

# Marine debris

from the Esri GeoInquiries™ collection for Environmental Science

Audience – Advanced environmental science

Time required – 15 minutes

**Activity** Investigate marine debris, the role of ocean gyres, and how humans impact trash accumulation.

**Science Standards** APES: IC. Global Water Resources and Use  
APES: IV.A. Benchmark: Pollution Types  
NGSS: HS-ESS3. Earth and Human Impacts

**Learning Outcomes**

- Students will investigate how marine debris becomes trapped by ocean gyres.
- Students will predict where marine trash will accumulate in oceans.

Map URL: <http://esriurl.com/enviroGeoInquiry9>



## Engage

### What are the major ocean currents?

- Click the map URL link above to open the map.
- Zoom and pan the map to see all the ocean currents.
- ? Why are some currents marked red and some marked blue? [*Temperature differences*]
- Turn on the layer, Prevailing Winds. Optionally, change the base map to Dark Gray Canvas.
- Wind patterns interact with water and land, globally.
- ? What is the cause of the global pattern of water currents? [*General, continental winds*]



## Explore

### Will an ocean current trap marine debris?

- With the Details pane visible, click the button, Show Contents of Map.
- Click the checkbox left of the layer, Pacific Markers. Click the Hawaii marker. Click the link to enlarge.
- Gyres are large circular ocean currents that redistribute heat and can trap marine debris.
- Zoom out and pan the map.
- ? Where are other gyres, potentially trapping debris? [*North & South Atlantic, South Pacific, Indian Ocean*]



## Explain

### Where does the trash come from?

- Researchers estimate 80% of trash comes from land and 20% comes from marine sources.
- ? What are the main sources of land-based trash? [*Litter; industrial discharges, such as microplastics; garbage transport; and landfills*]
- Click the button, Bookmarks. Select Spokane.
- From the Details pane, click the button, Show Contents Of Map.
- Click the checkbox to the left of the layer name, Spokane Downstream Trace.
- ? How can trash from inland areas, such as Spokane, reach the ocean? [*Trash and litter flow down rivers to the ocean.*]

## Elaborate

### Why are “garbage patches” filled with plastic?

- Pan the map to see the Pacific Ocean, and click the map marker near the Midway Atoll.
- In the popup window, click the animation of Trash Accumulation.
- Trash from the United States coastline may take six years to reach the Eastern Pacific Garbage Patch, while Japanese trash takes about one year.
- ? Why is plastic the main trash found in this area? [*Plastic floats; biodegradable material decomposes while plastic only breaks into smaller pieces but does not decompose.*]
- Click the Spokane map marker to see one common source of plastic pollution.

## Evaluate

### What is the impact of marine debris?

- Turn on the layer, Blue Whale Concentration.
- Click the Blue Whale area in the map for more information.
- ? How could the ingestion of microplastics, such as nurdles or other plastic trash, impact whales? [*It can cause malnutrition or intestinal blockage.*]
- ? How can you prevent additional marine debris? [*Recycle: Reduce plastic that ends up in the waste stream; educate others to prevent coastal pollution; and/or participate in beach cleanups.*]

## ZOOM TO A BOOKMARK

- Click the button, Bookmarks.
- Select a bookmark name to zoom to its map location and scale.

## TURN A MAP LAYER ON OR OFF

- Press the Details button to turn on the pane.
- Show the table of contents for the map by pressing the button, Show Map Contents.
- Show layers by checking the box next to layer names.
- If a map layer name is light gray, zoom in or out of the map until the layer name is black. The layer can now be turned on.

## Next Steps

**DID YOU KNOW?** ArcGIS Online is a mapping platform freely available to public, private, and home schools. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at <http://www.esri.com/schools>.

### THEN TRY THIS...

- Investigate the impact of marine trash on albatross in the story map, *Winged Ambassador*, at <http://esriurl.com/Geo551>.
- Using an ArcGIS Online organizational subscription for schools, create a cluster map analysis for point locations of garbage in the sea. Explore how the map scale of cluster data informs your data interpretation.

## TEXT REFERENCES

This GIS map has been cross-referenced to material in sections of chapters from these texts.

- *Environmental Science: A Global Concern* by McGraw-Hill — Water Use and Management Chapter
- *Living in the Environment (16<sup>th</sup>)* by Brooks/Cole, Cengage Learning — Global Climate and Biomes Chapter