Impact of Microplastic on Aquatic Macroinvertebrates in Morecambe Bay

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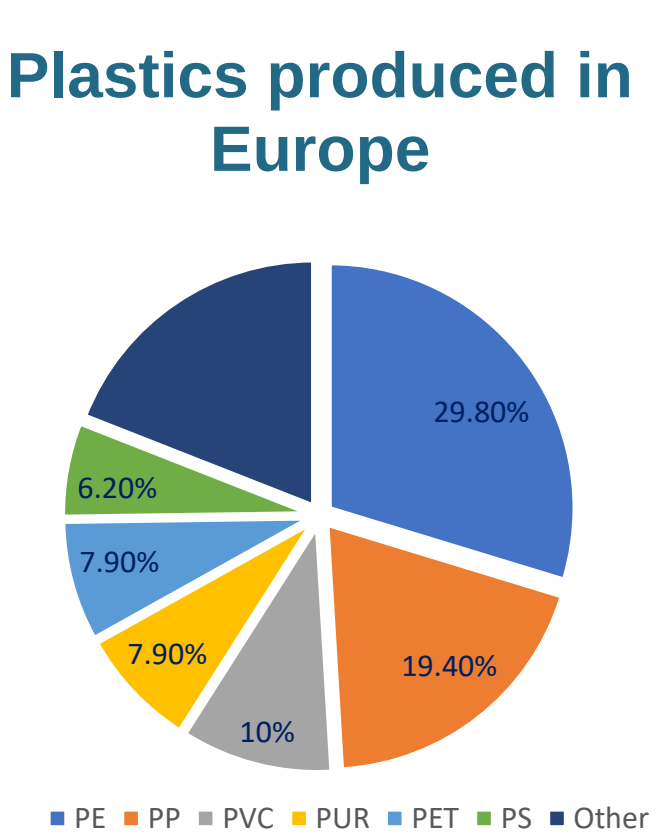
Plastics

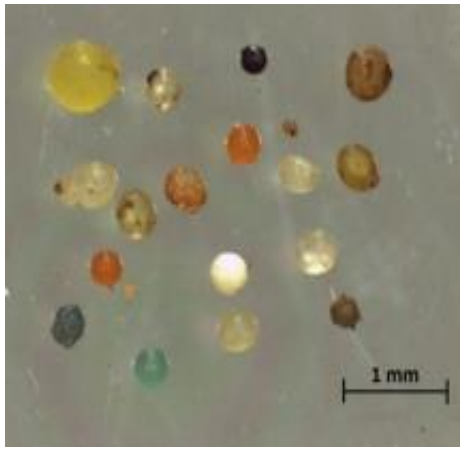


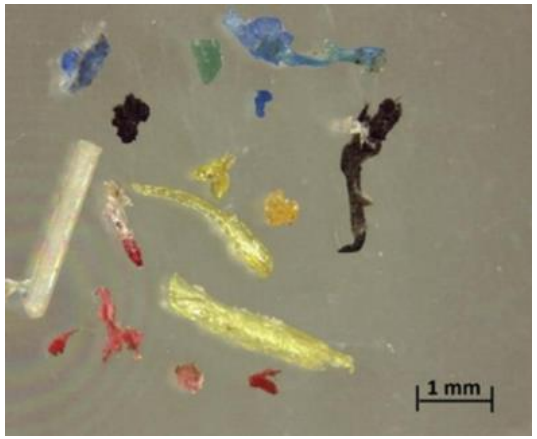
- **400 million tonnes of plastic produced yearly (globally)**
- **50% of manufactured plastics are for single use**
- **Globally 32% of plastic is recycled**

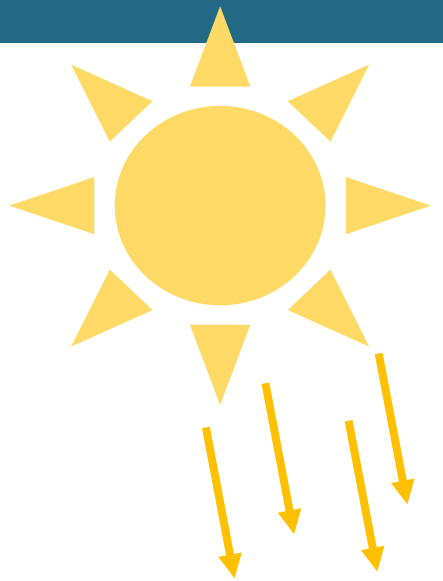
(Plastics Europe, 2020)

