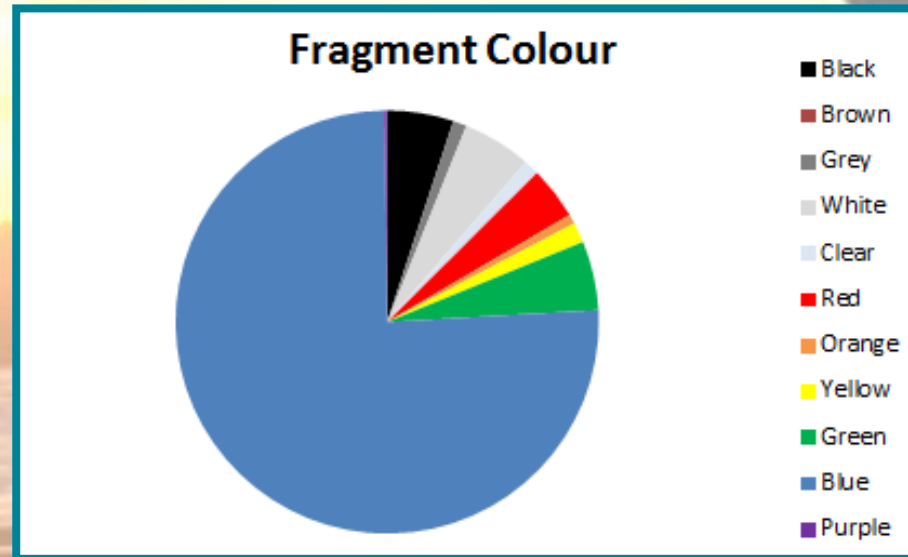
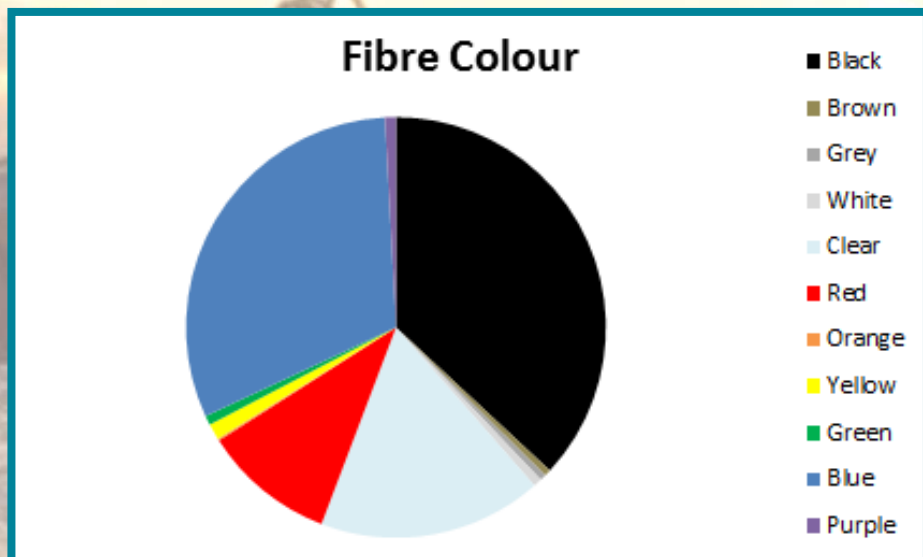
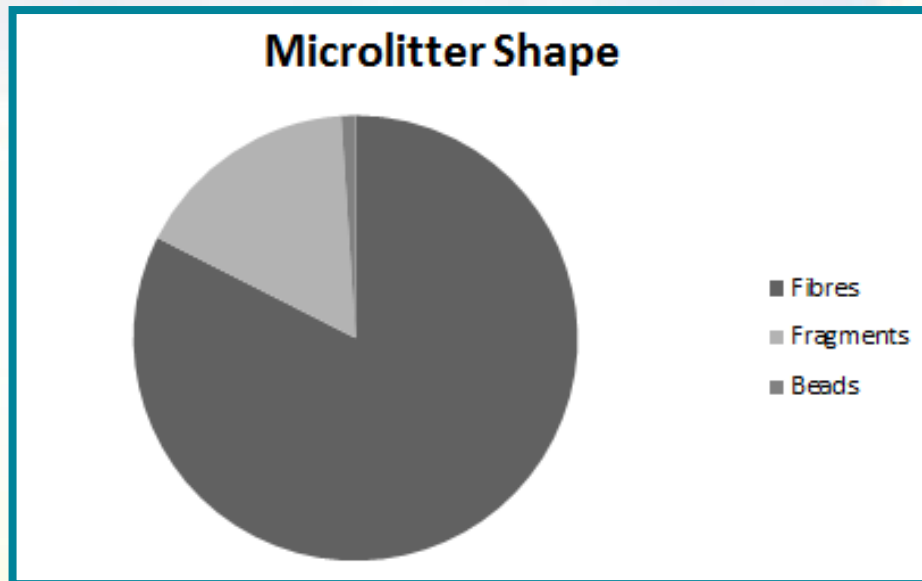
- Objective 1: determine the bioavailability of microplastics to invertebrate biota
- Are smaller microplastics missed by conventional sampling?



