Name: Date: Class:

Student Sheets

Ocean Circulation Patterns Story Map Student Sheets

Engage Section

A.1. Play I-Spy: What types of items do humans throw away?

A.2. What types of materials are these items made of?

A.3. Identify several examples of items in the photos that you use in your household.

A.4. What differences do you observe between the two images?

A.5. What ideas do you have about how this garbage and debris ended up here?

A.6. Of the top 10 waste items found in the ocean, how many are plastic?

A.7. What ideas do you have about why these items are the most common types of debris found in the ocean?

A.8. What ideas do you have about how the rubber ducks were transported around the world?

Explore Section

B.1. Where do the winds blow clockwise?

B.2. Where do the winds blow counterclockwise?

B.3. Make a claim: Which areas or regions of the ocean are garbage patches likely to form? Use evidence to support your claim.

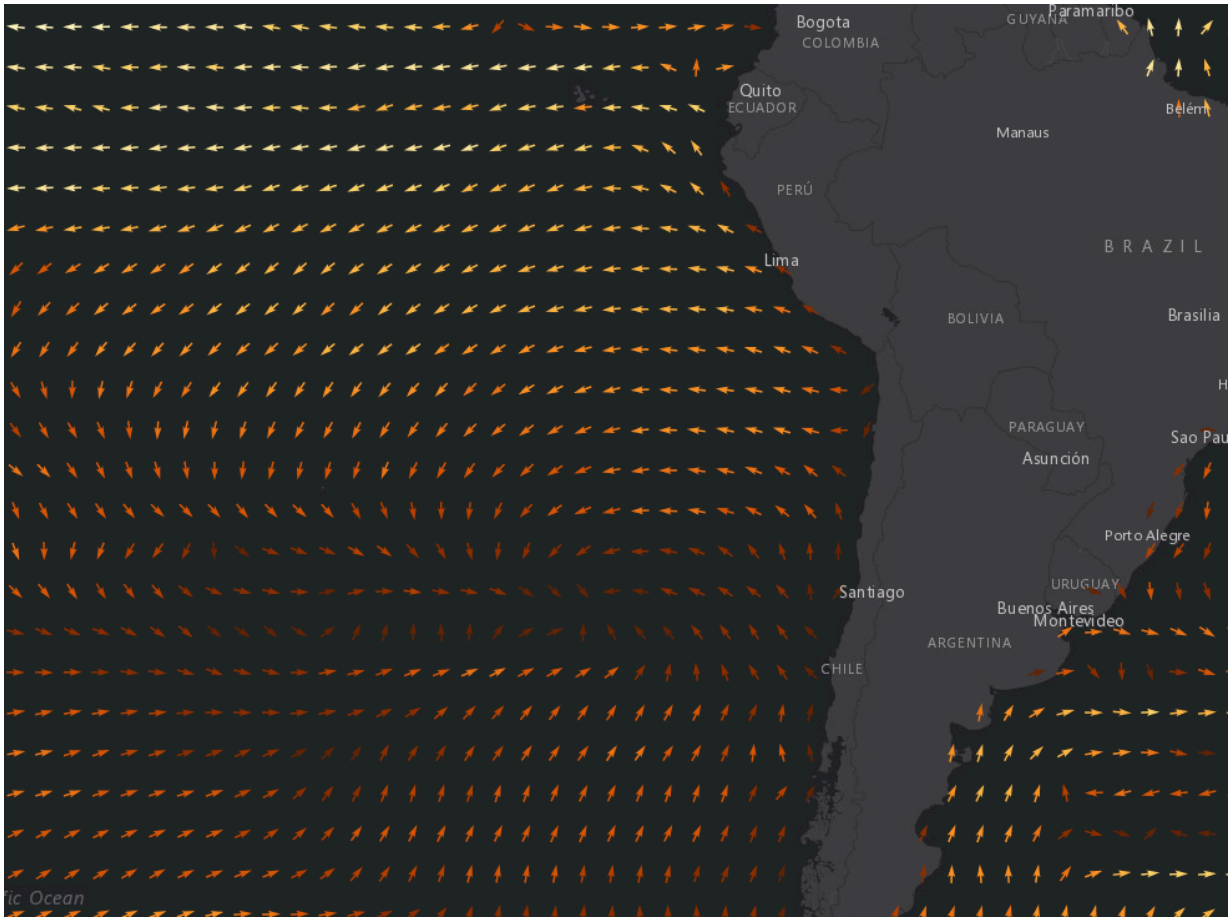
B.4. Observe the map of surface currents. What similarities do you notice between this map and the previous map of wind patterns?