Plastics

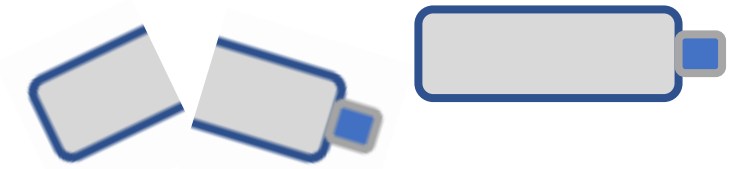
- Mechanical breakdown
- UV radiation (Photo-oxidation)
- Microfibres from clothing
- Degraded tyre and road markings
- Primary microplastics (Banned)







UV + Oxygen



Mechanical

Plastics

Macroplastics

Plastic particles with a diameter ≥ 5 mm and <2.5 cm

Mesoplastics

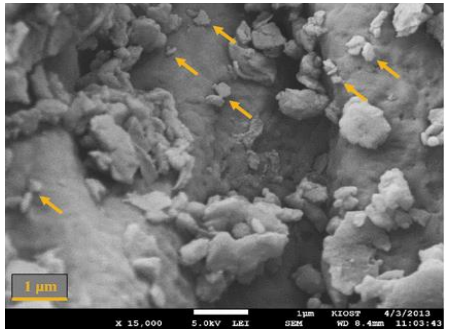
large plastic particles such as virgin resin pellets and are usually defined as 5–10 mm in range

Microplastics

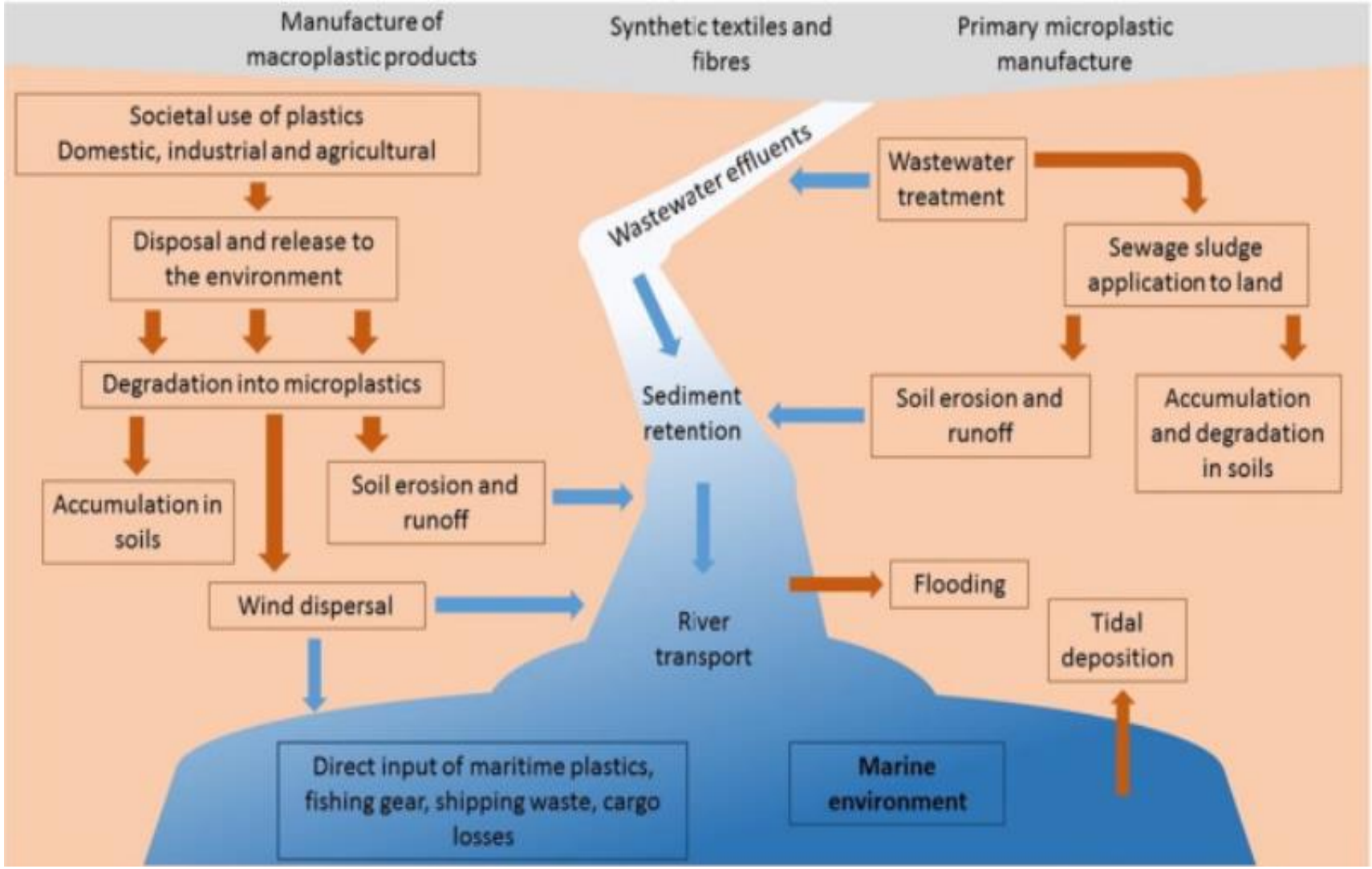
Small particles of any type of plastic, less than 5 mm in length

