

Case Study: Plastics in our water ways

Activity Sheet 8. “The types and distribution of plastics found in our oceans and waterways”

Introduction

This set of activities act as a follow up to those in Activity Sheet 7 and aims to provide students with a more in-depth understanding of the types of plastics entering our waterways and their location at a national and global scale. Activity Sheet 9 will investigate this content at a local scale.

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

Geographical Concepts and Skills

Place Space and Interconnection

- Explain processes that influence the characteristics of places.
- Identify, analyse and explain significant spatial distributions and patterns and identify and evaluate their implications, over time and at different scales

Data and information

- Analyse maps and other geographical data and information using digital and spatial technologies as appropriate, to develop identifications, descriptions, explanations and conclusions that use geographical terminology

Geographical Knowledge

- Causes of an atmospheric or hydrological hazard and its impacts on places, and human responses to it to minimise harmful effects on places in the future.

Introductory Activities

1. Bring into class a range of plastic items (ensure that you have examples of items shown in the infographic below). These items could include:
 - A plastic bucket or tub (to carry items)
 - Cigarettes
 - Gladwrap or a food wrap such as a chip packet
 - Glitter
 - Plastic bottle or plastic bottle 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
 - 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. These following links will take you directly there.

["Cigarette butt meme"](#)

["Balloons – a colourful killer"](#)

[Is Glitter Bad for the Environment \(Bustle\)](#)

2. From the items shown in class get students to rank the top eight sources of plastics that are found in our oceans. (Suggested answers can be found [here](#) and on the infographic below).

Alternative option:

This activity could be turned into a short game. Divide the class into groups of 4-5 students. 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.



Image taken from: <http://futuresagency.tumblr.com/post/51381768567/fastcompany-its-no-secret-that-the-worlds>

Types of plastics found in our waterways

The next sets of tasks aims to provide students with an understanding of the categories of plastic wastes found in our waterways.

1. Watch the clip "[Microplastic Oceans](#)" and then complete the following tasks

An alternative clip to the above to the above is "[Beat the Microbead](#)". This clip presents the information in a different manner that may appeal more to some students. Given that it is a short clip you could use both to complete the tasks below.

- a. Research and find a definition of microplastics. Copy it into your workbooks.
- b. What are the sources of microplastics? List them.

- c. 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. Putting it into a table may be an easy way to organise this information.
- d. What percentage of plastic in our oceans are microplastics?
- e. Can microplastics be filtered at treatment plants?
- f. What impacts can microplastics have on the marine environment? (this will be covered in more detail in Activity Sheet 10)

2. Watch the clip "[Nurdles- A drop in the ocean](#)". Read over the information contained at [Nurdle Free Oceans](#). (As an alternative to the questions below this could be used as a fact sheet).

Using the information contained in these resources complete the following tasks.

- a. What are nurdles and what are they used for? As an alternative to this question students could draw a simple flow diagram showing the life cycle of a nurdle.
- b. How do nurdles end up in our waterways?
- c. What impact can nurdles have on the marine environment? (This will also be covered in more detail in Activity Sheet 10)

3. As an example of the above read over and [discuss the article about a nurdle spill in Warrnambool](#). Alternatively, research and watch associated clips dealing with the nurdle spill at [Hong Kong](#).

4. Get students to research and discuss how plastics in our waterways are broken down and what chemicals can be released during this process. Alternatively go to [Tangaroa Blue](#) then the fact sheet, "[Marine debris – how long until it is gone?](#)"

5. Select a few of the plastic items used in the introductory activities. For each of the items ask students to guess how long it takes for these plastic items to break down.

Go to [Tangaroa Blue Foundation's](#) website, then to "[Rubbish timeline poster](#)" to show the actual length of time it takes for these items to break down. Discuss these results and the impact that it has on the amount of plastic pollution in our waterways.

Where is plastic pollution found?

1. As an introduction to the following tasks re the global location of our plastic waste watch and discuss the Youtube clip "[The Majestic Plastic Bag – A Mockumentary](#)"

Read over the article "[How does plastic end up in the ocean?](#)" - Greenpeace New Zealand

<https://www.greenpeace.org/new-zealand/story/how-does-plastic-end-up-in-the-ocean>

Describe the three main ways that plastics may enter our waterways.

2. Download a map similar to that below showing the world's ocean gyres.

Map Showing the Location of the World's Ocean Gyres.

