



**OCEAN
WISE**

Ocean Plastics Education Kit

STUDENT WORKBOOK

High School (Grades 9-12)

LESSON 1
The History of Plastics

LESSON 2
How Plastics Travel
to the Ocean

LESSON 3
Big or Small, Plastics Have
a Huge Impact

LESSON 4
Plastics at the Wheel, Driving
Through Ocean Currents

LESSON 5
Plastics and Climate Change,
a Never Ending Cycle

LESSON 6
Cleanup Your Shoreline for
a Cleaner Ocean

LESSON 1
**THE HISTORY OF
PLASTICS**

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TO THE OCEAN**

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**BIG OR SMALL,
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HUGE IMPACT**

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**PLASTICS AT THE
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THROUGH OCEAN
CURRENTS**

LESSON 5
**PLASTICS AND
CLIMATE CHANGE, A
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LESSON 6
**CLEANUP YOUR
SHORELINE FOR A
CLEANER OCEAN**



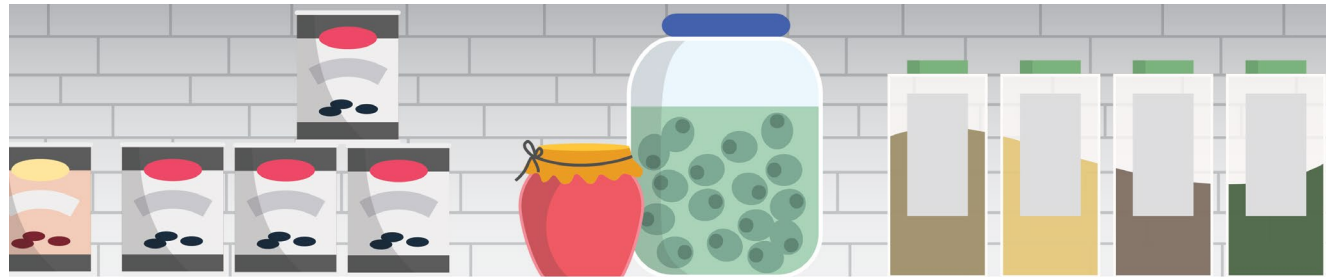
LAND ACKNOWLEDGEMENT

We acknowledge and are grateful that Ocean Wise employees live, work, and play on the traditional, ancestral and unceded territories of the x^wməθk^wəyəm (Musqueam), Sk_wx_wú7mesh (Squamish), and sə́ilwətaʔɬ (Tseil-Waututh) peoples.

Lesson 1

The History Of Plastics





ACTIVITIES

- 1 a) Read [Plastic: It's Not All The Same by Plastic Oceans](#).
- b) Identify the polymers in the table below by their structure. List some of their chemical and physical properties which should include flammability, toxicity, reactivity, and oxidation state and density, color, hardness, melting point, and degradation time, respectively. Find plastic products or waste items in your surroundings composed of the identified polymers and list them in the table.

Structure	Polymer Name	Physical Properties	Chemical Properties	Uses/Waste Items
$\text{-[CH}_2\text{-CH}_2\text{]}_n$				
$\text{-[}\begin{array}{c} \text{H} \quad \text{Cl} \\ \quad \\ \text{C} - \text{C} \\ \quad \\ \text{H} \quad \text{H} \end{array}\text{]}_n$				
$\text{-[CF}_2\text{-CF}_2\text{]}_n$				

2 After reading [Trade Goods of The Fur Trade by The Canadian Encyclopedia](#), answer the questions below as it relates to the fur trade good you selected.

a) Name of fur trade good:

b) What benefits did this fur trade good provide to colonizers

c) Between which Indigenous group and colonizing nation did this trade take place?

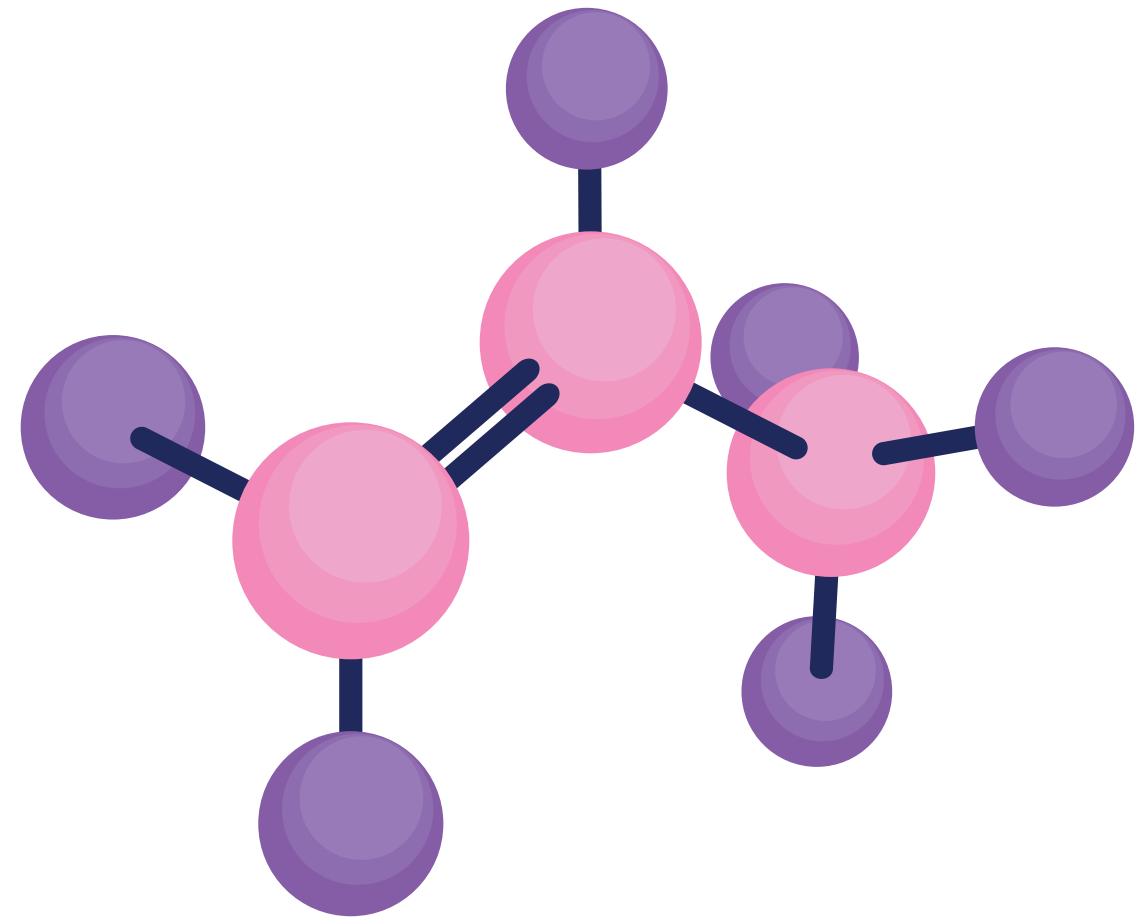
d) How did the material composition of this product change over time? How was it made by Indigenous peoples, and how is it made today?



e) Why was there a change in the material used to make this good?



f) How does changing the way fur trade goods are made harm Indigenous culture and Traditional Ecological Knowledge?



