

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

Activity Sheet 6 “The distribution of plastics in our waterways”

Introduction

This set of activities act as a follow up to those in Activity Sheet 4 and aims 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 distribution of plastics at a global and national scale.

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

Geographic Concepts and Skills

Place, Space and Interconnection

- Identify, analyse and explain significant distributions and patterns and identify and evaluate their implications over time and at different scales.
- Identify, analyse and explain significant interconnections within places and between places over time and at different scales and evaluate the resulting changes and further consequences.

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

1. As an introduction to the tasks re the distribution of our plastic waste watch the [Youtube clip "The Majestic Plastic Bag – A Mockumentary"](#)
2. Read over the article ["How does plastic end up in the ocean?" - Greenpeace New Zealand](#)
Describe the three main ways that plastics may enter our waterways.

The Global Distribution of Plastic Waste

1. To explain the broad global distribution of plastic waste it is important to understand ocean gyres. Read over the information found at [What are the Seven Continents](#) about ocean gyres and then answer the following questions:
 - a. What are ocean gyres?
 - b. How are ocean gyres formed? This can also be demonstrated - go to [Tangaroa Blue Foundation's](#) website then to the Lesson 5 (Plastic Island). The experiment that is described at the end of the lesson is a great way to explain this concept.
An alternative is to watch ["Garbage Patches in the World Ocean"](#) Visualisation Experiment
 - c. On a base map of the world mark in the location of the five major ocean gyres. Ensure that all geographic and mapping conventions are included.
 - d. Explain how ocean gyres collect plastic waste resulting in the development of ocean garbage patches.
 - e. Why does plastic waste tend to remain in the gyres? Explain this in a written paragraph.
2. Whilst the Great Pacific Garbage Patch is the largest ocean garbage patch, it is important to realise that this problem also occurs in the North Atlantic Ocean, the South Atlantic Ocean, the South Pacific Ocean and the Indian Ocean.

To show the characteristics of an ocean garbage patch watch the YouTube clip ["World's biggest garbage dump – size of Alaska"](#). This is a good summary of the initial report which also can be found on Youtube at ["Boyan Slat - The New Picture of the Great Pacific Garbage Patch"](#) (This clip is also referred to in Activity Sheet 9).

Divide the class into small groups or pairs and allocate each of the groups one of the five ocean garbage patches. For the allocated patch each group is to undertake research to produce a short presentation on:

- The location of the ocean garbage patch
- The size of the ocean garbage patch. (if you wish to extend the class ask them to estimate the % of Australia that the garbage patch would take up)
- The composition of the ocean garbage patch
- The rate of growth of the ocean garbage patch (accurate data may not be available for all of the ocean garbage patches)

Students could use PowerPoint, Keynote, Google docs, iMovie for their presentations or they could do a simple oral presentation or poster.

Once the groups have completed their presentations they can share their findings or show their presentations.

During the presentations, students should record the information from other groups in a table similar to that below.

Name of ocean garbage patch	Location	Estimated size	Composition	Rate of growth

3. Below are a range of activities that look at the global distribution of plastic waste in our waterways in more detail. Select those that best suit your class.
- Refer to the map below showing plastic waste available to enter oceans.
- a. On the base map previously completed showing the location of ocean garbage patches, using a simplified key, sketch in the data showing the distribution of plastic waste available to enter oceans. Remember to complete this map with the correct geographic conventions.
 - b. Describe the global distribution of plastic waste available to enter oceans.
 - c. Describe the spatial 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 this association (this leads onto the activity below).

Map showing plastic waste available to enter oceans.