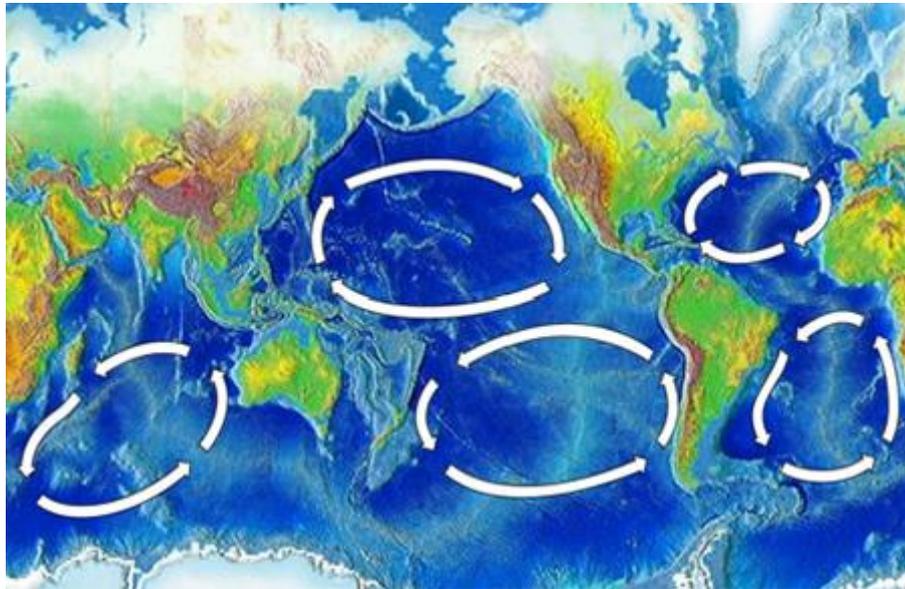


Image taken from: https://commons.wikimedia.org/wiki/File:Oceanic_gyres.png

Using this map explain to the students what ocean gyres are and how they result in the formation of plastic garbage patches. To assist your explanation consider using the resources below:

- [Ocean Today](#)
- [Ocean Gyres](#)
- Go to [Tangaroa Blue Foundation's](#), then to Education Kit, [Senior Units Lesson 5 PDF](#). The experiment Blue Foundation's website (www.tangaroablue.org/) then to education kit, senior units lesson 5 PDF. The experiment that is described at the end of the lesson is a great way to explain this concept.
- Read over the information found at [Ocean Gyres](#) and then answer the following questions
 - a) What are ocean gyres?
 - b) How are ocean gyres formed?
 - c) Explain how ocean gyres collect plastic waste resulting in the development of ocean garbage patches.
 - d) Why does plastic waste tend to remain in the gyres?

4. On a base map of the world get students to mark in the location of the 5 main ocean garbage patches. They are

- North Pacific Garbage Patch
- South Pacific Garbage patch
- Indian Ocean Garbage Patch
- North Atlantic Garbage Patch
- South Atlantic Garbage Patch

As a specific example get students to research five facts (similar to those listed in the table) and find associated images about the Great Pacific Garbage Dump. Students could then present their findings or simply place the information in a table similar to that shown below.

Great Pacific Garbage Dump Fact	Image of fact
Size	
Composition	
Rate of growth	
Impacts	
Other	

Alternatively watch a clip such as [“The Great Pacific Garbage Patch – Good Morning America”](#)

Whilst the Great Pacific Garbage Patch is the largest, it is important to realise that this problem is also occurring in other oceans. As an alternative to the above activity you could divide the class into small groups with each group researching one of the five ocean garbage patches. Similar to the above, students could then present their findings or simply place the information in a table similar to that above.

