Plastics in the Marine Environment

Plastics are versatile, durable, lightweight and cheap to manufacture making them the material of choice for packaging. Plastic production has increased exponentially since its invention the late 19th century. Its production took off in the 1950s with around 2.3 million tonnes produced which grew to 448 million tonnes by 2015 and plastic production is expected to double current production rates again by 2050. Since plastics last forever we now have over 9.2 billion tonnes of the stuff to deal with according to a 2017 estimate. Of that, more than 6.9 billion tonnes have become waste and of that waste, a staggering 6.3 billion tonnes never made it to a recycling bin!

Plastics do not decompose but get broken down into smaller and smaller particles in the marine environment by sunlight and wave action. These small bits persist and are called microplastics. Some are small enough to enter the marine food chain at the microscopic level and are eaten by tiny zooplankton which are food for a great many other animals. As a result, microplastics are building up rapidly in animals that feed at the top of the food chain. This could be one of the biggest threats that marine life has ever faced, little is known about how the microplastics are affecting the animals on a chemical level.

Definition:
Microplastics are plastic pieces that measure less than five millimetres.

Some microplastics have been made small intentionally, for example industrial abrasives used in sandblasting and microbeads for cosmetics, sun cream and paint. Others have formed by breaking away from larger plastics such as carrier bags which have fragmented over time.

Often plastics are used to make items that are only used once and then binned. This is a product/material mismatch as a disposable item is made from a durable persistent material and so hangs around in the environment long after its purpose has been fulfilled, leading to mountains of waste.

Take cigarette butts for example: these are the most common form of litter in the world and are the second most common type of litter found on UK beaches, surpassed only by plastic containers and their fragments. In 2019 there were 42.6 cigarette butts per 100m of UK coastline found as part of the Marine Conservation Society's Big Beach Clean.

These filters are made of plastics and so persist in the environment long after they are disposed of. They also leach toxins and can kill animals that mistake them for food. They eventually break down into microfibers that float around our oceans and enter the marine food chain.

Supported by TAQA

What are the Usual Suspects on your local beach?

Why not head out to your local beach to do a beach clean and a bit of citizen science along the way? Data about what types of rubbish are found and where along our shores help scientists to understand what the most common sources of litter are, making it easier to target stopping them at their sources.

What you will need:

Gloves
Bin bags (a few - some for recyclables and some for waste for landfill)
Mobile phone or pen and paper to record your findings
Luggage or bathroom scales to weigh the trash you collect

DO:

Choose your location and check the tides, it is best to plan your beach clean at low tide as you will have more beach available. Avoid areas with slippery rocks, cliffs and extremely muddy areas wherever possible. Consider what facilities you might need like parking and access to toilets and ensure proper hand washing after and hand sanitizing during your litter picking. Also follow the current regulations on social distancing and mixing with those from other households.

Check the weather and make sure you dress appropriately.

Invite a friend or family member, it will make it more fun and means you can collect more rubbish- win win!

Have a plan for what you are going to do with the waste you collect, identify a bin you can use to dispose of the rubbish and make sure you are aware of what can be recycled in your local area so if there is any suitable materials collected you can take those for recycling.

Take care to avoid any sharp items. If you find any dangerous items or items too large to be removed on the beach, mark the location and contact Wasteline on 03456 081207 or waste@aberdeenshire.gov.uk to make them aware so that a safe collection can be arranged.

Citizen Science Projects

You can report your findings through a few different platforms to help contribute to local and global knowledge of beach litter distribution. Here are just a few of the options that are available:

Clean Swell app from the Ocean Conservancy. This app allows you to enter the rubbish as you collect it by tapping an icon. You can also upload images. The data from this app is fed into a global database and you can see your contribution via a global map interface.

Marine Conservation Society organise the Great British Beach Clean every year and have loads of information on how to organise a beach clean and an online survey you can complete to contribute to their annual report on beach Litter in the UK https://www.mcsuk.org/beachwatch/.

Surfers Against Sewage (SAS) also have loads of information on how to plan a beach clean on their website, including risk assessment you can use if you wish to organise a formal beach clean https://www.sas.org.uk/our-work/beach-cleans/organise-beach-clean/. You can also report your finding online to SAS https://www.sas.org.uk/brands/ as part of their Brand Audit to identify the most commonly found brands of rubbish on the beach. This is compiled into an annual report that gives an indication of how and what types of rubbish are distributed along our coastlines.

Microplastics in the Sand?

Now that you have identified the most common types of rubbish encounter on your local beach, what do you think happens to it when it's not removed from the coastline?

The plastic rubbish will eventually be broken down into smaller and smaller fragments called microplastics. A lot of microplastics are fibres that have been shed from our own washing! Some of these microplastics will float in seawater so we are going to use a floatation and filtration experiment to see if we can find any microplastics in a sample of sand.

What you will need:

At the beach

A few small samples of beach sand, just a good scoop of a small spade will be enough per sample.
A few buckets or other containers to mix your sand with seawater
A good amount of seawater
A stick or wooden spoon
A few glass jars

At home

A sieve or colander
Coffee filters or paper towels
Mobile phone or magnifying glass

DO:

At the beach

Collect your sand samples, try to take from a few different locations along the shoreline to see if there are any noticeable differences if you are doing more than one sample.

Add seawater to the sand until the container is 3/4s full and stir well for several minutes with your stick or wooden spoon. This mixes the water though the sand so that any plastic particles have the chance to float to the top. Then allow a few more minutes for the sand, small bits of stone and shell to settle.

Now pour the top layer of sea water into your glass jar. Ideally you don't want any sand in this sample, and it should only be a few centimetres deep so it only contains the bits that were floating at the top of the sand and water sample. Repeat this process for any other sand samples you wish to collect and label the jar if they came from differing locations along the beach.

At home

Once back home set up the coffee filter or several layers of paper towels in a sieve or colander. Give your water sample a good swirl in case any bits have settled out again and very slowly pour the water sample over the filter or paper towels. Ideally you don't want any of the water running over the edges of the paper, so you need to pour very

slowly and wait for the water to soak away. Once all your water sample is through the filer, let it drain for a few minutes then leave in a warm place to dry.

Once dry carefully examine your sample with the camera from a mobile phone using the zoom or use a magnifying app to look for microfibres or other tiny bits of plastics. Be careful not dislodge the particles if the paper is completely dry as they will just fall off if jostled. You can usually identify any microplastics based on their colours, any overly bright or unnatural colours are bound to be bits of plastic debris. Take a photo and send to the aquarium so we can see what you found too!

If you collected samples from different areas of the beach, did they look the same? Or were there different sorts of microplastics or different quantities?

Be a part of the Solution to Plastics Pollution

Marine plastic is a global problem and requires action at all different levels all around the world to fight the plastic tide. We need to stop producing new plastics to turn off the tap on the plastics leaking into the natural environment. To do this it is important to practice our RRRRRs (you can talk like a pirate if will help you remember) to do our bit to be part of the solution.

Refuse- single use plastics, unnecessary and excessive plastic packaging.

Choose Reusable items and Repurpose and Repair plastic items when possible.

Recycle as much as possible so we can move away from industry making new plastics.