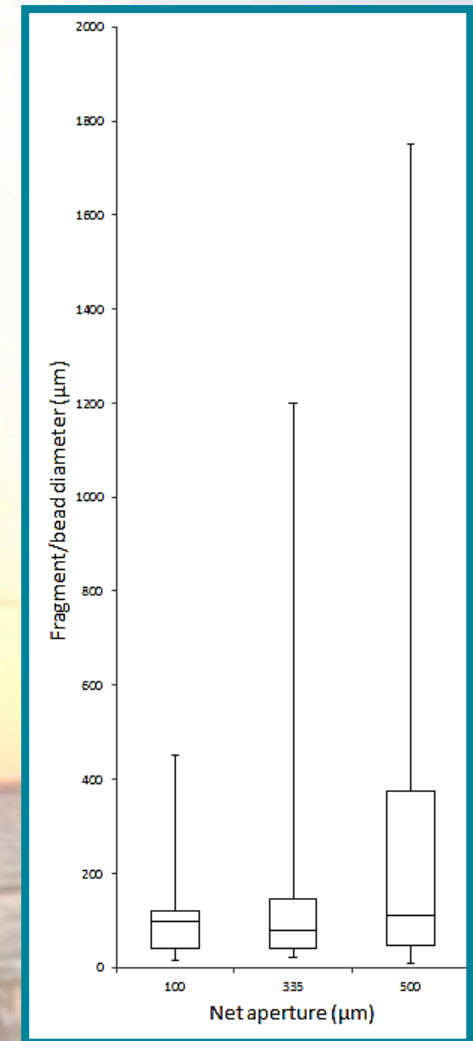
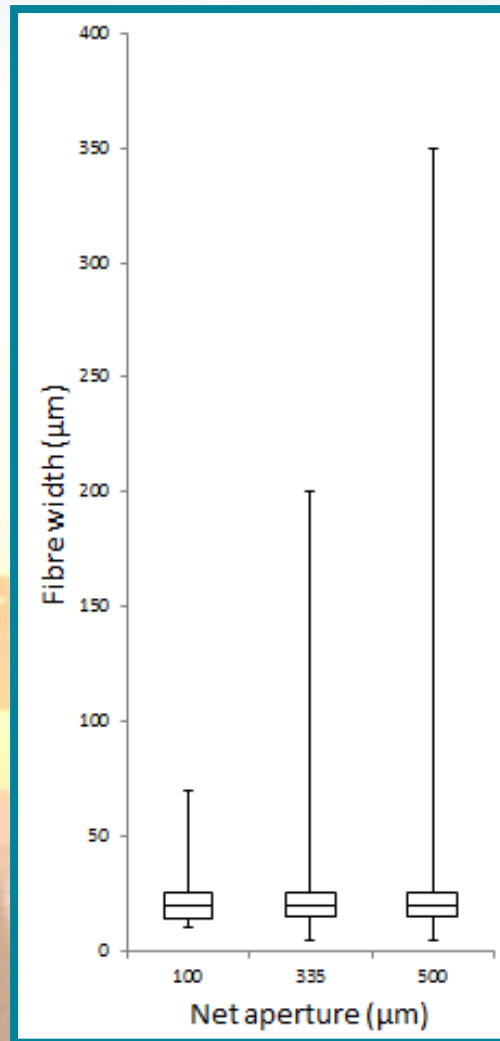
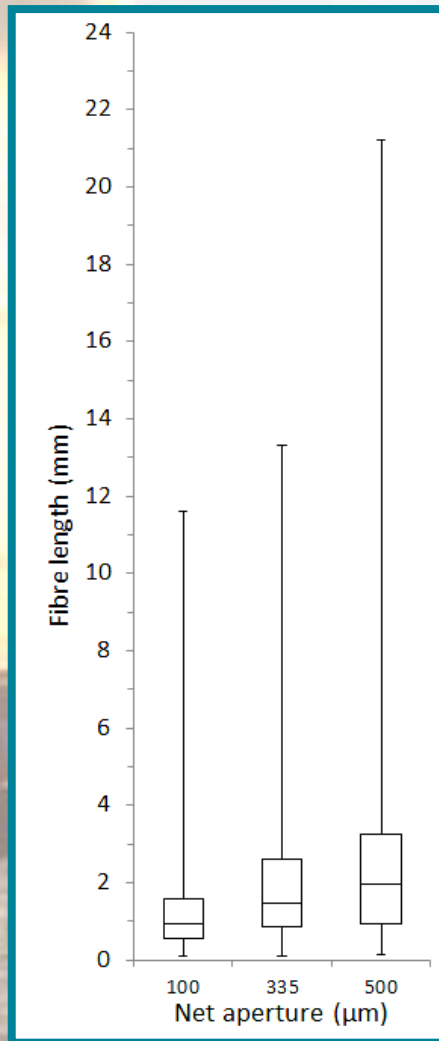
# Presence of ingestible microplastics in the ocean