4. Refer to the map below showing plastic waste available to enter oceans.

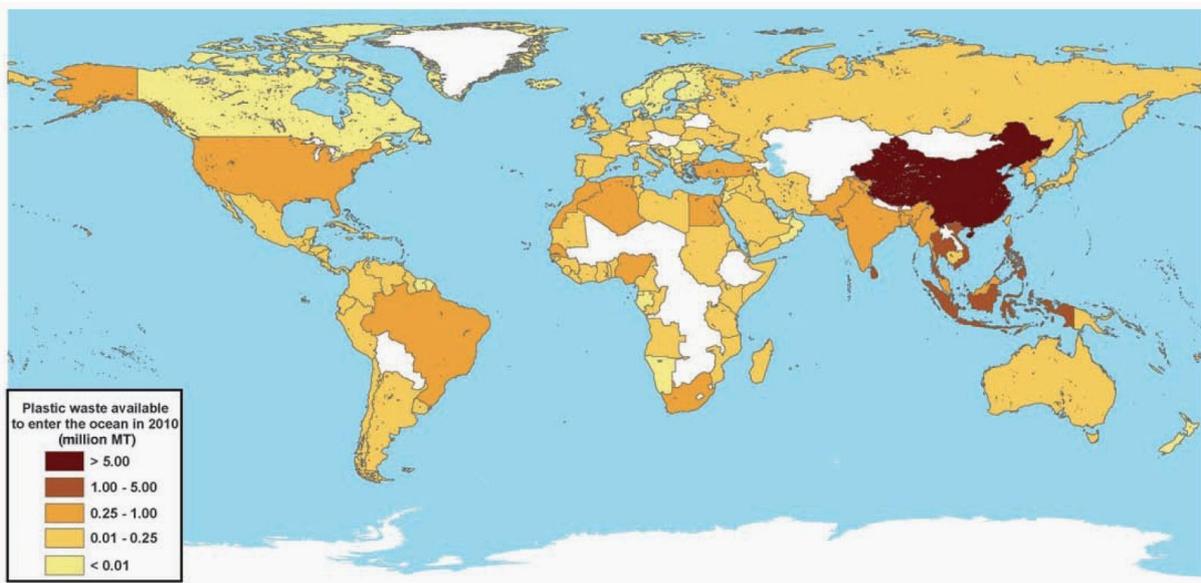


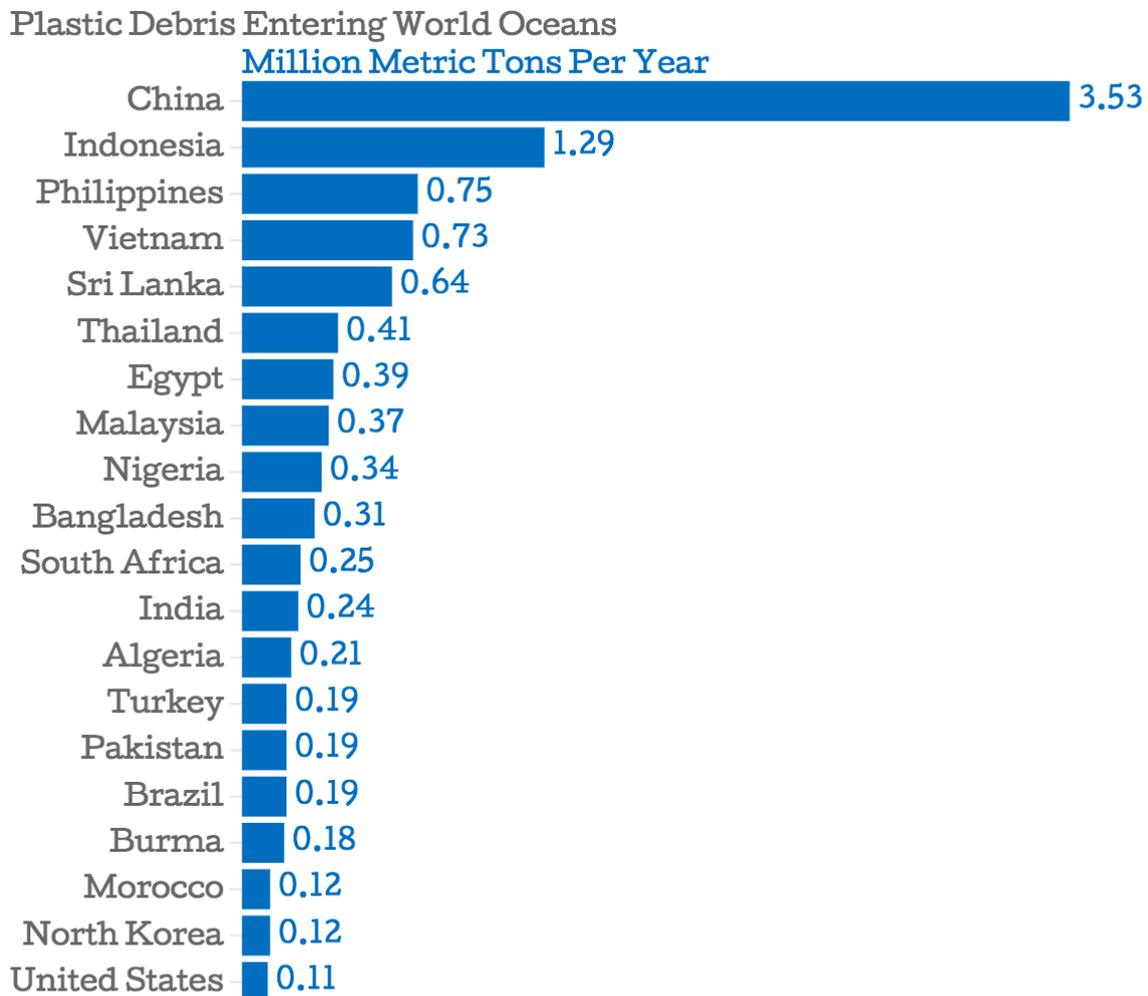
Image taken from: <http://www.factsandopinions.com/tag/plastic-pollution/>

- List those countries that have a high amount of plastic waste available to enter the world.
- Describe the global distribution of plastic waste available to enter oceans (teacher instruction on how to describe distribution patterns may be required prior to commencing this task).
- Refer to the image below showing the top 20 countries that contribute to plastic waste.

