

Microplastic Pollution

What are microplastics?

● Microplastics are tiny plastic particles smaller than 5 millimetres in diameter. There are two types; Primary and Secondary.

● **Primary Microplastics:** Purposefully manufactured small plastic spherical particles that are used in commercial products such as facial exfoliating cleansers, paints and industrial abrasives.



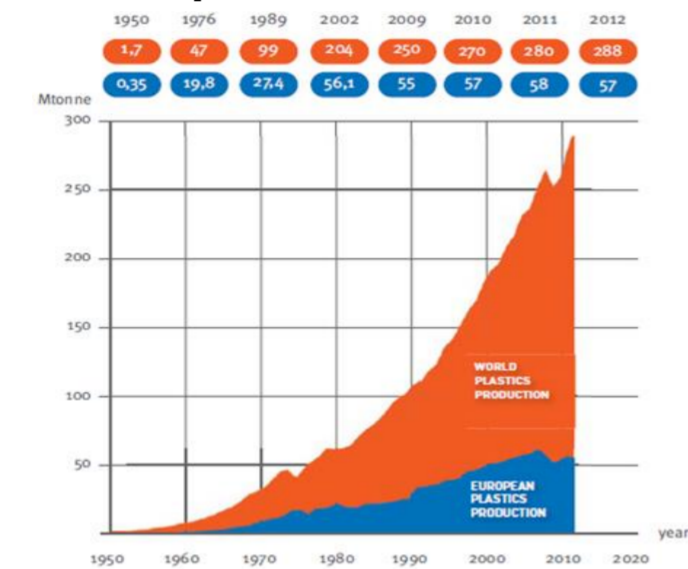
● **Secondary Microplastics:** Plastic particles that are produced over a long period of time as a result of degradation of large pieces of plastic by ultraviolet radiation and physical abrasion to form smaller and smaller plastic particles.



Environmental Risks:

● Ingestion by filter feeders and small bottom dwelling organism can disrupt gastrointestinal function resulting in death. Additionally, chemical pollutants present on the surface of the plastics can traverse the food chain or cause death of the organism.

Plastic production 1950-2012



The production of plastic is rapidly on the increase and is expected to reach approx. 450 million tons per year by 2050

WWTP as a Source

Waste Water Treatment Plants (WWTP) as a source of Microplastics:

- A WWTP in Glasgow, representing the waste of 650,000 people was sampled at different stages of the treatment process
- Plankton Nets & Metal Sieves were used for sampling
- Samples were then filtered and Microplastics counted
- Initial findings of final effluent show that microplastics are being released from WWTP



Site	MP Found	Litres Filtered	MP/L
PL Net 5A	3	50	0.06
PL Net 5B	4	50	0.08
65µm Sieve 5A	4	30	0.13
65µm Sieve 5B	2	30	0.07

Average MP/L 0.09
Average MP/m³ 85

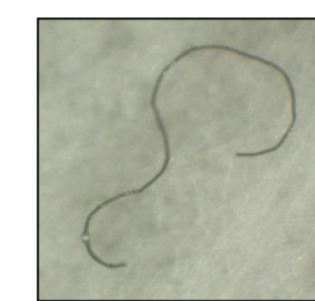
Average Day = MP/260954m³ 22,181,090
MP/Hour 924,212

Next Step:

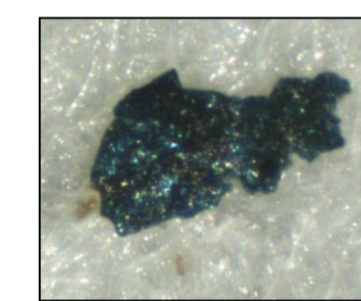
- Examine different stages of treatment process
- Sampling at different times of year
- During periods of high rain fall, the treatment plant may not be able to cope with the greater volume of water so untreated water is released directly to the river Clyde



