



**OCEAN
WISE**

Ocean Plastics Education Kit

EDUCATOR'S GUIDEBOOK

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

NOTE TO EDUCATORS

CURRICULUM LINKS

GLOSSARY

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
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WHEEL, DRIVING
THROUGH OCEAN
CURRENTS**

LESSON 5
**PLASTICS AND
CLIMATE CHANGE, A
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LESSON 6
**CLEANUP YOUR
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REFERENCES

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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^wəy^əm (Musqueam), Sk_wx_wú7mesh (Squamish), and sə́ilwətaʔɬ (Tseil-Waututh) peoples.

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INTRODUCTION

The Earth's Ocean is a large interconnected system that is vital for every living thing on earth. Without our ocean, we wouldn't exist. It produces 50% to 80% of the oxygen we breathe, regulates and controls climate, weather, and temperature, sequesters and absorbs roughly 40% of the carbon dioxide produced by human activities, and provides one billion people with their main source of protein being seafood. There is no mystery as to why we cannot live without our ocean.

In the early 20th century, chemists created plastic, a synthetic polymer which could take any shape that humans desired. From then on, plastics would impact human life and the environment forever - especially the ocean. As it took over the world of consumer goods, plastic rapidly accumulated in landfills and eventually reached our ocean. Today, approximately 13 million tons of plastic enters the ocean on an annual basis, which has resulted in there being more pieces of plastic in our ocean than there are stars in our galaxy.¹ And just to put things into perspective, there are about 100 thousand million stars in the Milky Way! With 400 million tons of plastic produced every year, of which 36% is designed for single use or packaging, and only 9% of which is recycled, it is inevitable that plastics are polluting our ocean.^{2,3} Additionally, as plastic enters marine environments it never disappears or decomposes. Instead, plastic breaks up into smaller

pieces, known as microplastics. These are then consumed by zooplankton, contaminating the food chain. There are over 800 marine and coastal species impacted by plastic pollution without counting other species who are indirectly affected, like humans, who eat fish whose food chain is contaminated by plastic pollution.⁴

With plastic being a pillar for modern day life, it is going to take a deep, transformational change in humanity's consciousness and behaviors regarding plastic and our ocean to turn the tables and prevent plastic from harming ocean health. At Ocean Wise, we know this is possible. It starts with youth becoming aware of the interconnectedness of our lives and the ocean, the environmental impact of their consumer choices, and the role they hold in protecting the ocean. By merging our expertise in climate change education and the research of Ocean Wise's conservation teams, we aim to do just that. For over 50 years we have dedicated our work to ocean conservation and education guided by the international community, including the Sustainable Development Goals (SDG) of the United Nations and the International Union of Conservation for Nature (IUCN). Informed by recognized science and climate change pedagogies, these lessons aim to guide youth to become leaders of change by educating, equipping, and empowering them to become ocean champions and plastic reduction ambassadors.



NOTE TO EDUCATORS

Each lesson follows the same format throughout the kit with critical questions and reflections built into the **activities** section.

The kit follows the overarching theme of **interconnectedness**, integrating decolonization practices with scientific conservation and Indigenous knowledge. The thought book component prompts students to journal on interconnectedness and consider its connection to each lesson's focus. Through reflection students will consider their role in decolonization and climate action so that they are encouraged to be changemakers within their community.

Each lesson ends with ways to **take action**. We invite educators and students to create their own actions. We acknowledge that those provided may not be accessible or applicable to all. We recognize that individual action should be coupled with systemic change. We aim to empower students through active approaches and creative problem solving that address individual or smaller-scale behavioral change, but also through actions that can positively influence large systemic issues.

Finally, Ocean Wise thanks you for promoting climate change education, social justice, and Indigenous knowledge in your classroom. By doing so, you are providing a unique skill set to the future leaders of the world, allowing them to be better prepared to deal with environmental issues, including plastic pollution. Today you are the leader, guiding our youth towards a cleaner and more sustainable future.