THOUGHTBOOK

In this lesson, you have been introduced to plastic as a consumer good and how it has impacted society and the environment. Take a minute to reflect on what you learned, especially regarding the presence of plastics in our modern world.

REFLECT

1. What makes plastics such a unique and useful material?



2. Why have plastics become so prevalent in the world of consumer goods?

Empty rectangular box for student response to question 2.

3. What makes plastics a threat to the environment and Indigenous culture?



TAKE ACTION



Get the details and specifics about recycling collections in your area!

THE WHY?

Even though most plastics can only be recycled once, recycling can significantly reduce the number of raw materials extracted, energy consumed, and greenhouse gasses released during the production of synthetic polymers, just like the one you researched. By recycling plastic waste, you are allowing plastics to be used to their full potential and limiting the unnecessary production of plastic polymers by giving the existing ones a second life!



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Lesson 2

How Plastics Travel to the Ocean





ACTIVITIES

- 1 Compose a creative literary piece which tells the story of a piece of plastic becoming an ocean pollutant as it travels to the ocean. You can use any literary style including songs, poetry, short stories, plays, comic strips, etc. You should include one of the ways plastic travels to the ocean mentioned in [How Does Plastic End-Up in The Ocean by WWF](#).

LESSON 1
The History of Plastics

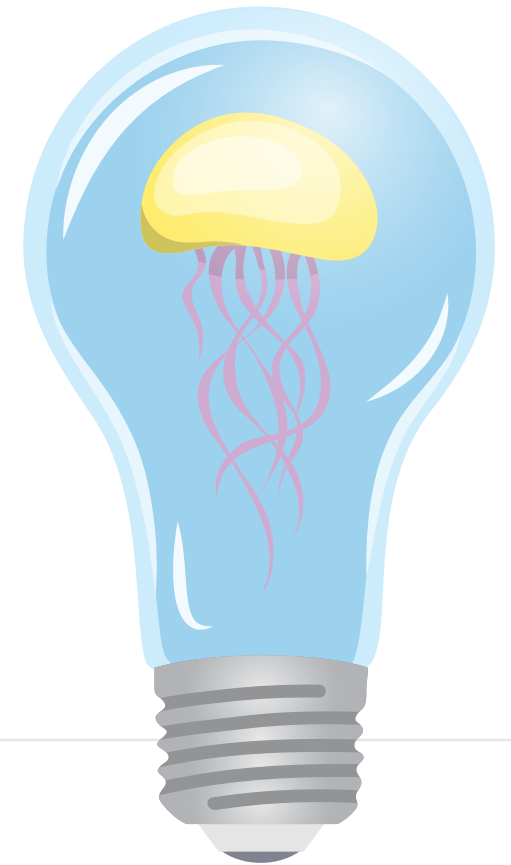
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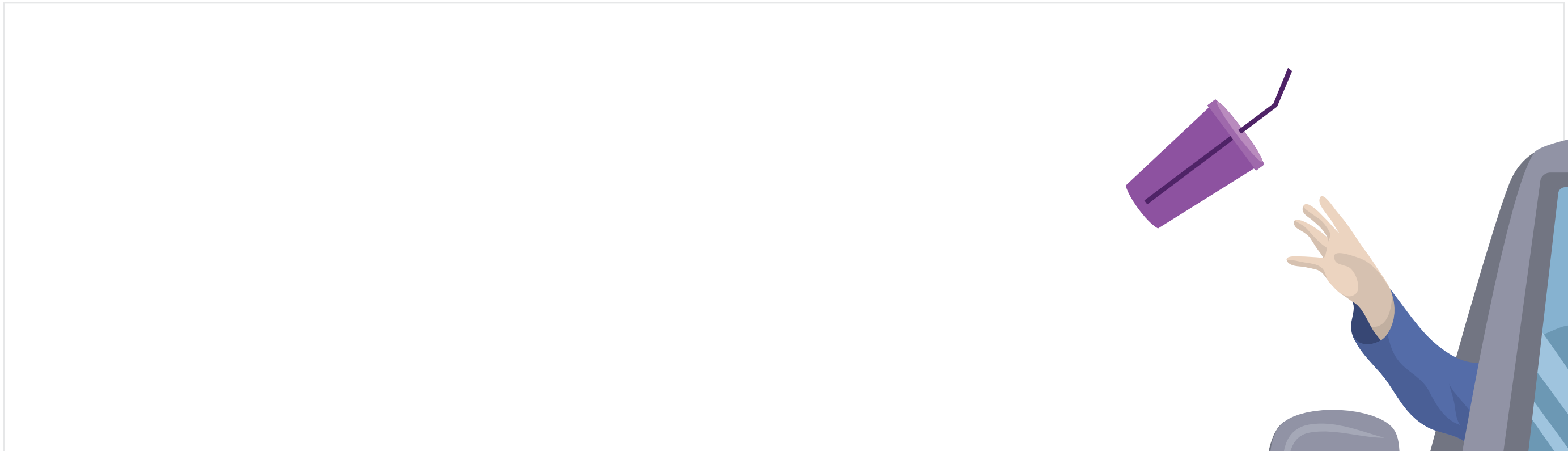
2 Create a system prototype to help solve the plastic crisis and prevent plastics from entering our ocean. You should conduct research and refer to Traditional Ecological Knowledge concepts. Your prototype proposal should include an illustrated design and a descriptive paragraph. If completing this activity online, use a separate sheet of paper for the illustration.

THOUGHTBOOK

From these activities and discussions, you discovered how plastics go from being a consumer good to an ocean pollutant by traveling to the sea. Take a moment to reflect on the ways that the plastic waste you produce can harm marine environments and coastal Indigenous communities.

REFLECT

1. How might a plastic bag, straw, or cup make its way from your school to the ocean?



2. What are the different ways we can prevent plastic from reaching the ocean?

3. In what ways can Traditional Ecological Knowledge (TEK) be applied to better understand the impacts and solutions to the world's plastic problems?

TAKE ACTION



Watch [Take The Pledge by Ocean Wise](#) and visit [Be Plastic Wise by Ocean Wise](#) and take the pledge, whether it be individually or as a class. Go over the different steps on how to stay accountable in this challenge by [Reducing Your Plastic Footprint by Ocean Wise](#).

THE WHY?

According to experts from the [Ocean Wise's Plastic Lab](#), reducing your plastic footprint is the best way to help protect the ocean from plastic pollution. Removing plastic from the ocean and waterways is important, but if we keep consuming plastics, it will continuously enter the ocean and contribute to the never-ending cycle of ocean plastic pollution! Help to solve this issue by reducing the plastic you use, buy, and discard. Talk to someone you know about the pledge and see if you can inspire action in others around you.