Nanoplastics

Ultra small particles of plastic, 1-100 nm in one dimension of length



Plastics



(Horton et al., 2017)

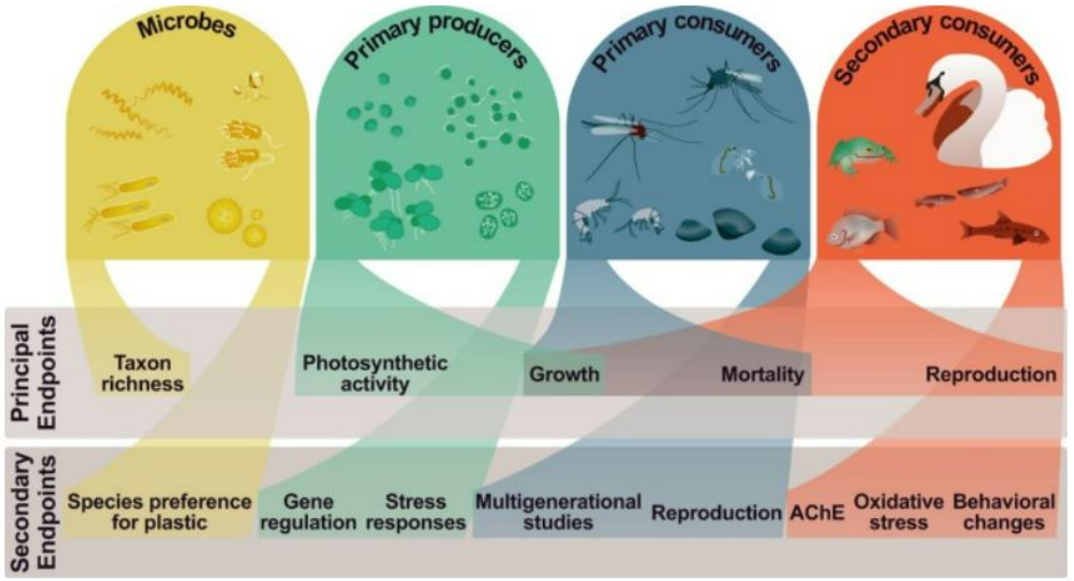
Literature Overview

Microplastic Uptake

- Microplastic **ubiquitous** in freshwater and marine habitats
- Plastic uptake mainly governed by particle **size and morphology**
- Selective uptake by biota (mistaking plastics for food), due to **biofilms**
- Passive uptake by filter feeders
- **Aging** of microplastics promotes ingestion

Life History Impacts

- Negative impacts of **growth, survival, reproduction** and **generational** for some organisms
- But for most organisms the impacts are **unknown**



