# Microplastic in the Environment

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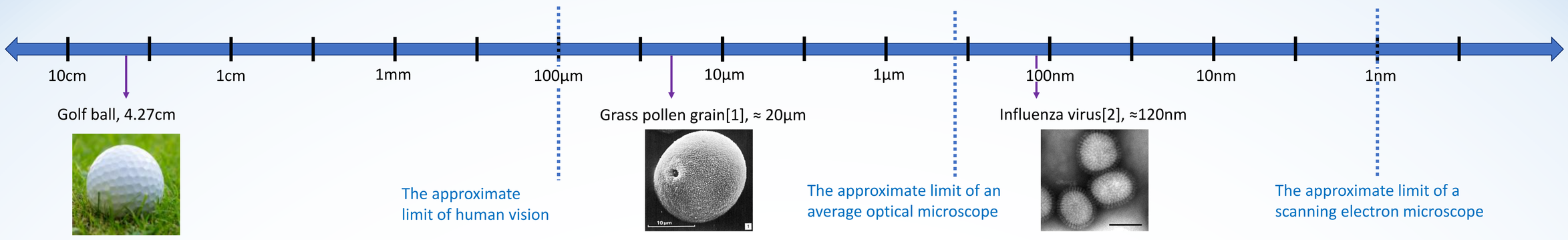


## Introduction:

Microplastics are plastic particles which are less than 5mm in size [4]. They are of great concern as they persist in the environment for many years and can enter the food chain due to their small size. The effects of microplastics on human health are not yet known but recent studies have shown that they can have many adverse effects on other organisms including aquatic fauna and mice [3].
In this research project, experimental work to evaluate the microplastic pollution in bodies of water in Ireland was completed along with a literature review of microplastic in food.

## Microplastic in water – sample collection:

The samples were collected using two different methods. The bulk grab method involves collecting a few litres of water which is then filtered in the lab using filter paper. The second method, "the pillow case method" was developed during the course of this research project. In this method a cotton pillow case is used as a filter at the water collection site. The pillow case method was found to be a very fast, efficient, and cost effective method for collecting microplastic samples. It was able to retain particles as small as 20µm in size.

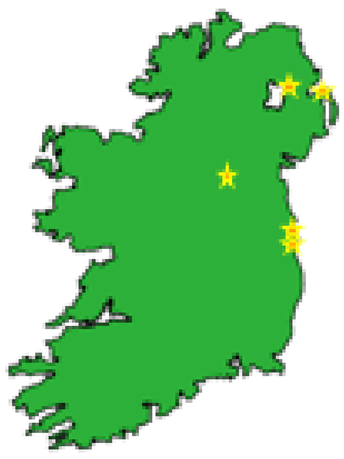

Figure 1: The sample collection locations: Grand Canal Dock (Dublin), Portmarnock beach (Dublin), Lough Neagh at Antrim town, Helen's Bay (Antrim), Skeagh Lough (Cavan). Unfortunately due to time restrictions and the COVID-19 pandemic it was not possible to complete the analysis of the samples from Portmarnock and Lough Skeagh.

## Microplastic in water – analysis:

Optical microscopy was used to identify particles resembling microplastics and other interesting particles. Samples were then analysed in the scanning electron microscope (SEM). A SEM uses an electron beam to image a sample instead of a beam of light, for this reason it has a much higher magnification than an optical microscope. Most SEMs are also equipped with Energy-Dispersive X-ray spectroscopy (EDX). When the electron beam in a SEM strikes the atoms in a sample, X-rays which are unique to the element are produced and the elemental composition can be determined. The main element in plastic is carbon so if the main element in a particle is not carbon then we know that it is not a plastic.