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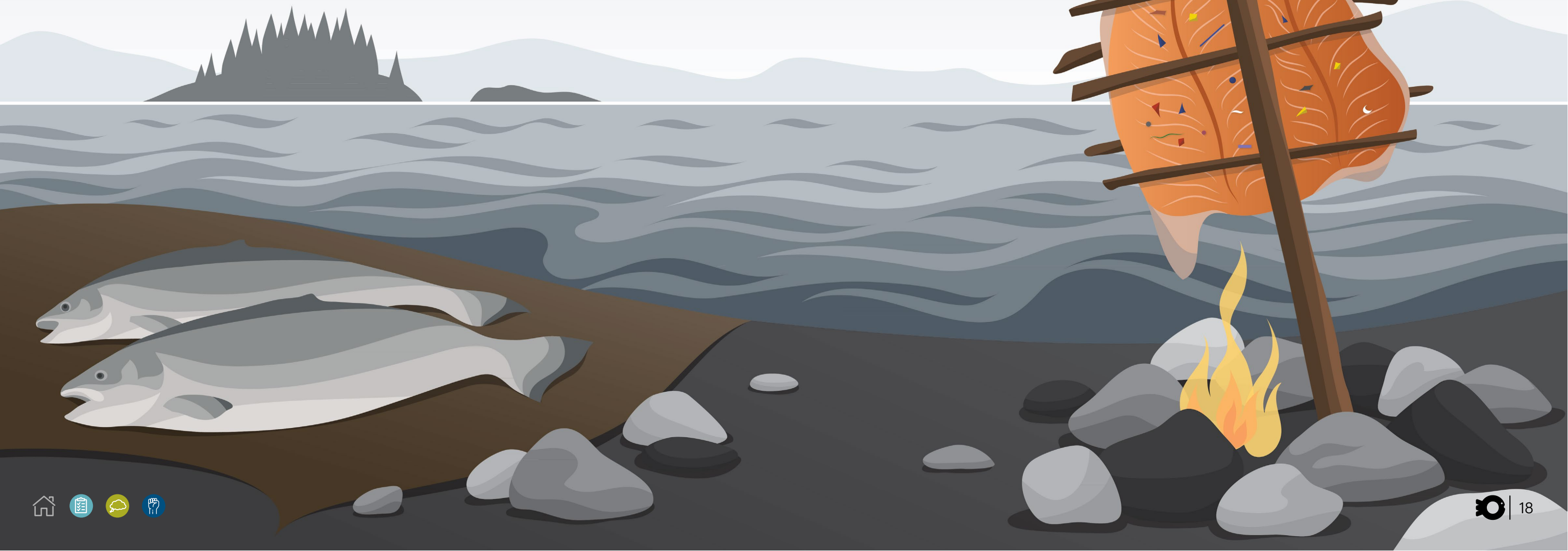
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ACTIVITIES

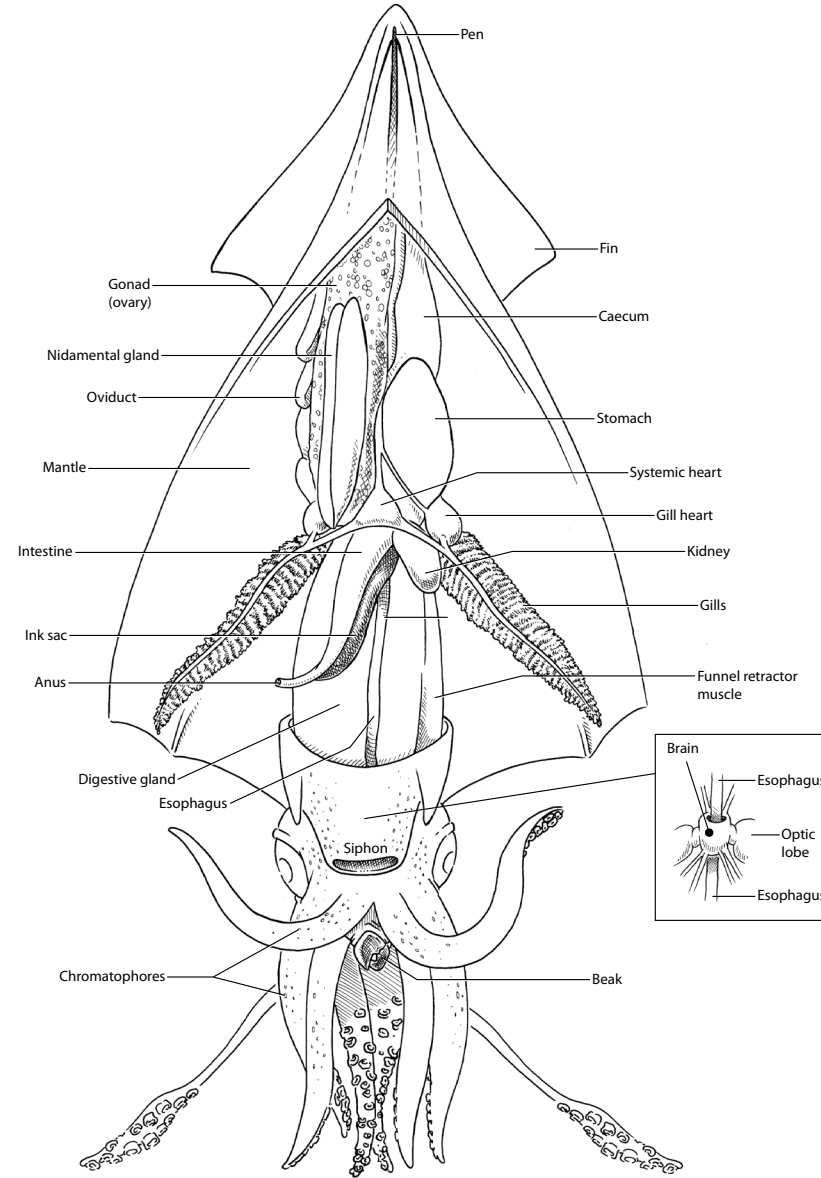
1 a) Read [The Other Source: Where Does Plastic in The Great Pacific Garbage Patch Come From by Ocean Cleanup](#).

b) Fill in the table below by listing the different types of macroplastics you expect to find in the Great Pacific Garbage Patch. For each macroplastic listed, you need to identify its potential source(s), a marine species it impacts, the physical and/or behavioral characteristics of the marine species relevant to its interaction with the macroplastic, and how the macroplastic adversely impacts the respective marine species.