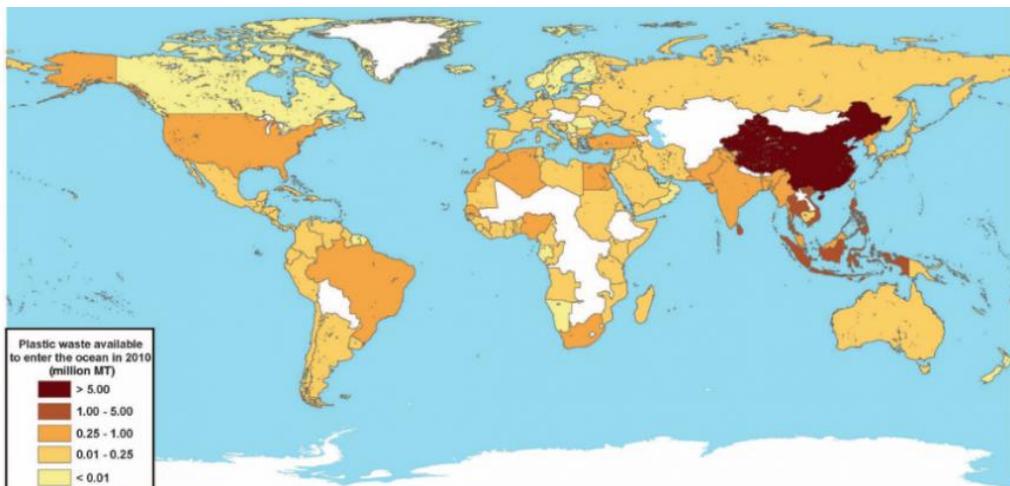


Image taken from: <https://www.sciencealert.com/here-s-how-much-plastic-waste-is-ending-up-in-our-oceans>

- Refer to the chart below showing plastic debris entering world oceans. For the countries listed (also include Australia) undertake research to complete the following table (on page 6).

You may wish to alter the nature of this task by reducing the number of countries or by breaking the class into small groups and allocating specific areas to research. The criteria in this table is only a sample of what could be included. For example, the level of plastic consumption per region could be included. Before commencing this task, it is important to explain the meaning and purpose of this criteria. An alternative to the list of countries below is to use the map above to select four countries with high levels of plastic waste available to enter our oceans, four with moderate levels and four with low levels.