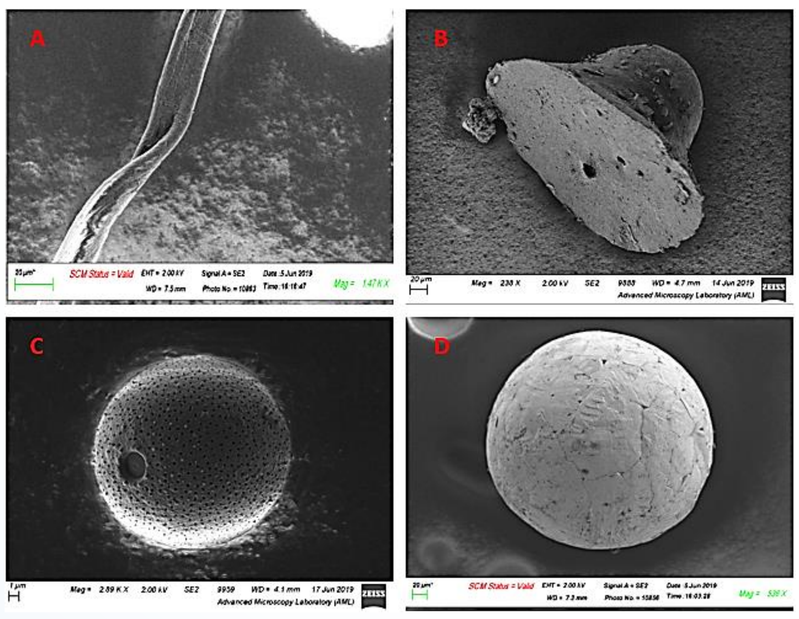


Figure 2: A: was identified as a microplastic fibre, B: was identified as a microplastic fragment, C: was identified as a diatom, D: was identified as an iron microsphere.

## Microplastic in water – results:

Microfibres were particularly abundant in the grand canal dock sample but they were present in large numbers in all samples. A number of microplastic fragments were also identified in every sample. Other interesting microparticles that were found in the samples include a huge number of tiny seeds in the Grand Canal Dock sample, a large number of iron microspheres in the Grand Canal Dock sample and also the Lough Neagh sample and two brown microspheres in the Lough Neagh sample that were identified as diatoms. The iron microspheres found in two of the samples are likely from construction.

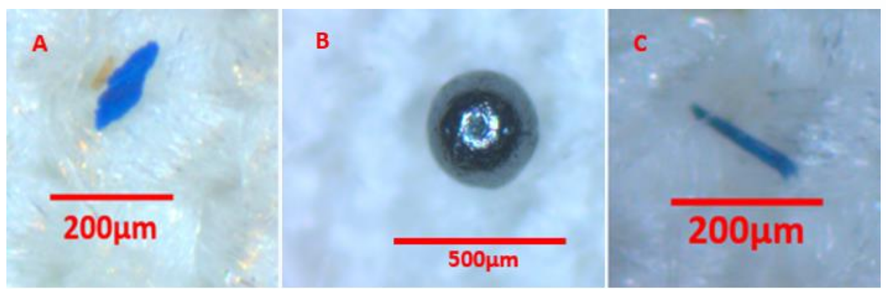


Figure 3: Images A-C were identified as, A: microplastic fragment, B: iron microsphere, C: microplastic fibre

## Microplastic in food – table salt:

The first research about microplastic in table salt was carried out in 2015 and since then there have been a number of other studies on the topic [4]. Microplastic was found in almost all of the salt samples tested in each study [4]. Some studies noted that sea salt contains the most microplastic [4]. The average person is found to consume between 25.55 and 115,632 microplastic particles a year due to eating salt [5],[6].

## Microplastic in food – bivalves:

Bivalves such as mussels and oysters are filter feeders and the entire soft tissue of bivalves are generally consumed by humans so microplastic in bivalves is of particular concern. One study found that bivalves contain between 2.1 and 10.5 microplastic particles per gram of soft tissue [7]. The yearly microplastic consumption of the top European bivalve consumers is then calculated to be up to 276,000 microplastic particles a year [8].


Figure 4: A: table salt, B: plastic tea bag, C: mussels

## Microplastic in food – packaging:

A recent study found that plastic tea bags release approximately 14.7 billion microplastic particles into a single cup of tea [9]. Another report analysed two different types of polypropylene containers used for take away food and they were found to contain 1.2±0.5mg and 8±1mg of nanoplastic per container [10]. Disposable polypropylene cups were also tested and were found to contain 0.06±0.02mg of nanoplastic per cup [10].

## Conclusion:

Microplastic can be found all over the world from our seas, canals, and lakes to our table salt, fish, and food packaging. The extent of the microplastic pollution problem is not yet known. Although there are a lot of questions that remain unanswered, some questions can currently be answered with certainty. Is microplastic pollution a global problem? Yes. Is microplastic present in Irish waterways? Yes. Are humans consuming microplastic? Yes.

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