

Marine Debris in the Pacific Ocean



Assignment Overview

Marine debris consist of any man-made, solid object that enters the marine environment through rivers, streams, storm drains, jettison from vessels, or terrestrial littering on or near the coast. Marine debris can negatively impact ocean ecosystems and can pose a threat to human health. In the Pacific, as well as other oceans, there are natural gathering points where rotating ocean currents, winds, and other ocean features converge to form a vortex that accumulates and traps marine debris. These zones are commonly known as “Garbage Patches”.

The Great Pacific Garbage Patch is a collection of marine debris trapped by ocean currents in the North Pacific Ocean. Approximately 80% of the debris in the Great Pacific Garbage Patch consist of waste from North America and Asia. In this assignment, you will gain a deeper understanding of what marine debris consist of and what processes cause the accumulation in certain zones. To do this, you will use ArcGIS Online to explore areas within the Pacific Ocean, the role of ocean currents, and the human impact on debris accumulation.

The following tutorials should be referenced to help you complete the assignment:

- Introduction to ArcGIS Online: <http://bit.ly/2nYdY8O>
- Creating a Map Journal Story Map: <http://bit.ly/2oQkKej>.

Assignment Tasks

Part A: Getting Started

1. A Web map has been created in ArcGIS Online to help you begin: <https://arcg.is/1H8Dfm>. Sign in with your ArcGIS Online account and save a copy of this map. It will be saved in your “My Contents” folder. You can change the title, tags (keywords), and summary of your map to include your initials or other important information.

Part B: Major Ocean Currents

1. Explore the *Major Ocean Currents* layer. **Zoom** and **pan** the map to see all the ocean currents. **Click** on a few ocean currents to see relevant details in a pop-up.
 - a. In a couple of sentences, explain why some currents are colored red and some are colored blue?
2. Turn on the *Prevailing Winds* layer, and change the **basemap** to Dark Grey Canvas.
 - a. In a couple of sentences, describe the relationship between wind patterns and ocean currents.
3. Turn on the *Mean July Land Temperature* layer.
 - a. In a couple of sentences, describe the movement of ocean currents and the impact on regional climates.

Part C: Ocean Gyres & Marine Debris

1. Turn on the *North Pacific Subtropical Gyre* layer and click on the marker. Watch the video: [TRASH TALK: What is the Great Pacific Garbage Patch?](#)



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- a. In a paragraph, describe an ocean gyre. In your answer, describe the relationship between ocean currents and gyres and explain why gyres contain higher amounts of marine debris compared to other areas in the ocean?
2. Using Map Notes, **draw a polygon** around the approximate location of the Great Pacific Garbage Patch. Change the title to “Great Pacific Garbage Patch”.
 - a. In the **description**, write a few sentences describing the characteristics of this area. Make reference to your earlier answers and be sure to include responses to the following questions: What is the Great Pacific Garbage Patch? Why is the garbage patch located here? Why do you think marine debris consists mostly of microplastics?
 - b. In a few sentences, explain why do you think ocean garbage patches are a problem for both humans and the inhabitants of the earth’s oceans?
3. Navigate to the *Whole World* **Bookmark**.
 - a. Using what you’ve learned about ocean currents and wind patterns, using Map Notes, **place pins** to indicate the locations of four other major ocean gyres around the world that are potentially trapping marine debris in other garbage patches.

Part D: Canada and the Pacific Ocean

1. Navigate to the *Canada’s Pacific Coastline* **Bookmark**. Ensure the *Major Ocean Currents* layer is turned on.
 - a. Use the **Measure** tool to determine which major ocean current is closest in proximity to Vancouver.
 - b. Determine the length of Canada’s Pacific coastline.
 - c. Using Map Notes, **place a line** to represent the location of Canada’s Pacific coastline. Change the title to “Canada’s Pacific Coastline”.
 - i. In the **description** include: the straight-line distance to, and name of, the closest major ocean current determined in Step 1a; the length of the coastline determined in Step 1b; and describe some possible ways you think marine debris may enter the Great Pacific Garbage Patch from cities along the Pacific coast.
2. Turn on the *Watersheds in Canada – Ocean Drainage Areas* layer, adjust the **transparency** and change the **basemap** as necessary.
 - a. Create a Map Notes layer and change the title to “Two Canadian Cities/Towns”. **Place pins** on 2 Canadian cities/towns within the Pacific Ocean Drainage Area. Ensure that one of the locations you choose is inland, and the other is along the Pacific coastline.
3. Run the **Trace Downstream** analysis tool, using your *Two Canadian Cities/Towns* layer as the starting locations for each downstream trace, to determine the downstream flow path from these cities.
 - a. Using the results of your analysis, describe how both inland and coastal cities/towns may contribute to marine debris in the Pacific Ocean and the Great Pacific Garbage Patch. Write a paragraph describing what you think could be done to minimize the amount of marine debris that result from land and end up in the ocean garbage patch? Consider what you think you could do to make a difference?



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Part E: Create a Story Map

1. Using your map, and the answers to the questions above, create a **map journal story map** that demonstrates the location of the Great Pacific Garbage Patch, the human impact on marine debris, the definition of marine debris, how this can impact your life, and what you can do to reduce the amount of pollution that enters the world's waterways and oceans.
2. **Save** your story map with an appropriate **title**, **description**, and **tags**. **Share** your story map with your classroom Group in ArcGIS Online, if applicable.

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