Brown Flake polyester 0.33mm



Black Fibre polyester 2.08mm



Blue flake acrylic 0.6mm

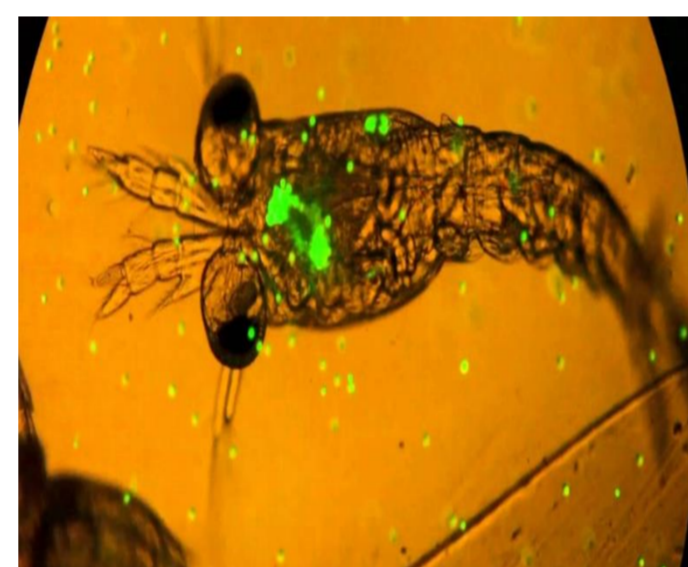


Yellow flake polyester 2.55mm

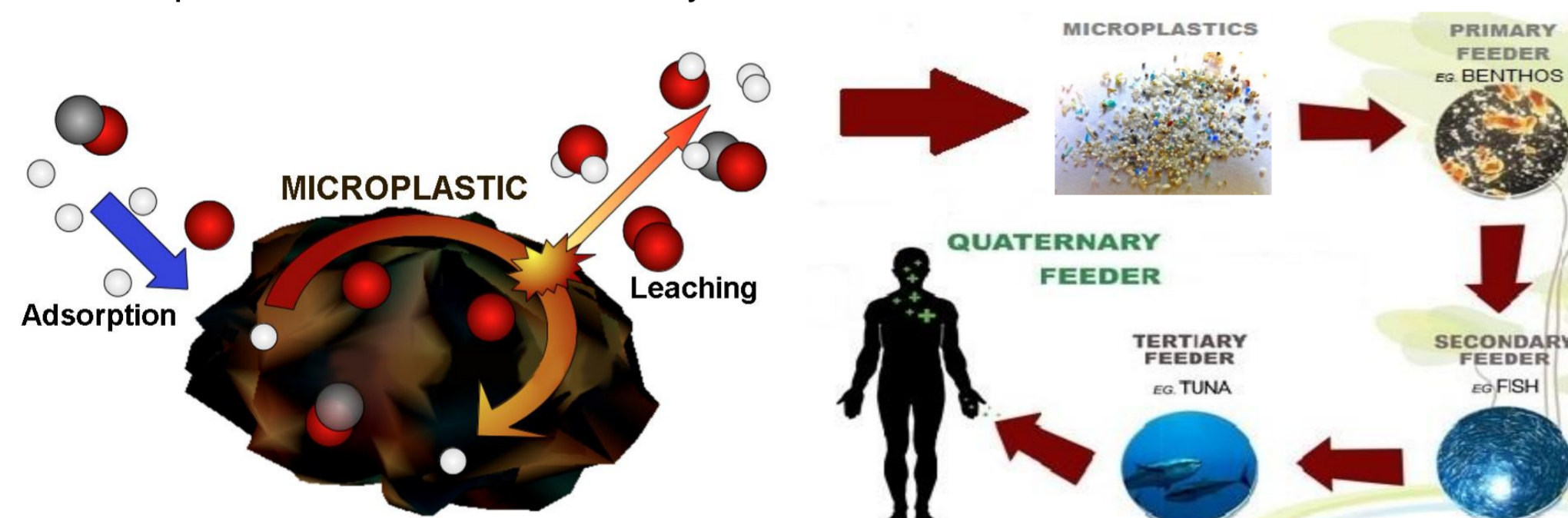
Chemical Adsorption, Leaching and Trophic Transfer

Adsorption and Leaching:

- Hydrophobic persistent organic pollutants in the marine environment have a tendency to adhere to the surface of microplastic particles by way of chemical adsorption.
- Filter feeders such as muscles, and deposit feeders such as the lugworm are able to ingest these microplastic particles.
- Once in the organism, the toxic contaminants are able to leach of the microplastic particles resulting in death or bioaccumulation within the organism.
- Predation of the contaminated organism provides a mechanism for trophic level transfer of the organic pollutants up the food web and ultimately, to humans.



Microplastics ingested by organism



Where Does it End Up?