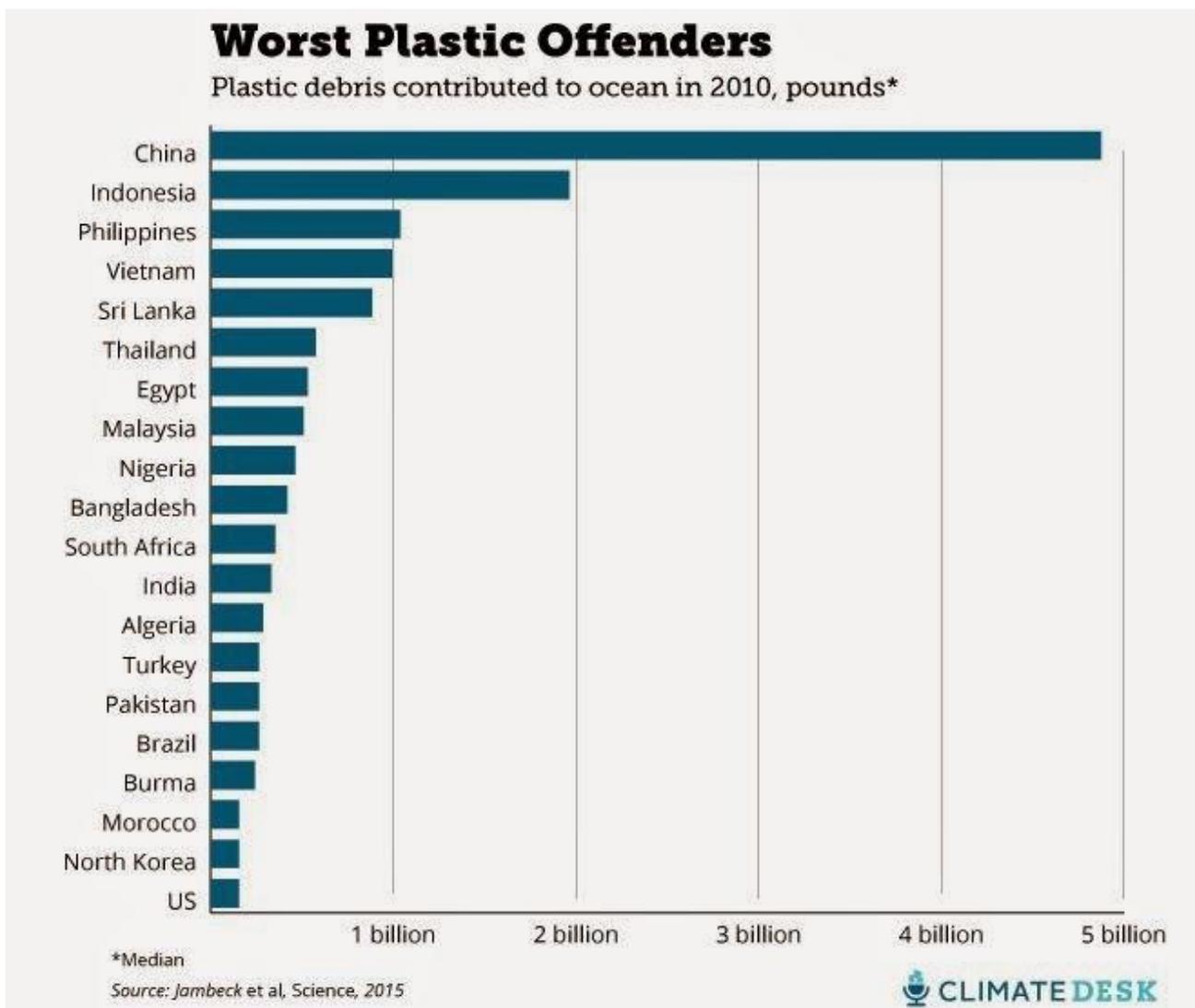


Image taken from: <http://apeuk.org/ocean-plastics-come/>

Once groups have completed the necessary research and collated their results, as a class share and discuss the results.

Extension tasks:

To go into further depth complete overlay maps showing the amount of debris entering the oceans per year and a specific criteria, such as HDI (Human Development Index). It may be best to allocate students to a specific criteria to map and then share the maps/results. Overlay maps can be produced traditionally with tracing paper or digitally using a site such as [scribble maps](#) or [Google my Maps](#) (you will need a Google account for this).

Describe the spatial association between the amount of debris entering the oceans per year and (the specific criteria allocated). Suggest reasons that may account for this association.

Once all of the above tasks have been completed, shared and discussed get students to write a brief report summarising their findings about the factors contributing to plastic waste.

- Read over the article [“Almost all plastic in the ocean comes from just 10 rivers”](#) .
 - a. According to the article what are the rivers that are the main contributors to plastics entering the oceans?
 - b. For each of the rivers list the reasons why they contain and transport a large amount of plastics.
 - c. On the base map previously completed showing the location of the ocean garbage patches, using an appropriate key, show the location of the rivers mentioned in the above article. Remember to use the correct geographic conventions when completing your map.

Describe the spatial association between the location of the rivers mapped and the location of the five main ocean garbage patches.

- Go to [River plastic emissions to the world's oceans](#)
 - a. Look at Figure 1 and describe the distribution of river plastic flowing into oceans in tonnes per year.

- b. Describe the spatial association between the amount of plastic flowing into the oceans and the location of the five main ocean garbage patches.
- c. If you have not done the activities above, using this map identify the countries/regions that are the main contributors to plastic waste in our waterways. Undertake research to complete a similar table and tasks to that previously shown.

The National Distribution of Plastic Waste

1. As a broad introduction read the article [Plastic is Literally Everywhere](#) and watch the associated clip.
2. Go to [Australia's Waters full of Plastic that we put there.](#)

After reading and discussing the article complete the following tasks:

- a. Briefly describe the method used to collect the data.
 - b. What is the range in the density of plastics found in Australia's coastal areas?
 - c. Refer to the map showing "Sea surface plastic concentrations". Describe the distribution of plastic waste.
3. The next set of tasks would be best done as a class or in small groups.
 - With reference to the concepts previously covered in this activity sheet, suggest factors that could account for the distribution of plastic waste in Australia. (Examples of these factors could include population density, location of industrialised areas, location of seaports, river discharge, rainfall pattern etc)
 - For each of the factors listed gather evidence that would allow you to establish the extent to which the factor has contributed to the distribution of plastic pollution in Australia. Present this evidence in an appropriate format and summarise your findings. For example, complete an overlay map showing the distribution of plastic waste and Australia's population density. Describe the spatial association between these two criteria.
 - Share these findings within the group or with the class.
 - Write a report discussing the key factors that have contributed to the location of plastic waste found along Australia's coastline. Ensure that you support your findings with evidence.

Local Distribution of Plastic Waste

Please refer to the case study of Port Phillip Bay found in Activity Sheet 7.