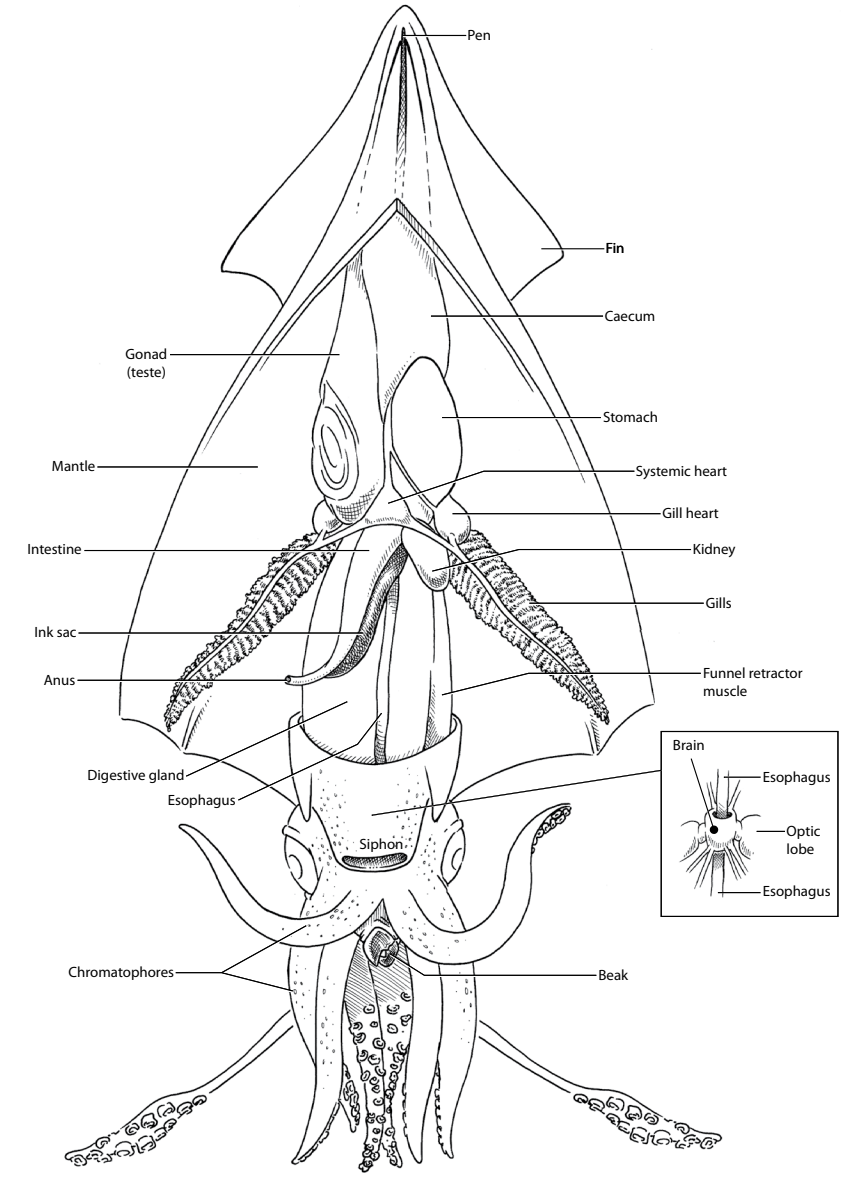
Macroplastic	Source(s)	Marine Species	Behavioral + Physical Characteristics	Impact on Marine Species

2 Squid Herring Dissection: Complete the squid and/or herring dissection following the diagrams shown here and answer the questions once the dissection is complete.

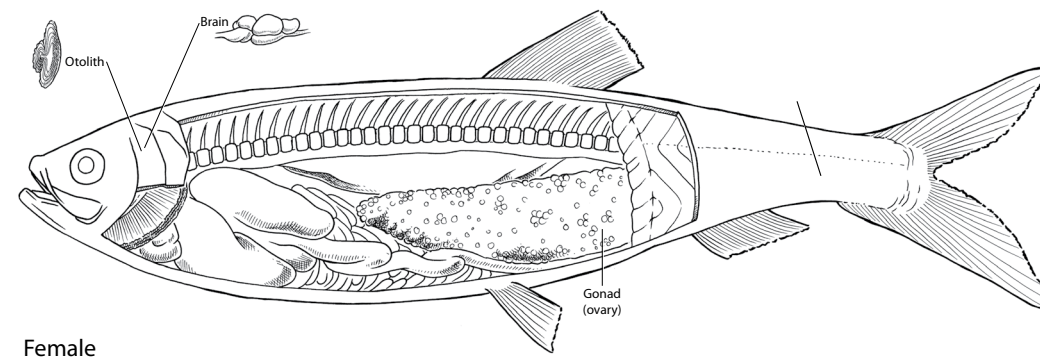
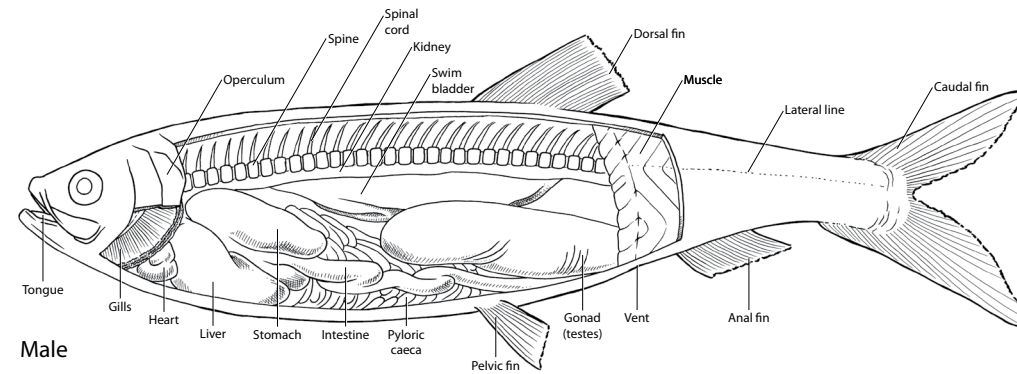
Squid Dissection Female Anatomy



Squid Dissection Male Anatomy



Herring Dissection Anatomy



a) What was the most surprising find from the dissection?

Empty rectangular box for student response.

b) Did you notice any discernible pieces of plastics in your animal? Keep microplastics in mind! Would you be able to see it with your bare eye? What would you need to make a clear observation of microplastics in your animal? If you didn't see any, where may you find those pieces of plastic in another specimen?

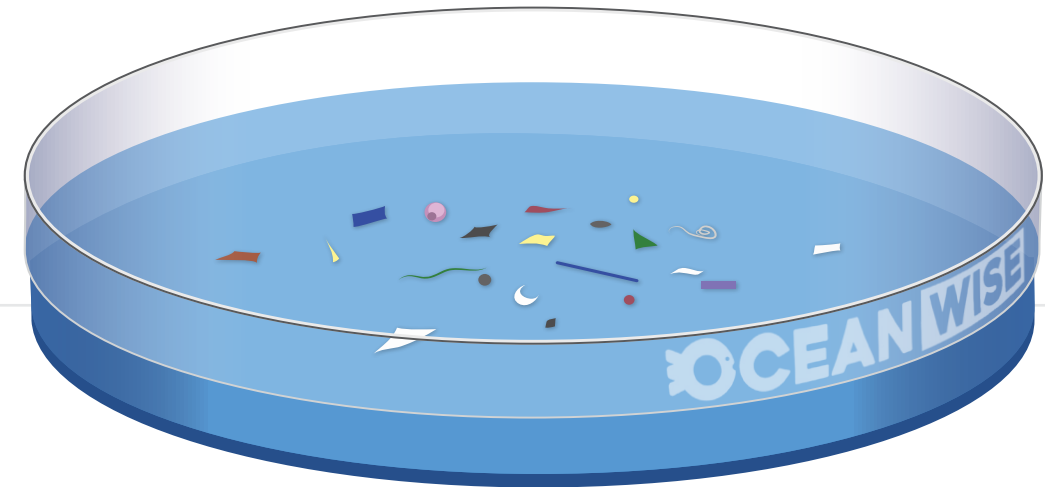
c) Consider the impacts plastics would have on this animal and the species connected to it via the food chain (humans should be taken into consideration in your food chain!).

THOUGHTBOOK

As you now know, plastics come in all shapes and sizes which affect how they harm ocean health and marine species. While microplastics are tiny, they ironically have a huge impact! Think of this when reflecting on the following questions.

REFLECT

1. What are the various ways that plastic impacts animals and ecosystems in our ocean?



2. How do microplastics pose a more extensive and widespread threat to the environment and humans than do macroplastics?

3. What are meaningful and equitable ways to reduce and remediate plastic pollution around the world?



TAKE ACTION



Minimize the microfibers you release into waterways by:

- buying fewer synthetic clothes
- washing synthetic items less often (try spot cleaning!)
- washing clothes in cold water on gentle cycles

THE WHY?