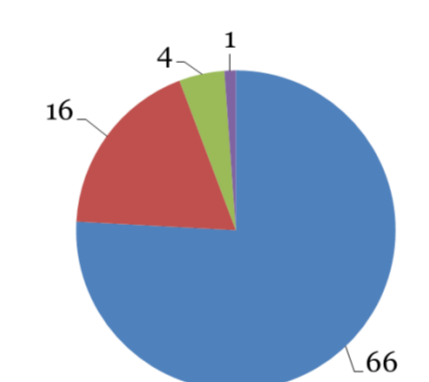
Two commercially important flatfish species were sampled on the east west coasts of Scotland:

● The fish stomach and intestines were then examined for microplastics

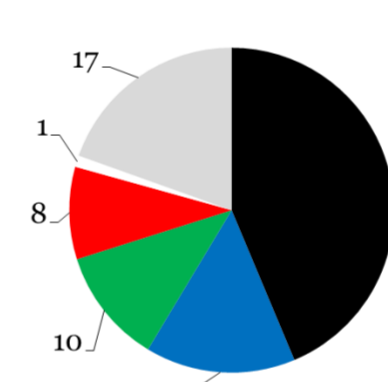
Results:

- 47.6% of fish sampled contained plastic of some size
- 39.0% of fish contained microplastics

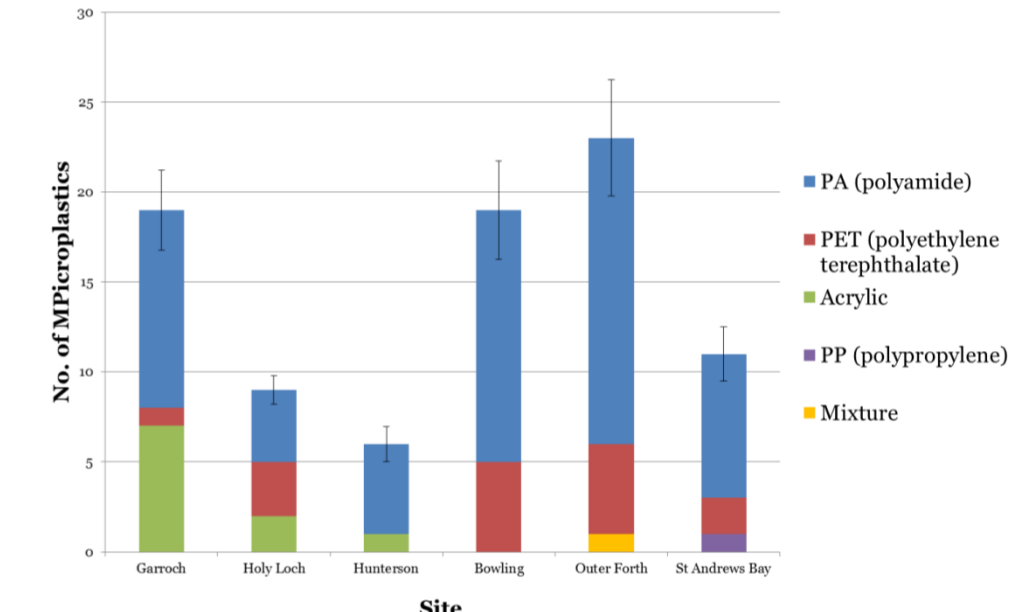
Types of Microplastics



Colour of Microplastics



Microplastics Found at Each Site



Shorelines & River banks:

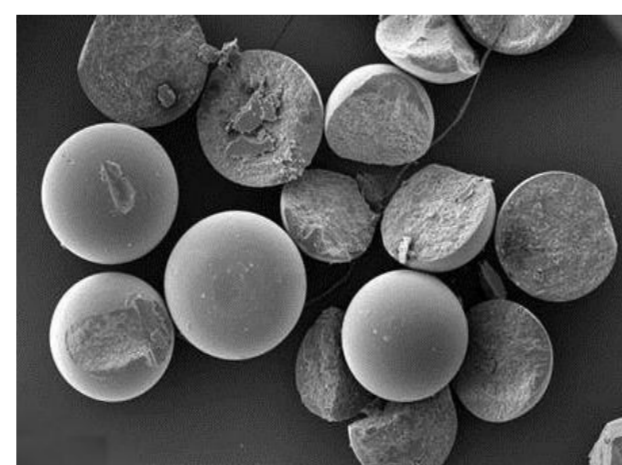
- Method developed to extract microplastics from sediment
- Sediment collected from the west coast of Scotland and along the river Clyde
- Will be analysed for Microplastics to determine distribution and concentration along shorelines and river banks



Future Work

Chemical:

- Investigation of the mechanisms whereby persistent organic pollutants are able to contaminate the surface of microplastics by way of chemical adsorption.
- Determination of the ability of specifically nominated organic pollutants to bioaccumulate within organisms and subsequently transfer up the trophic levels of the food chain to humans.
- Determination of the suitability of microplastics as the sampling medium within an in-situ passive sampling device by examining the adsorption capacity of microplastic particles.



Biological:

- Investigate different species of fish for microplastic ingestion. Different species may have different feeding behaviour and different position within the water column. Examine different sites further out to sea.
- Investigate invertebrates both Marine & Freshwater for the ability to uptake microplastics and the potential effect it may have on feeding behaviour



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