Research Objectives

1. Investigate the uptake of microplastics by aquatic macro-invertebrates across a salinity gradient in Morecambe Bay 

2. Investigate the interactions between microplastic biofilms and aquatic macro-invertebrates in Morecambe Bay 

3. Investigate the ‘Life History’ impacts of environmentally relevant microplastics on aquatic macro-invertebrates 

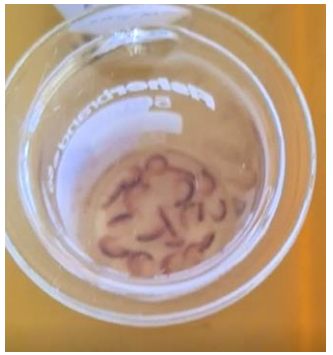
Objective 1 – Microplastic uptake in Morecambe Bay

Location of Study Area and Sample Sites In Morecambe Bay

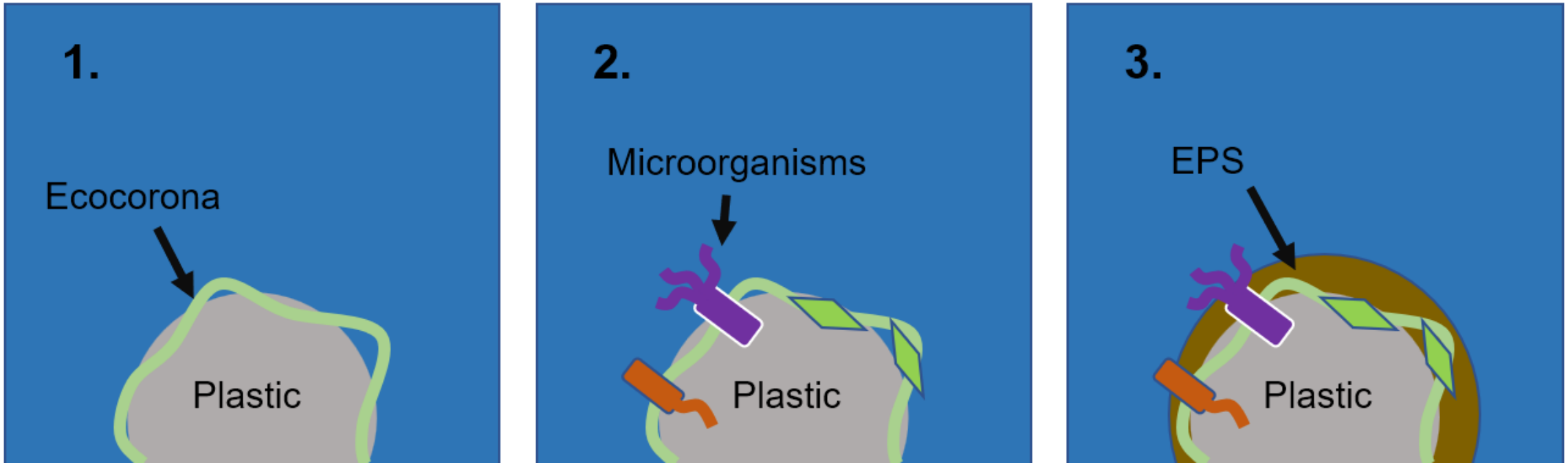
- 4 Rivers/Estuaries:
  - Leven river/estuary (LE) (n = 30)
  - Kent river/estuary (K) (n = 16)
  - Lune river/estuary (L) (n= 23)
  - Wyre river/estuary (W) (n=20)
- 765 individual Macro-Invertebrates
- Marine/Brackish/Freshwater sites