B.5. What does this tell you about the relationship between winds and surface currents?

B.6. Are there regions where there are less currents present than others? Describe these regions.

B.7. Here you have chance to revise your claim from the previous slide. Which areas or regions of the ocean are garbage patches likely to form? Use new supporting evidence to support your claim.

B.8. On the map on your student sheet find the country Peru. Imagine that garbage was released somewhere on the coast of Peru. Draw the path the garbage would take, and mark its final destination with an X.



B.9. Now, on the map on your student sheet find a location in southern Chile. Once again, draw the path garbage would take if it was released on the coast of southern Chile, and mark its final destination with an O.

B.10. What similarities do you notice between the two paths?

B.11. Here you have another chance to revise your claim from the second slide. Which areas or regions of the ocean are garbage patches likely to form? Use any new supporting evidence to support your claim.

B.12. Were your results the same as the previous slide? If not, take a moment to revisit questions B.8 and B.9 and the map of ocean surface currents, and revise your answer.

B.13. Was your claim from the previous slides on garbage patch locations correct? Why or why not?

B.14. What surprised you about the results of this experiment?

B.15. What patterns do you notice about the locations of garbage patches and ocean tires?

B.16. What does this tell you about the formation of garbage patches?

B.17. How do you think rivers contribute to the transportation of garbage and debris into the ocean? Provide evidence in your answer.

Explain Section

C.1. Why do rivers drain into the ocean?

C.2. What events or processes of the atmosphere contribute to trash entering creeks?

C.3. What events or processes in the biosphere contribute to trash entering creeks?

C.4. What events or processes in the hydrosphere contribute to trash entering creeks?

C.5. What are the most common types of marine debris?

C.6. What are microplastics and why are scientists studying them?

C.7. Why does the Coriolis Effect take place on Earth?

C.8. Why is there an apparent motion to the right in the Northern Hemisphere, and an apparent motion to the left in the Southern Hemisphere?

C.9. Compare the directions of major air currents in the Northern and Southern Hemispheres. How are they similar and how are they different?

C.10. Compare the map of major wind patterns to the map of ocean circulation patterns. How are they similar and how are they different?

C.11. Write a paragraph explaining how wind patterns, Earth's rotation (Coriolis Effect), and the position of Earth's landmasses contribute to ocean circulation patterns.

C.12. What characteristics of ocean gyres lead to the formation of garbage patches?.

Elaborate Section

D.1. How many million tonnes of mismanaged coastal plastic waste existed in 2010?

D.2. How many million tonnes of plastic waste were input into the ocean in 2010?

D.3. In what stage of the ocean plastic life cycle do larger pieces of plastic break down into microplastics?

