

Case Study “Environmental change and management of the coastal environment”

Activity Sheet 5 “The types of plastics found in our waterways”

Introduction:

This set of activities are a follow up to those in Activity Sheet 4 and aim to provide students with a more in-depth understanding of the nature of this hazard. More specifically this activity sheet aims to provide an understanding of the types of plastics entering our waterways.

The content of this activity sheet relates to the following Geographical Concepts and Skills and Geographic Knowledge:

Geographic Concepts and Skills

Data and Information

- Collect and record relevant geographical data and information, using ethical protocols, from reliable and useful primary and secondary sources.
- Select, organise and represent data and information in different forms, including by constructing special purpose maps that conform to cartographic conventions, using digital and spatial technologies as appropriate.
- Analyse and evaluate data, maps and other geographical information using digital and spatial technologies and Geographical Information Systems as appropriate, to develop identifications, descriptions, explanations and conclusions that use geographical terminology.

Geographic Knowledge

- Environmental, economic and technological factors that influence environmental change and human responses to its management.
- Causes and consequences of an environmental change, comparing examples from Australia and at least one other country.

Introductory Activities

Choose **one** of the introductory activities below:

The first of these is an audit that provides an example of how much plastic is in our everyday life. For this activity there are a range of extension tasks that enable you to determine the detail and depth that you would like your class to go into. The second of these tasks is simply a copy of an activity that is found in the Water in the World unit. Modify this to suit your needs.

The purpose of these activities is to get students to think about and initiate discussion regarding:

- The amount of plastics in their everyday life
- The number of times a plastic item may be used
- Whether this plastic item is recyclable and to what extent is it actually being recycled
- Whether this item has the potential to end up in our water ways
- The forms that plastic may take when it enters the water ways.

Introductory Activity 1: Complete an audit of how many plastic items are in a selected area/s by following the steps below:

1. Select an area that the class will audit. This area could range from selected locations at school such as the cafeteria, a class room, or specific rooms in a house such as a kitchen, bathroom, laundry etc. or a strip of shops.
2. Divide the class into groups of 3-4 and allocate the areas for them to complete the audit. This may vary according to the sites that are selected in Step 1. For example, if you choose a house, each member of the group may audit a different room and then collate their results. You could also allocate each group a different location; e.g.: one group audits school sites, another group audits a house and so on. Alternatively, each member of the class completes their own audit for the selected location and then the whole class' results are collated.
3. Record the results of their findings in a table similar to that below.

Prior to the class completing the audit discuss the following:

- Whilst it is clear for most items that they are made from plastic, there are others that could be overlooked. For example, cigarettes, some facial scrubs and toothpaste products, glitter, meat trays etc. It is important that the contents of products are carefully checked. Look at websites such as that below to help students become more aware of these products.
[Ten 'stealth microplastics' to avoid if you want to save the oceans](#)
[KS Environmental](#)
[Blinkist](#)
- To decide whether a product is a single use item, websites such as those below are of help. Discussion will need to occur about how to classify items such as plastic water bottles as they could fit into either category.
[Single use plastic items you can quit right now](#)
[Single-use items](#)
- When deciding whether the product is able to be recycled students can use a simple code of Yes/No. However, if you would like to extend this section of the audit you could get students to identify the plastic identification number shown on the item. This code is shown in the table below. By looking at the last column "recycled in" and by referring to sites such as ["Earth Friends"](#) or [Sustainability](#)

4. Get students to collate and record their results (either in their groups or as a whole class) and then graph their results. These graphs could show aspects such as:

- The main categories of plastic items found (to assist you forming categories look at the survey sheet devised by [Port Phillip Baykeeper](#)).
- The percentage of plastic items that are single use
- The percentage of plastic items that are recyclable. Alternatively, you could graph the percentage of items that fit into the different plastic identification codes.
- The percentage of items that may end up in our water ways
- The percentage of plastic items that have non-plastic alternatives.

Summarise the results of each graph.

**This task could be structured so it is a practice for writing and completing a fieldwork report.*

5. Discuss the results obtained. Some key questions that could be raised are:

- Were you surprised by the amount of plastics used in your everyday life?
- What were the most common single use plastic items? Are there suitable alternatives to these?