Researchers have found polyester fibers in the ocean as far away as the Arctic, believed to be from common polyester clothing. When buying new clothes, be sure to check their labels. Generally, clothes composed of more synthetic “ingredients” have a greater risk of releasing microfibers such as polyester, nylon, acrylic, and lyocell. Instead, look for clothing made from hemp, linen, and bamboo. Spot cleaning and washing your clothes less often reduces the number of microfibers released into the ocean. Ocean Wise research found that washing clothes in cold water on a gentle cycle reduces microfiber shedding by up to 70%.



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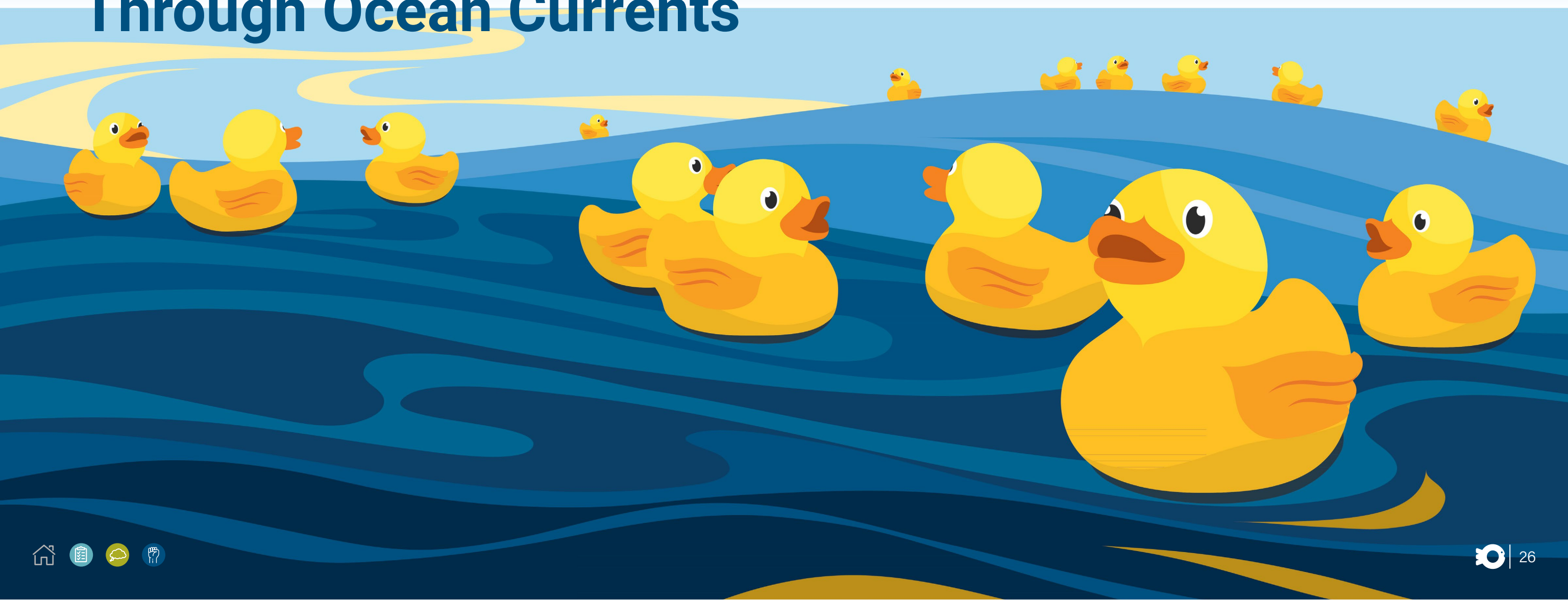
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Lesson 4

Plastics at the Wheel, Driving Through Ocean Currents



ACTIVITIES

1 a) Read [The Journey of Forgotten Plastics Through Our Ocean Currents by Ocean Blue Environmental News Blog](#) and visit [Pollution Tracker by Ocean Cleanup](#).

b) Considering ocean currents, hypothesize where the rubber ducks may have ended up by circling a region(s) on the world map below. Explain why you have circled these areas.



Reasoning:

2 Answer the questions below after watching, [Hokulea Sailed Around The World, But Couldn't Escape Plastic – Ocean Stories by Ocean Wise](#) and [How Our Trash Reaches Remote Beaches](#).

a) How are these remote islands and beaches accumulating so much plastic and garbage?

b) What are some key takeaways/messages you found from watching the Hokulea voyage? How can we apply those to our daily lives?

c) What does mālama honua mean? How could you take that translation and include it into your life in a meaningful way?

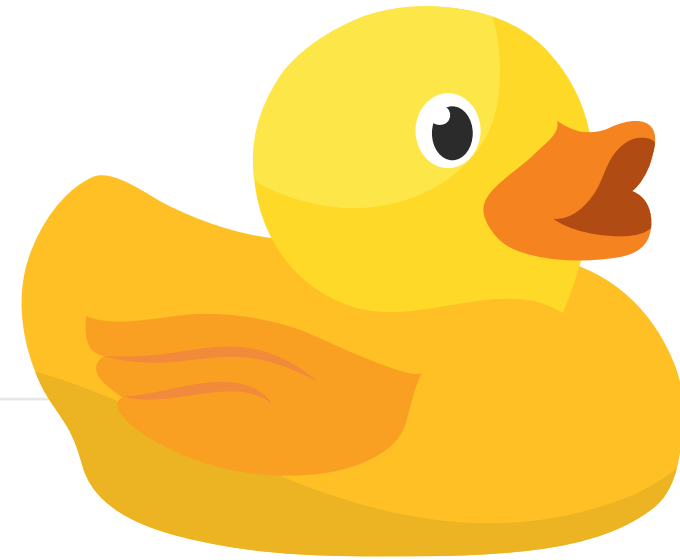
d) What kind of impact would plastic pollution have on people if we had to perform a necropsy on all our own food? Could you see this impacting the way we treat plastic and the ocean?

THOUGHTBOOK

Wow, most plastics have probably traveled around the world more than you have! Reflect on what you learnt about plastic pollution traveling throughout the ocean via ocean currents.

REFLECT

1. What is the connection between the ocean and the Earth's global temperature?



2. How does plastic pollution move around the world?



3. How do ocean currents affect the overall goal of removing all plastics from the ocean?





TAKE ACTION



By checking out the [Plastic Wise Partner Map by Ocean Wise](#), support a plastic reduction partner or encourage your favorite business or restaurant to #BePlasticWise and join the Plastic Wise partners!

THE WHY?