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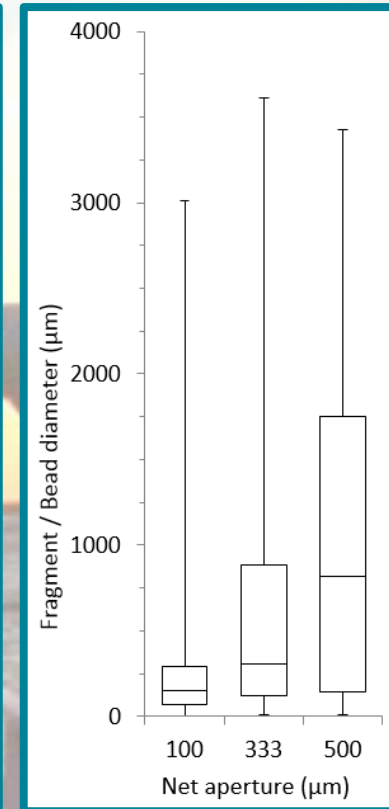
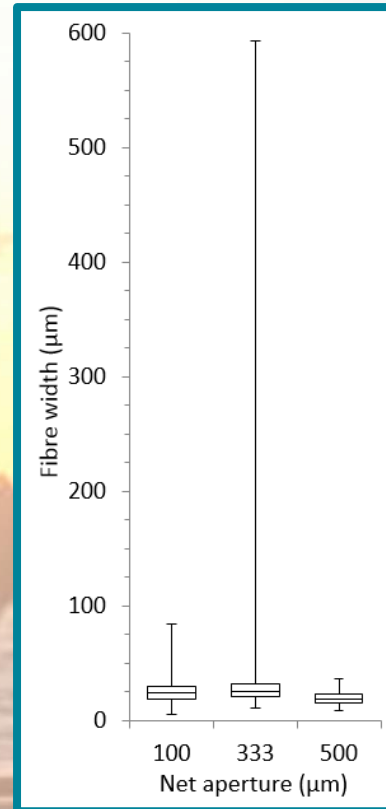
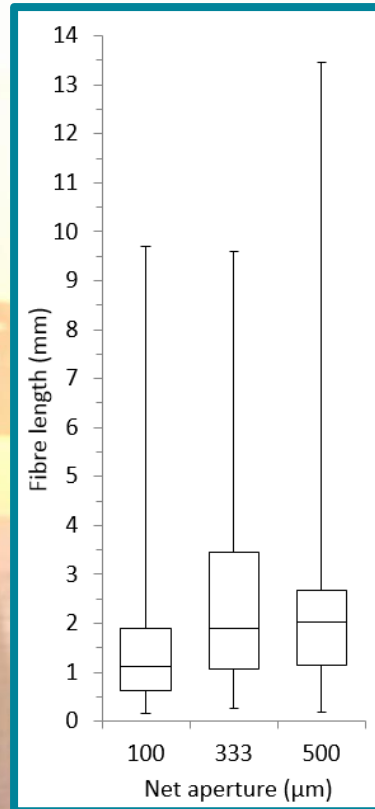
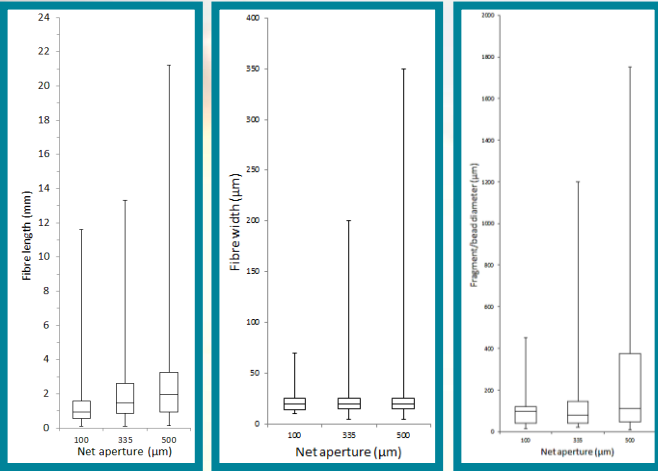