On the base map showing the location of the 5 main ocean garbage patches previously completed, using an appropriate key, mark in the location of the countries listed.

- By referring to the completed map, as a class discuss whether there is an association between the location of the ocean garbage patches and the amount of plastic waste

available to enter oceans. Suggest factors that could account for the level of association.
(this leads onto the activity below)



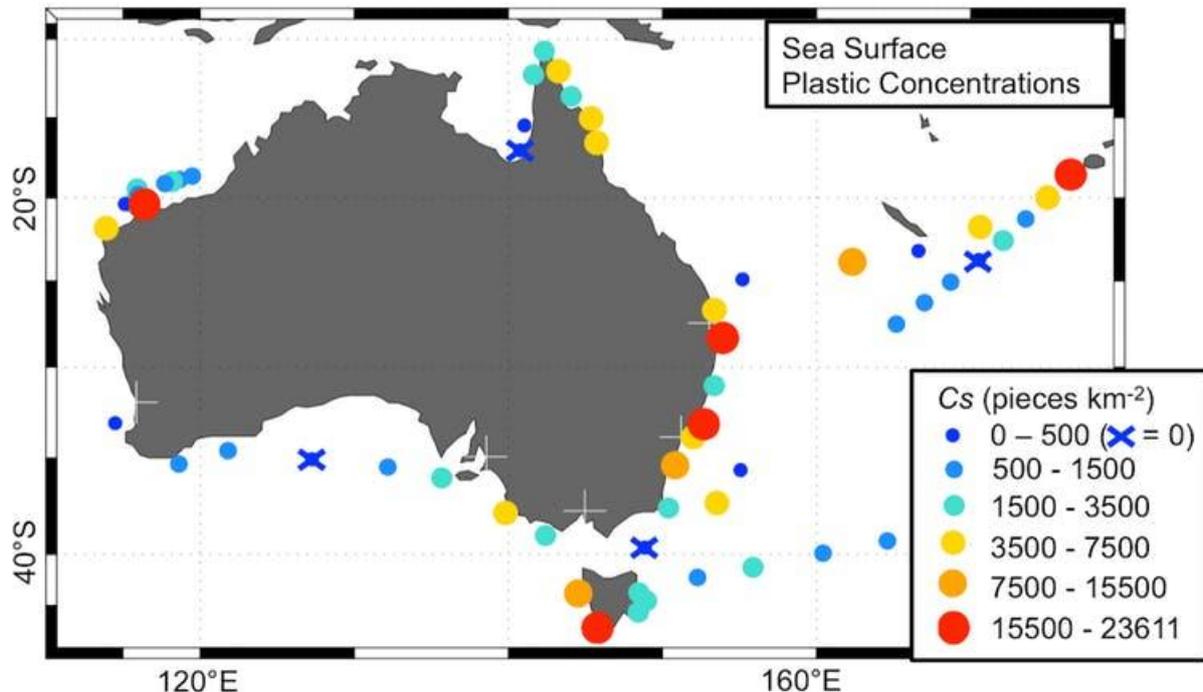
Chartbuilder

Data: Jenna R. Jambeck et. al.

Image taken from: <https://www.zmescience.com/ecology/pollution-ecology/dumping-plastic-13022015/>

- e) Discuss with students these results. Brainstorm the reasons that could explain the above results.
- f) Using the points from the brainstorm select the main factors that could explain the results in the above image (such as population, level of industrialisation, level of development) and discuss how these factors could be measured. Based on this discussion create and then complete a table similar to that below. The research could be completed as a class or in small groups.

5. Download an image, such as that shown below, showing the distribution of plastic waste in Australia. Explain the legend to the class and develop a simple classification system of what constitutes high, medium and low plastic concentrations



Source: [The Conversation https://www.zmescience.com/ecology/pollution-ecology/dumping-plastic-13022015/](https://www.zmescience.com/ecology/pollution-ecology/dumping-plastic-13022015/)

Using the information contained on this map get students to complete some of the questions below. There is a range of similar questions to allow for differentiation.

- List the cities that have high levels of plastic concentrations nearby. Why do you think that these cities have higher levels of plastic concentrations near them?
- Name the regions of Australia that have the highest level of plastic concentrations and the regions that have the lowest level of plastic concentrations. Suggest factors that could explain this result.
- List examples of the spatial association between areas of high plastic concentrations and cities/population density. (Teacher instruction about the concept of spatial association will be required for this task). Describe factors that could explain this association.
- Suggest reasons why areas with low population density still have plastic waste.
- Rank capital cities from highest to lowest plastic concentrations.