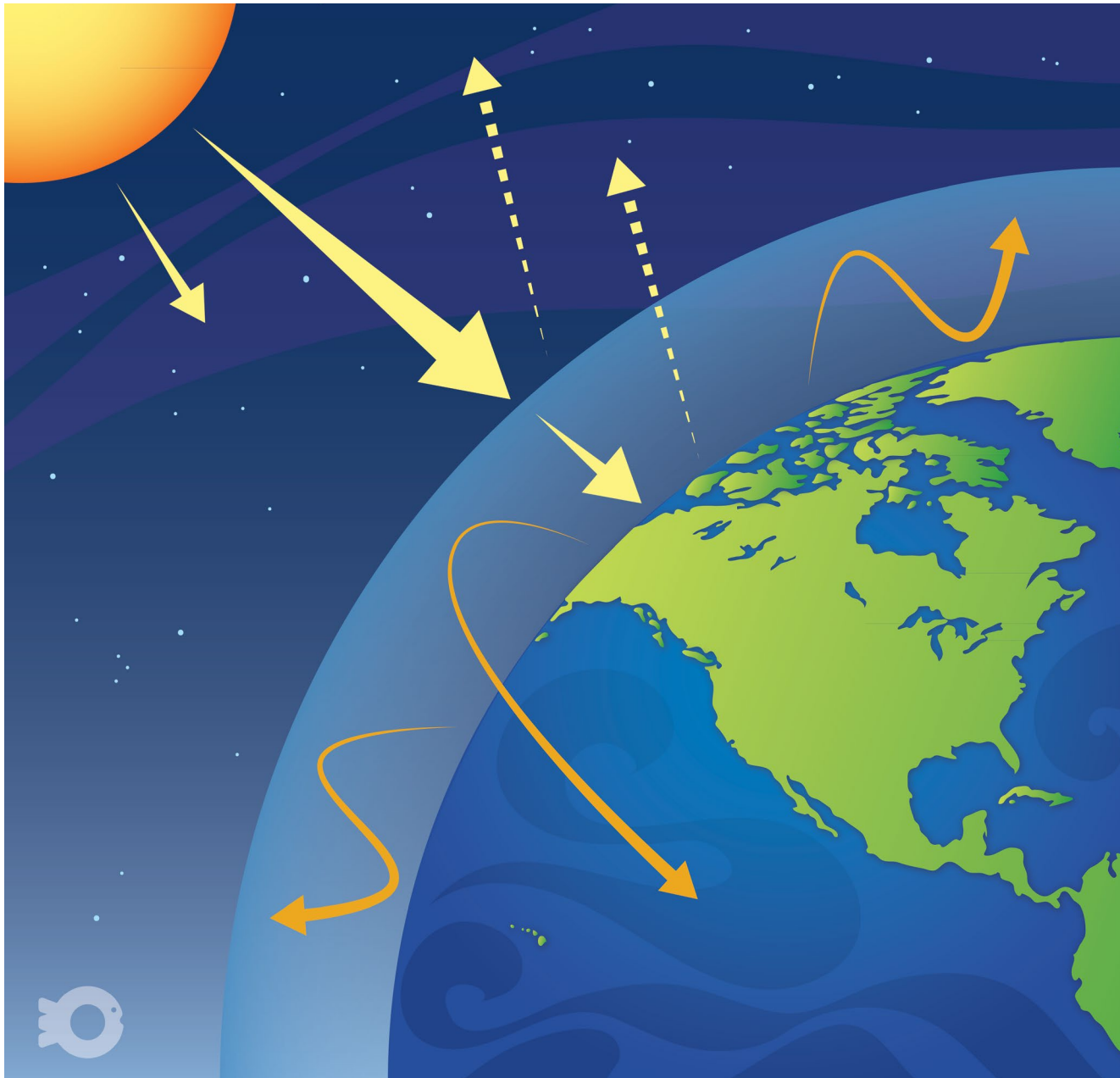
Plastic pollution isn't only produced by individuals or households, it's produced by businesses too. And, like it or not, the choices you make when supporting a business ties you to their plastic pollution. Have you ever gotten plastic boxes and cutlery when ordering take-out at a restaurant, or ordered something online and received it in a plastic bag? Whether you are buying from a business at home or abroad, you are (perhaps unknowingly) contributing to the international plastic pollution problem. By supporting plastic reduction partnered businesses, or encouraging your favorite companies to #BePlasticWise, whether they be local or international, you can help reduce the plastic pollution entering our ocean. This way, it won't be plastic pollution connecting us but the determination and efforts to protect the ocean!



Lesson 5

Plastics and Climate Change, a Never Ending Cycle





ACTIVITIES

1 Read [Greenhouse Effect 101 by NRDC](#). Complete the greenhouse effect experiment and answer the following questions.

a) How does the soda bottle affect the temperature of treatment 1 compared to treatment 2, that does not have a soda bottle covering it?

Answer:

b) List some of the chemical compounds contributing to climate change. Which component of the experiment simulated these chemical compounds?

Answer:

c) What are some similarities between the effects of greenhouse gasses and the soda bottle? You can draw a diagram on a separate sheet of paper to explain.



2 Report on the physical activities and chemicals used/released during the plastic lifecycle stage that you have been assigned. Make sure to clarify how these contribute to climate change. You can refer to [More Than Just Litter: Plastic and Climate Change by Foodprint](#). Prepare to present your report to the class.



3 Read [Plastic Suffocation: Climate Change Threatens Indigenous Populations and Traditional Ecological Knowledge by Samantha Chisholm Hatfield](#).

a) The general public seem immune and unaware of the daily impacts of plastic waste, explain in your own words why this is not the case for *many* Indigenous populations.

b) How is plastic and climate change threatening vital Traditional Ecological Knowledge as well as threatening the cultural foundations and lifeways?

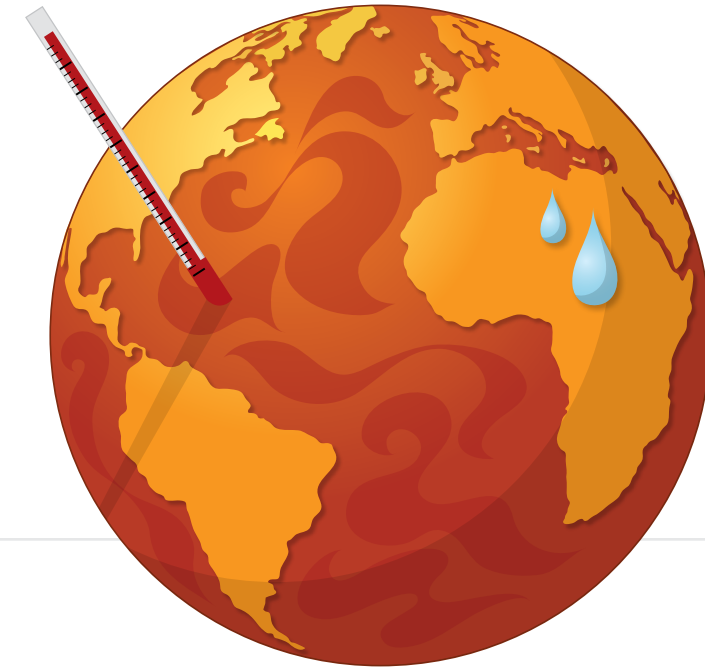
c) Marine Indigenous communities have a unique and intimate understanding and relationship of TEK that relates, not only to the ocean, but the beaches and mudflats of their homelands. How is climate change and plastic waste disrupting not only that relationship but that understanding of their homelands?

THOUGHTBOOK

Would you have ever thought that plastic can also contribute to climate change? Well now you know, and you are aware that the life cycle of plastic begins polluting before it's even discarded by the consumer. Take a minute to reflect on what you have learned and how it might urge you to change your habits.