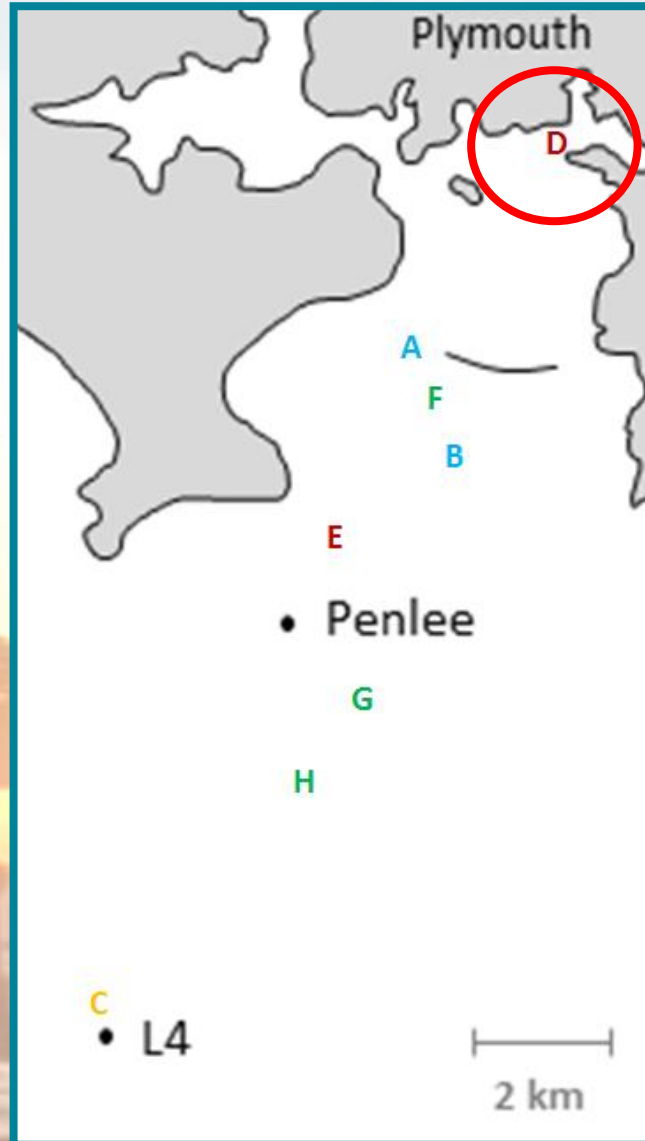
# Presence of ingestible microplastics in the ocean