Method

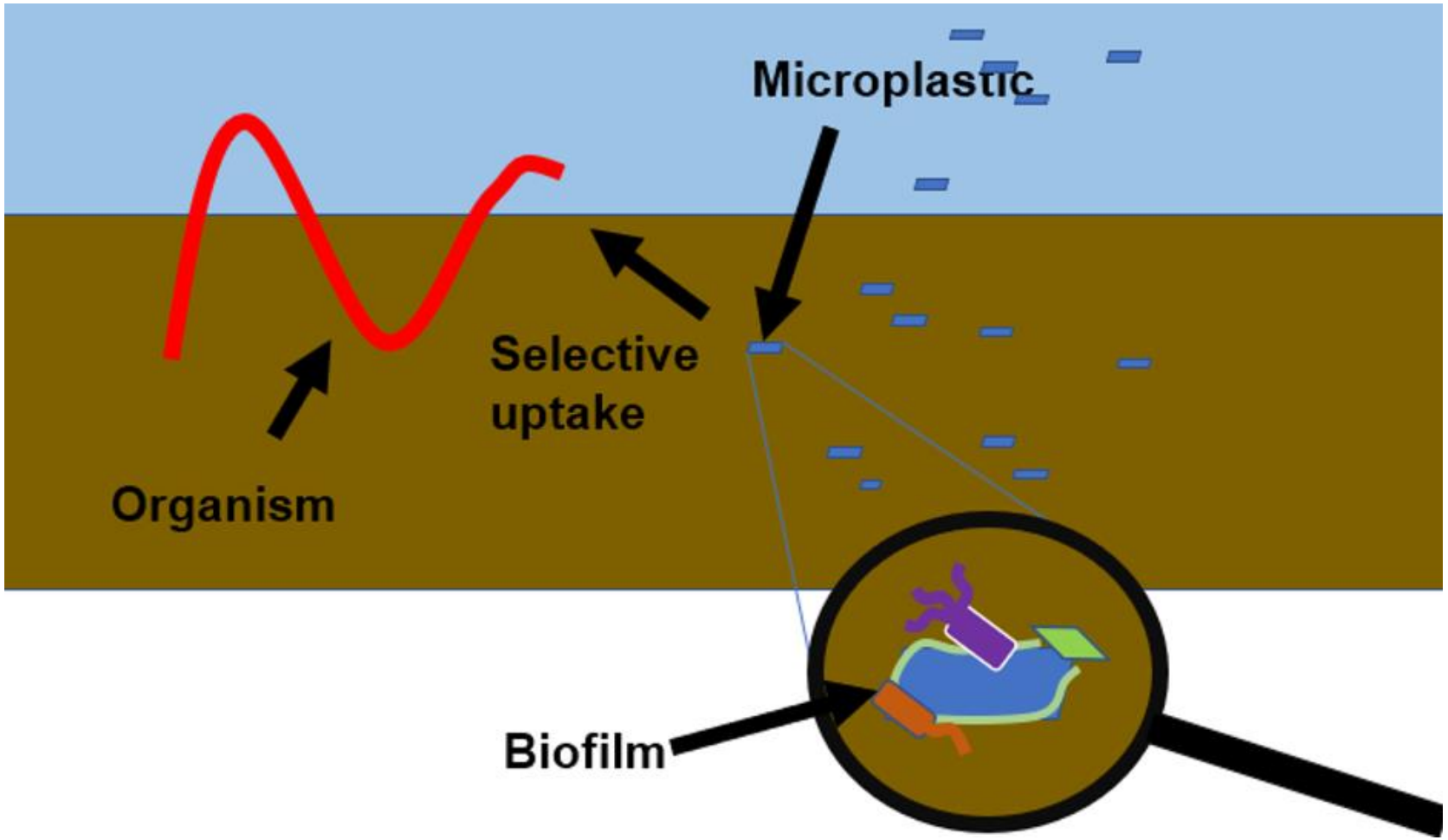
Sampling	Kick Sample
Gut Clearance	24 hrs in filtered water
Dissection	Prep for digestion
Digestion	KOH including heating
Staining	Nile red
Inspection	Fluorescent microscope
Identification	FT-IR



Microorganism colonization

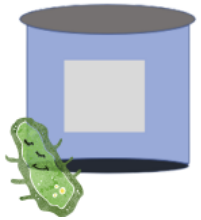


Microplastic Uptake



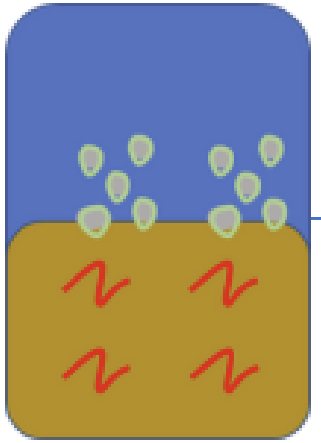
Method: Exploring objective 2

Biofilm



UV

Three polymers, with variation in biofilm and UV aging



Compare biofilms of different UV aged and non-UV aged polymers by 16s & 18s rRNA Sequencing & analysis using a microvolume spectrophotometer

examine the polymer surface chemistry Using X-Ray Photoelectron Spectroscopy (XPS)