REFLECT

1. What aspects of the plastic life cycle contribute to the release of greenhouse gasses?



2. How does plastic harm the environment before it physically enters the environment as pollution?



3. How is the extinction of TEK directly impacted by plastic waste and climate change?



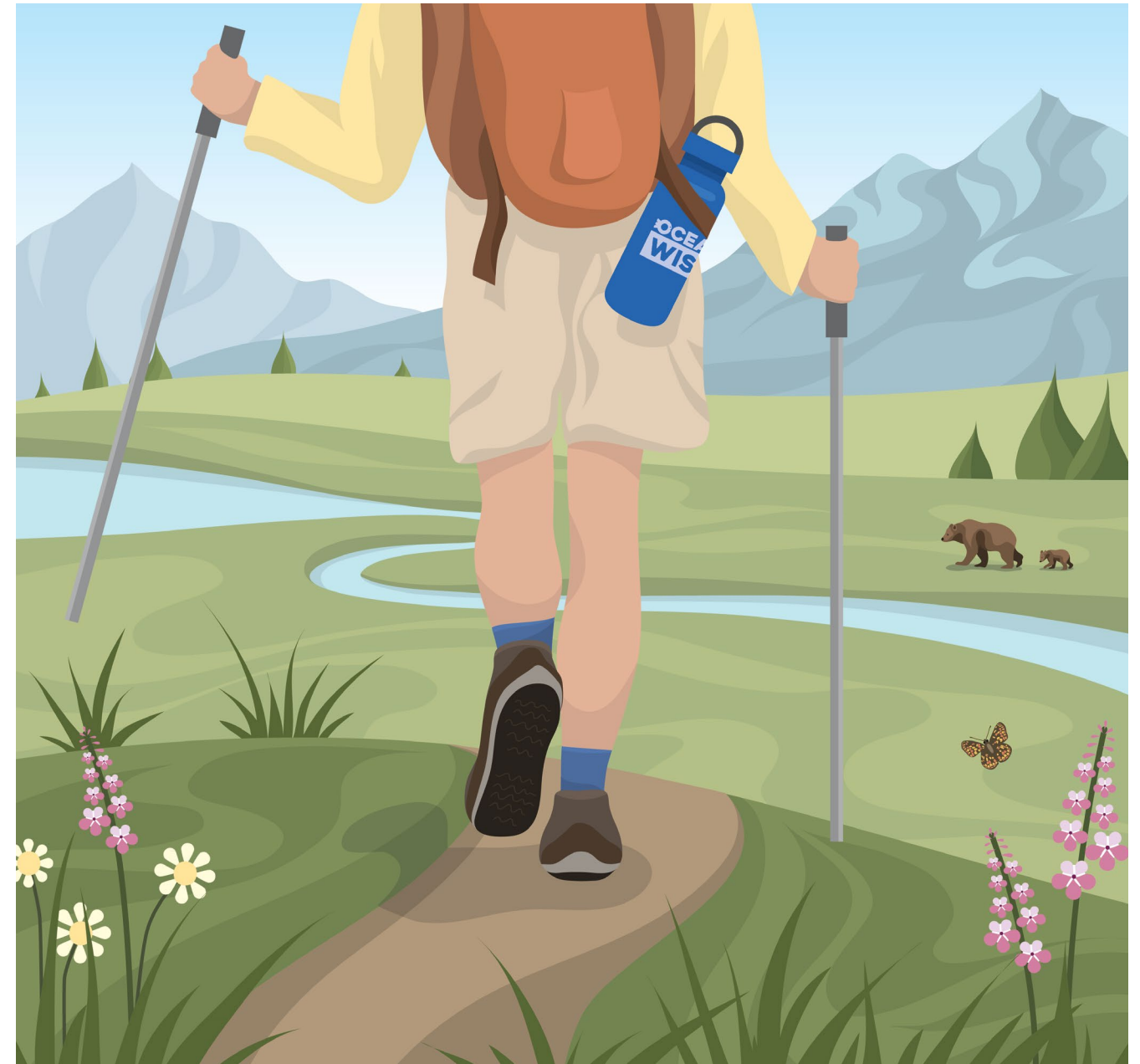
TAKE ACTION



Reduce your consumption of plastics! Buy a glass or stainless-steel water bottle, a cotton and non-woven polypropylene grocery bag, a bamboo toothbrush, or better yet, re-use items you already have at home!

THE WHY?

By reducing the amount of plastic you purchase, whether that be single use or multi-use, you are no longer supporting the plastic life cycle which contributes to climate change from start to finish. More specifically, you are preventing your consumer habits from contributing to oil production and fracking, the production of petrochemical byproducts, incineration of plastics, the overwhelming of landfills and recycling centers from plastics, and environmental pollution.



Lesson 6

Cleanup Your Shoreline for a Cleaner Ocean





ACTIVITIES



Ocean Wise | Shoreline Cleanup

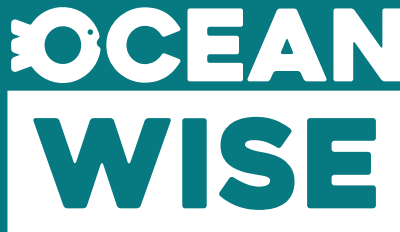
1 a) In the table below, write down some of the *Dirty Dozen* items you use on a weekly basis and come up with a non-plastic alternative for each.

Dirty Dozen Item	Non-Plastic Alternative

b) For one of the dirty dozen items, create a non-plastic alternative which may not be on the market yet. When doing so, you may want to consider some of the disadvantages of the non-plastic alternatives you have listed.



2 Record the different types of garbage you observed and collected during the garbage clean up in the data card below.



SHORELINE CLEANUP
Presented by Loblaw Companies Limited


Individual Data Card

SITE INFORMATION:


Cleanup Site Name	Cleanup Date	
<input style="width: 90%;" type="text"/>	<input style="width: 90%;" type="text"/>	
Site Coordinator	Distance Cleaned (KM)	
<input style="width: 90%;" type="text"/>	<input style="width: 90%;" type="text"/>	
Total Weight (KG)	# of Garbage Bags	# of Recycling Bags
<input style="width: 90%;" type="text"/>	<input style="width: 90%;" type="text"/>	<input style="width: 90%;" type="text"/>
# of Volunteers Working On This Card	Most Unusual Item	
<input style="width: 90%;" type="text"/>	<input style="width: 90%;" type="text"/>	

Citizen scientists: Pick up all litter that you find and record data only for the items listed on the back. Please do not use words or check marks. Only numbers are useful. Please return this card to the Site Coordinator when complete.