## Gulf of Maine, USA

## Plymouth, UK

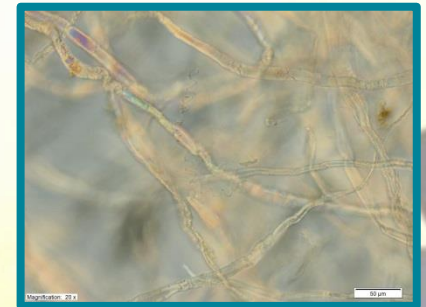
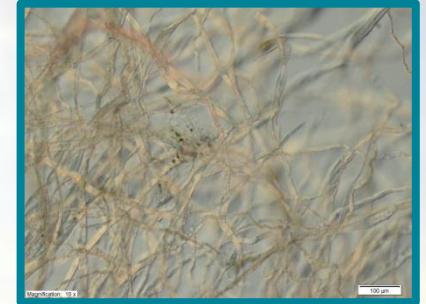


# How much microplastic is there?



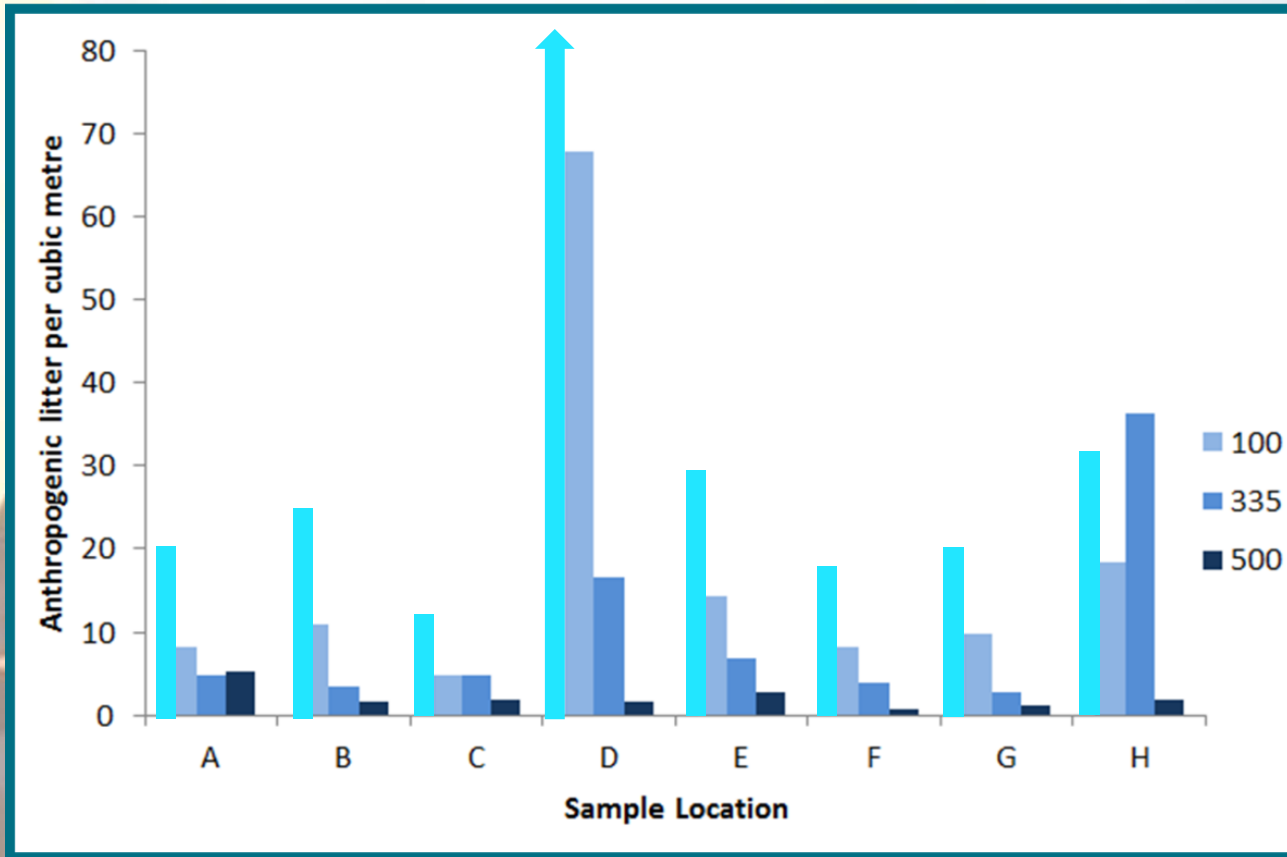
## How much microplastic is there?