Students could research the average lifespan of usefulness for some of these items. For example, the average lifespan of a plastic shopping bag is estimated to be 15 minutes, however it takes much, much longer to break down.

Discussion/research about the health concerns about re-using plastic water bottles could also take place.

- To what extent are plastic items are being recycled? This could open up discussion about the potential impacts of China's decision to no longer use our recycled materials.

Discuss the statements that it is commonly cited that as low as 9% of plastics are actually recycled in Australia (although some reports such as [this one](#) suggest that it is closer to 14%) or that according to the CSIRO Australia produces over 13,000 tonnes of plastic litter per year. Further details can be found in Activity Sheet 10.

- How do plastics end up in our waterways? Do you think that this problem may be larger in other parts of the world, especially those that are developing rapidly?
- What do they believe would be the most common plastics found in our waterways? (See image below titled "Top 10 items found")

The Plastic Identification Code

| Symbol | Type of Plastic | Properties | Common Uses | Recycled In |
|--|--|--|---|--|
|  PET | PET Polyethylene Terephthalate | Clear, tough, solvent resistant, barrier to gas and moisture, softens at 80°C | Soft drink and water bottles, salad domes, biscuit trays, salad dressing and peanut butter containers | Pillow and sleeping bag filling, clothing, soft drink bottles, carpet |
|  PE-HD | PE-HD High Density Polyethylene | Hard to semi-flexible, resistant to chemicals and moisture, waxy surface, opaque, softens at 75°C, easily coloured, processed and formed | Crinkly shopping bags, freezer bags, milk bottles, ice cream containers, juice bottles, shampoo, chemical and detergent bottles, buckets, rigid agricultural pipe, milk crates | Recycling bins, compost bins, buckets, detergent containers, posts, fencing, pipes |
|  PVC | PVC Unplasticised Polyvinyl Chloride PVC-U Plasticised Polyvinyl Chloride PVC-P | Strong, tough, can be clear, can be solvent welded, softens at 80°C Flexible, clear, elastic, can be solvent welded | Cosmetic containers, electrical conduit, plumbing pipes and fittings, blister packs, wall cladding, roof sheeting, bottles Garden hose, shoe soles, cable sheathing, blood bags and tubing, watch straps | Flooring, film and sheets, cables, speed bumps, packaging, binders, mud flaps and mats |
|  PE-LD | PE-LD Low density Polyethylene | Soft, flexible, waxy surface, translucent, softens at 70°C, scratches easily | Glad wrap, garbage bags, squeeze bottles, black irrigation tube, black mulch film, garbage bins | Rubbish bin liners, pallet sheets |
|  PP | PP Polypropylene | Hard but still flexible, waxy surface, softens at 140°C, translucent, withstands solvents, versatile | Dip pottles and ice cream tubs, potato chip bags, straws, microwave dishes, kettles, garden furniture, lunch boxes, blue packing tape | Pegs, bins, pipes, pallet sheets, oil funnels, car battery cases, trays |
|  PS | PS Polystyrene | Clear, glassy, rigid, brittle, opaque, semi-tough, softens at 95°C. Affected by fats and solvents | CD cases, plastic cutlery, imitation 'crystal glassware', low cost brittle toys, video cases | Coat hangers, coasters, white ware components, stationery trays and accessories |
|  PS-E | PS-E Expanded Polystyrene | Foamed, light weight, energy absorbing, heat insulating | Foamed polystyrene hot drink cups, hamburger take-away clamshells, foamed meat trays, pro-TECTIVE packaging for fragile items | |
|  OTHER | OTHER Letters below indicate ISO code for plastic type e.g. SAN, ABS, PC, Nylon | Includes all other resins and multi materials (e.g. laminates) Properties dependent on plastic or combination of plastics | Car parts, appliance parts, computers, electronics, water cooler bottles, packaging | Car parts, concrete aggregate, plastic timber |

Taken from: <https://econation.co.nz/plastic-recycling/>

Introductory Activity 2. Modify the activity found in the Water in the World unit. A copy of this is below.