EXAMPLE:

Plastic Bags:		TOTAL #
	=	8

PRESENTING SPONSOR



NATIONAL SPONSORS

Trash Collected

<p>MOST LIKELY TO FIND ITEMS:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="width: 20%; text-align: right;">TOTAL #</td> </tr> <tr><td>Cigarette Butts:</td><td style="text-align: right;">=</td></tr> <tr><td>Beverage Cans:</td><td style="text-align: right;">=</td></tr> <tr><td>Bottle Caps:</td><td style="text-align: right;">=</td></tr> <tr><td>Coffee Cups and Lids:</td><td style="text-align: right;">=</td></tr> <tr><td>Food Containers: <small>(i.e. yogurt or snack cups, milk containers)</small></td><td style="text-align: right;">=</td></tr> <tr><td>Food Wrappers:</td><td style="text-align: right;">=</td></tr> <tr><td>Glass Bottles:</td><td style="text-align: right;">=</td></tr> <tr><td>Paper:</td><td style="text-align: right;">=</td></tr> <tr><td>Plastic Bags:</td><td style="text-align: right;">=</td></tr> <tr><td>Plastic Bottles:</td><td style="text-align: right;">=</td></tr> <tr><td>Plastic Cups:</td><td style="text-align: right;">=</td></tr> <tr><td>Six Pack Holders:</td><td style="text-align: right;">=</td></tr> <tr><td>Straws:</td><td style="text-align: right;">=</td></tr> <tr><td>Takeout Containers:</td><td style="text-align: right;">=</td></tr> <tr><td>Utensils:</td><td style="text-align: right;">=</td></tr> </table> <p>TOP 3 ADDITIONAL ITEMS: <small>Identify the top 3 items found that are not listed on the card</small></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="width: 20%; text-align: right;">TOTAL #</td> </tr> <tr><td>1:</td><td style="text-align: right;">=</td></tr> <tr><td>2:</td><td style="text-align: right;">=</td></tr> <tr><td>3:</td><td style="text-align: right;">=</td></tr> </table>		TOTAL #	Cigarette Butts:	=	Beverage Cans:	=	Bottle Caps:	=	Coffee Cups and Lids:	=	Food Containers: <small>(i.e. yogurt or snack cups, milk containers)</small>	=	Food Wrappers:	=	Glass Bottles:	=	Paper:	=	Plastic Bags:	=	Plastic Bottles:	=	Plastic Cups:	=	Six Pack Holders:	=	Straws:	=	Takeout Containers:	=	Utensils:	=		TOTAL #	1:	=	2:	=	3:	=	<p>FISHING GEAR:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="width: 20%; text-align: right;">TOTAL #</td> </tr> <tr><td>Fishing Buoys, Pots or Traps:</td><td style="text-align: right;">=</td></tr> <tr><td>Fishing Net and Line:</td><td style="text-align: right;">=</td></tr> <tr><td>Rope (1 metre = 1 piece):</td><td style="text-align: right;">=</td></tr> </table> <p>PRODUCT PACKAGING</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="width: 20%; text-align: right;">TOTAL #</td> </tr> <tr><td>Soft Plastic Packaging:</td><td style="text-align: right;">=</td></tr> <tr><td>Rigid Bottles and Jugs:</td><td style="text-align: right;">=</td></tr> </table> <p>PERSONAL HYGIENE:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="width: 20%; text-align: right;">TOTAL #</td> </tr> <tr><td>Diapers, Wipes, Tampons, Condoms:</td><td style="text-align: right;">=</td></tr> <tr><td>Syringes:</td><td style="text-align: right;">=</td></tr> <tr><td>Personal Protective Equipment: <small>(i.e. gloves, masks)</small></td><td style="text-align: right;">=</td></tr> </table> <p>TINY TRASH LESS THAN 2.5 CM:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="width: 20%; text-align: right;">TOTAL #</td> </tr> <tr><td>Styrofoam Pieces:</td><td style="text-align: right;">=</td></tr> <tr><td>Plastic Pieces:</td><td style="text-align: right;">=</td></tr> </table> <p>OTHER TRASH:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="width: 20%; text-align: right;">TOTAL #</td> </tr> <tr><td>Balloons:</td><td style="text-align: right;">=</td></tr> <tr><td>Clothing, Shoes:</td><td style="text-align: right;">=</td></tr> <tr><td>Construction Materials:</td><td style="text-align: right;">=</td></tr> <tr><td>Large Styrofoam:</td><td style="text-align: right;">=</td></tr> <tr><td>Tires:</td><td style="text-align: right;">=</td></tr> <tr><td>Toys:</td><td style="text-align: right;">=</td></tr> </table>		TOTAL #	Fishing Buoys, Pots or Traps:	=	Fishing Net and Line:	=	Rope (1 metre = 1 piece):	=		TOTAL #	Soft Plastic Packaging:	=	Rigid Bottles and Jugs:	=		TOTAL #	Diapers, Wipes, Tampons, Condoms:	=	Syringes:	=	Personal Protective Equipment: <small>(i.e. gloves, masks)</small>	=		TOTAL #	Styrofoam Pieces:	=	Plastic Pieces:	=		TOTAL #	Balloons:	=	Clothing, Shoes:	=	Construction Materials:	=	Large Styrofoam:	=	Tires:	=	Toys:	=
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Diapers, Wipes, Tampons, Condoms:	=																																																																																		
Syringes:	=																																																																																		
Personal Protective Equipment: <small>(i.e. gloves, masks)</small>	=																																																																																		
	TOTAL #																																																																																		
Styrofoam Pieces:	=																																																																																		
Plastic Pieces:	=																																																																																		
	TOTAL #																																																																																		
Balloons:	=																																																																																		
Clothing, Shoes:	=																																																																																		
Construction Materials:	=																																																																																		
Large Styrofoam:	=																																																																																		
Tires:	=																																																																																		
Toys:	=																																																																																		

Thank you for contributing to trash free shorelines.

[#teamshoreline](#)
 /shorelinecleanup
 @shorelinecleanup
 @cleanshorelines

THOUGHTBOOK

Shoreline cleanups are a powerful environmental remediation and conservation tool. Reflect on how you can bring shoreline cleanups to your local community and make a difference!

REFLECT

1. How does taking direct action to protect the environment benefit the environment and yourself?



2. How can you influence the state of the environment and the lives of the people who rely on it, including yourself?

3. How can direct action, especially shoreline cleanups, help and be informed by Traditional Ecological Knowledge?



TAKE ACTION



Take part in an [Ocean Wise Shoreline Cleanup](#) with your classmates or within your community!

THE WHY?

So far, Ocean Wise’s shoreline cleanups have removed 13,915kg of litter from coastlines in Canada and the United States. That’s the equivalent of 700 killer whales! Shoreline cleanups have prevented plastics from entering marine ecosystems, reducing fatal impacts on thousands of species, such as the hawksbill sea turtle. Since plastics travel with ocean currents around the world, by participating in a shoreline cleanup, you are directly contributing to the removal of plastics in every ocean and shoreline around the world!



WHAT IS OCEAN WISE?

Ocean Wise is a non-profit organization whose mission is to empower communities and individuals to take action to protect and restore our world's ocean.

Ocean Wise does this by tackling three critical ocean challenges - climate change, overfishing and plastic pollution – through six intersecting initiatives: seaforestation, changing arctic, plastics, fisheries and seafood, youth, and whales. Through our work we make a real and measurable difference to the health and well-being of the ocean and the people who depend on it. You can learn more about the actions you can take at ocean.org.

Looking for more Ocean education?

Ocean Wise's Education team offers in-person mobile education opportunities, online virtual programs, and more. Ocean Wise's Professional Development Workshops are designed to train educators on discussing ocean health and literacy for students K-12. Visit ocean.org or email education@ocean.org to learn more.

Follow us on Social Media

IG: [@oceanwise](https://www.instagram.com/oceanwise), FB: [@oceanwise](https://www.facebook.com/oceanwise), TW: [@oceanwise](https://twitter.com/oceanwise), LK: [@oceanwise](https://www.linkedin.com/company/oceanwise)

Sign up for our [newsletter](#).

Have feedback? We would love to hear from you!

Please take 4 minutes to [rate us](#).

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Waves of Change

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