- Huge numbers of translucent fibres were found at the mouth of the Plym (station D)
- Fourier Transform Infrared spectroscopy identified these as rayon
- Not plastic, but physical effects could be similar
- **An average of 16740 fibres were found per cubic metre**
- Are concentrations of microplastics in laboratory experiments ecologically relevant?



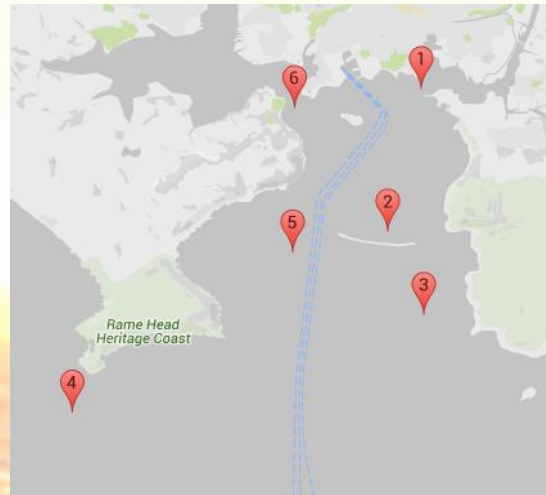
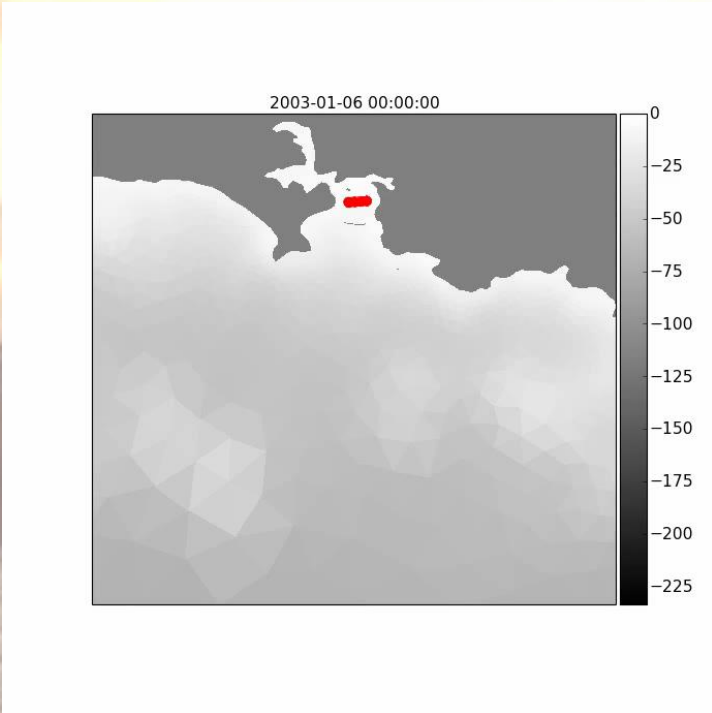
# How much microplastic is there?