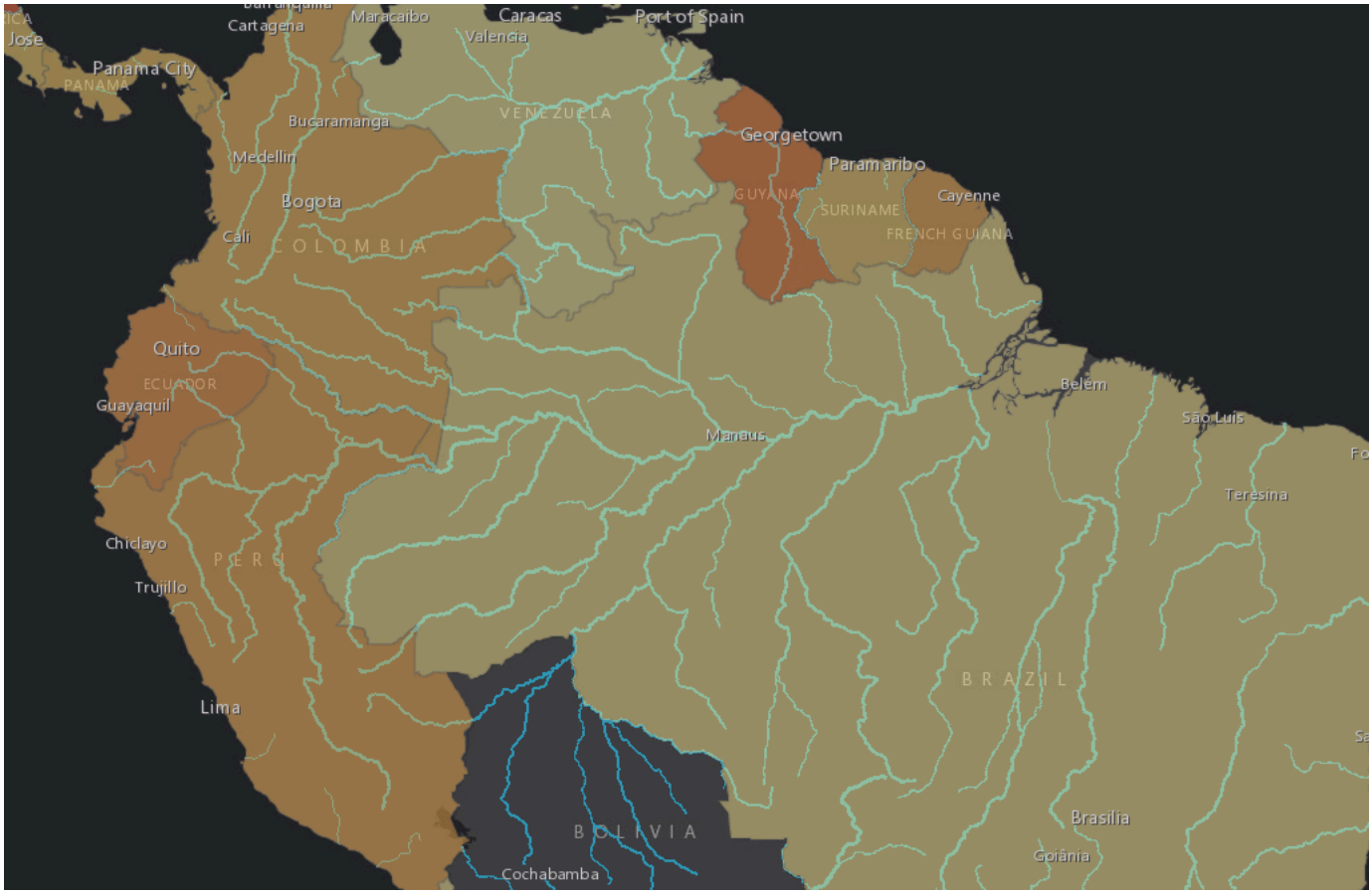
D.4. Describe the different scenarios that can end the plastic life cycle.

D.5. Which region generated the most plastic waste in 2010?

D.6. What impact do you think population density has on the amount of plastic waste that is generated in a region?

D.7. Which regions of the world mismanage the most amount of plastic waste? D.8. Compare this map with the map in the previous slide. What influence do you think population density has on the amount of mismanaged waste that exists in a region?

D.9. Locate the country of Ecuador on the map. On the map on your student sheet, trace the path the rivers of Ecuador would take until they eventually drain into the ocean.



D.10. Based on the path you traced, how many countries are downstream from Ecuador?

D.11. Consider how each of these countries manages their waste, as well as the river systems connecting them. Do you think mismanaged waste in Ecuador impacts other surrounding countries? How?

D.12. Should waste management be considered an individual country's problem, or a regional problem? Why?

D.13. Based on what you have learned so far, why do you think Asia has significantly greater river plastic inputs than the rest of the world?

D.14. Based on this map, which countries of the world do you think are the most at risk of having plastic pollution transported from rivers to the ocean.

Evaluate Section

E.1. Pick a location on the world map that is within a region with a high concentration of mismanaged waste, referring to the previous section, Elaborate. This is where your plastic will start its journey. (NOTE: Assume the plastic will enter the river nearest to this location. The world map displays rivers that become more detailed the farther you zoom in, so make sure you zoom in on the location you pick.)

E.2. Describe the processes that contribute to your plastic entering a river.

E.3. How do Earth systems (atmosphere, biosphere, hydrosphere, geosphere) contribute plastic to rivers and creeks?

E.4. Describe any relevant information about the region your plastic is located in that may contribute to how plastic ends up in a river.

E.5. Describe how population density, the locations of cities and rivers, and attitude towards waste management lead to plastic river pollution. You may want to refer to the data in the Elaborate section.

E.6. What physical or political boundaries does the plastic travel through while on land? Describe any countries that may be downstream from where your plastic started, making them susceptible to river pollution.

E.7. Describe the processes that contribute to river flow, as well as the direction the plastic travels. Does it enter larger rivers from smaller ones?

E.8. Where is the location the plastic enters the ocean, and which ocean is this?

E.9. Now that your plastic has reached the ocean, how does it travel to reach a garbage patch?

E.10. Which garbage patch is this?

E.11. What forces contribute to its movement towards this garbage patch?

E.12. What are the end of life cycle scenarios for this plastic after it has reached the garbage patch?