1. Bring into class a range of plastic items (ensure that you have examples of items shown in the visual below). These items could include
 - A plastic bucket or tub (to carry items)
 - Cigarettes
 - Gladwrap or a food wrap such as a chip packet
 - Facial scrub (check whether it has beads)
 - Plastic bottle or cap
 - Plastic bag
 - Plastic cup or plate
 - Plastic knife, fork or spoon
 - Toothpaste (check the contents)
 - Plastic straw
 - A balloon
 - Polystyrene foam
 - Pen
 - Polar Fleece (made of plastic fibres)
 - Fishing line
 - Glitter
 - Lego blocks etc

For each of the items shown ask students to consider the following questions

- Are they single use items?
 - Is it possible that they could end up in our oceans and if so how?
 - If these items ended up in our waterways what form or shape could they eventually take? (use this point as an introduction to microplastics)
 - If you wish you could go into more detail for two specific examples of the above. Go to [Tangaroa Blue Foundation's website](#) and then
"Cigarette butt meme"
"Balloons – a colourful killer"
2. From the items shown in class get students to rank the top 8 sources of plastics that are found in our oceans. (see image below for the answer)

Alternatively, you could turn this activity into a short game. Divide the class into groups of 4-5. After discussion each group writes their ranking from 1-8 on the whiteboard. Go through each list awarding 2 points if they have the item in the correct order and 1 point if the item is one place out of position. The winning team is the one with the highest total. There are a number of common images such as the one below showing this result. Discuss this result.



Taken from: <https://oceanconservancy.org/trash-free-seas/international-coastal-cleanup/>

Types of plastics found in our waterways

Begin by showing the following clip

[Diver films wave of plastic pollution off Bali on scale 'never seen before'](#)

This clip clearly shows plastics in our waterways such as those listed in the image above “Top 10 items found”. What may not be so visible are the smaller pieces of plastics (microplastics) and nurdles entering our waterways.

The next sets of tasks aim to provide students with an understanding of these categories of plastic wastes.

1. Read over the information contained in the websites below, then answer the following questions.

[Greenfacts](#)

[Thoughtco](#)

- a. After researching, copy down a definition of *microplastics*.
- b. Describe the main sources of microplastics.
- c. According to these articles what is the predicted growth of microplastics?
- d. Refer back to the list of plastic items used in the introductory activities. For each of the items listed indicate whether it has the potential to become microplastic.
- e. Conduct research to find the percentage of plastic in our oceans that are microplastics.
- f. Can microplastics be filtered at treatment plants?
- g. What chemicals can be found in or absorbed by microplastics?
- h. What impacts can microplastics have on humans and the marine environment? (this will be covered in more detail in Activity Sheet 8)

2. Watch the clip [“The nurdles' quest for ocean domination - Kim Preshoff”](#) and then complete the necessary research to answer the questions below.

- a. What are nurdles?
- b. What are nurdles used for?
- c. Draw a flow diagram to show the life cycle of a nurdle.
- d. How do nurdles end up in our waterways?
- e. Why do nurdles have such a long life span?
- f. How can nurdles become toxic?
- g. What impact can nurdles have on the marine environment? (this will be covered in more detail in Activity Sheet 8)

As an alternative to these questions look at the fact sheet found at [Nurdle Hunt](#).

To illustrate the above it is highly recommended that you watch the clip showing the damage caused by a nurdle spill near Hong Kong. This can be found at [here](#).

You could also read over and discuss the article about a nurdle spill in Warrnambool. This article can be found at [here](#).

3. Go to [“The Story of Microfibers - The Story of Stuff Project”](#)

After watching the clip and reading over the associated content answer the following questions:

- a. Describe what microfibers are.
- b. Draw a flow diagram explaining how microfibers can end up in our waterways.
- c. What impacts can microfibers have on the marine environment? Write a paragraph summarising this.

4. To fully understand the problems that plastics in our waterways create it is important to realise the lifespan that plastics have. To illustrate this and to initiate class discussion go to [Tangaroa Blue Foundation's website](#) and download the fact sheet: "Marine debris – how long until it is gone?"

5. To extend discussion on a previous point re the impact of growing waste go [to MRA Consulting: State of Waste 2016- current and future Australian trends.](#)

Read over the first part of this report on the increase of waste production compared with population and discuss the implications of the information contained in the graph. The following questions may help with this discussion.

- a. Suggest reasons for this increase
- b. Discuss the implications of such an increase
- c. Suggest ways to reduce the amount of waste produced.