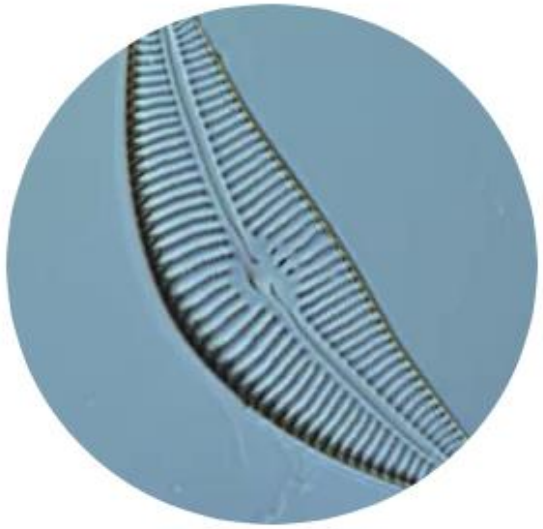
determine if all plastics are equally ingested

Investigate effects on macroinvertebrate growth

PhytoPlastic Project

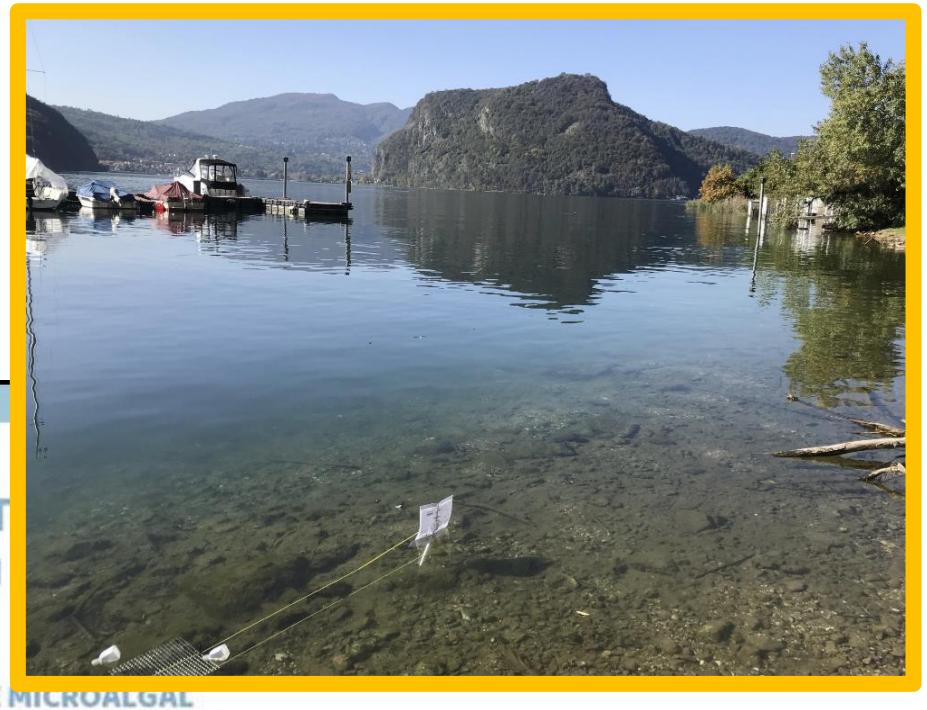
Quantify the **microalgae biomass** developed on microplastics with different polymeric composition and determine whether biomass vary significantly among substrates across a variety of aquatic systems

Identify the **microalgae species** that are able to develop on different substrates and understand whether plastics exert a strong enough selection to drive species sorting



Evaluate the **temporal and seasonal evolution** of the epiplastic community of microalgae in relation to several environmental variables

PhytoPlastic Project



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STIC, IT'S FANTASTIC: UNRAVELLING THE MICROALGAL
F PLASTISPHERE ACROSS EUROPEAN LENTIC SYSTEMS

Following

PhytoPlastic

@PhytoPlastic Follows you

"Life in plastic, it's fantastic: unravelling the microalgal community of plastisphere across European lentic systems" - funded by @EFFS_EFYR

Conclusion

- **Microplastics are ubiquitous in the environment**
- **All organisms in Morecambe Bay**
- **The impacts on organisms are poorly understood**
- **All macro-invertebrates in Morecambe Bay river and estuaries are consumer microplastic**
- **It is theorised that microorganisms that colonize plastic impacts the palatability of primary consumers**

Thankyou for listening

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