➤ Can we extrapolate?



## Sampling with smaller mesh

- Using 63  $\mu\text{m}$  nets, we can quantify even smaller microplastics
- Six sites selected with hydrodynamic models and sampled across a one year time series



## Ingestion in the natural environment

- Objective 2: determine whether zooplankton in these waters are ingesting microplastics
- Collect zooplankton samples alongside microplastic trawls



63  $\mu\text{m}$  – for microplastics

200  $\mu\text{m}$  – for zooplankton distribution

200  $\mu\text{m}$  – for microplastic ingestion

## Ingestion in the natural environment

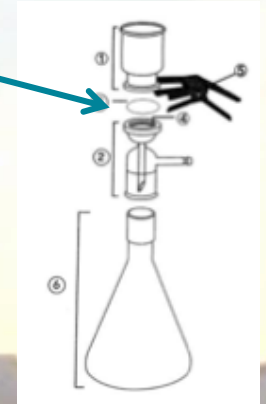
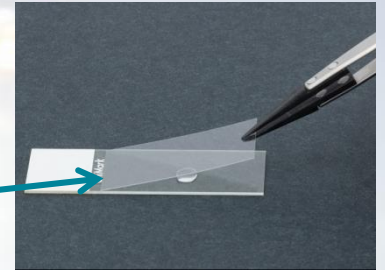
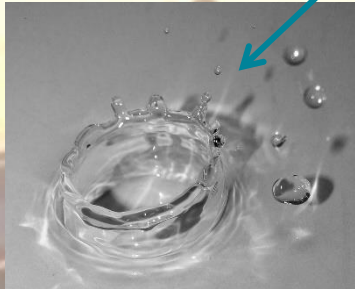
- Groups of Calanoid copepods and decapod zoea are enzymatically digested
- Removes biological material without damaging any microplastics



➤ Why these animals?

➤ Why large groups?

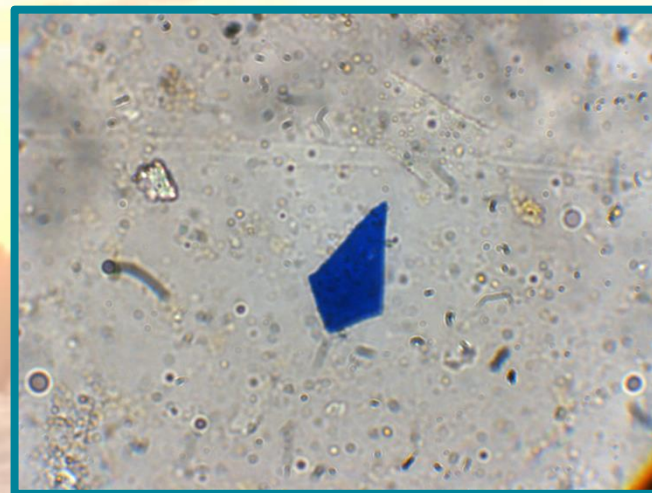
# Contamination issues





## Preliminary results

- Trial: three groups of 20 decapod larvae >1mm (Brachyura)
- Three fibres and a one fragment found, between 20 and 80  $\mu\text{m}$
- Contamination <20  $\mu\text{m}$  found on controls – excluded from results
- Cannot exclude when looking at smaller animals with smaller prey



The abundance  
of microplastics

The incidence  
of ingestion

**Whether zooplankton are ingesting  
microplastics frequently enough to have  
ecological impacts**

The distribution of  
zooplankton

## Summary

- Marine microplastic pollution could be a far greater problem than previously estimated due to sampling bias
- Sampling with smaller mesh sizes would be ideal, but impractical in highly productive regions
- Microplastics of an ingestible size are bioavailable to marine zooplankton
- Preliminary results suggest they are being ingested
- With more data we can establish the extent of this, and hence the risk to populations, ecosystems, and humans

# Acknowledgements

Dr Pennie Lindeque

Dr Matthew Cole

Dr James Clark

Professor Tamara Galloway



Thank you