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CURRICULUM LINKS

The table below illustrates curriculum connections, outlining the Big Ideas in a variety of courses and detailing which lessons are connected to which Big Ideas. Please note that although this resource is developed with a focus on aligning to the BC curriculum, there exists a lot of overlap across provincial curricula and lesson activities possess room for interpretation so different curriculum objectives can be met, making this kit applicable throughout Canada.

LESSON 1
Science 9, Social Studies 9, Social Studies 10, Environmental Science 11, Chemistry 11, Specialized Science 12, B.C. First Peoples 12, Economics 12, Engineering 12

LESSON 2
Science 9, Social Studies 9, Applied Design, Skills, and Technologies 9, English Language Arts 9, Social Studies 10, Composition 10, Technology Explorations 10, Science for Citizens 11, Environmental Science 11, Earth Sciences 11, Exploration in Social Studies 11, Composition 11, Engineering 11, Specialized Science 12, Environmental Science 12, Contemporary Indigenous Studies 12, B.C. First Peoples 12, Social Justice 12, Human Geography 12, Economics 12, Engineering 12

LESSON 3
Science 9, Social Studies 9, Social Studies 10, Science for Citizens 1, Environmental Science 11, Exploration in Social Studies 11, Specialized Science 12, Environmental Science 12, Anatomy and Physiology 12, Contemporary Indigenous Studies 12, B.C. First Peoples 12, Social Justice 12, Human Geography 12

LESSON 4
Science 9, Social Studies 9, Science 10, Social Studies 10, Science for Citizens 11, Environmental Science 11, Earth Science 11, Exploration in Social Studies 11, Specialized Science 12, Environmental Science 12, Contemporary Indigenous Studies 12, B.C. First Peoples 12, Social Justice 12, Human Geography 12

LESSON 5
Science 9, Social Studies 9, Science 10, Social Studies 10, Science for Citizens 11, Environmental Science 11, Chemistry 11, Earth Science 11, Exploration in Social Studies 11, Environmental Science 12, Contemporary Indigenous Studies 12, B.C. First Peoples 12, Social Justice 12, Physical Geography 12, Industrial Coding and Design 12, Engineering 12

LESSON 6
Social Studies 9, Social Studies 10, Science for Citizens 11, Environmental Science 11, Exploration in Social Studies 11, Environmental Science 12, Contemporary Indigenous Studies 12, B.C. First Peoples 12, Social Justice 12, Human Geography 12

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GRADE	SUBJECT	BIG IDEAS	CONNECTED LESSON(S)
9	Science	The electron arrangement of atoms impacts their chemical nature.	1
		The biosphere, geosphere, hydrosphere, and atmosphere are interconnected, as matter cycles and energy flows through them.	2, 3, 4, and 5
	Social Studies	Emerging ideas and ideologies profoundly influence societies and events.	1, 2, 3, 4, and 6
		The physical environment influences the nature of political, social, and economic change.	1, 2, 4, 5, and 6
	Applied Design, Skills, and Technologies	Social, ethical, and sustainability considerations impact design.	2
English Language Arts	Language and story can be a source of creativity and joy.	2	
10	Science	Energy is conserved and its transformation can affect living things and the environment.	4 and 5
	Social Studies	Worldviews lead to different perspectives and ideas about developments in Canadian society.	1, 2, 3, 4, 5, and 6
		Historical and contemporary injustices challenge the narrative and identity of Canada as an inclusive, multicultural society.	1, 2, 4, 5, and 6
	Composition	Engagement with writing processes can support creativity and enhance clarity of expression.	2
	Technology Explorations	Social, ethical, and sustainability considerations impact design.	2

GRADE	SUBJECT	BIG IDEAS	CONNECTED LESSON(S)
11	Science For Citizens	Scientific understanding enables humans to respond and adapt to changes locally and globally.	2, 3, 4, 5, and 6
		Scientific processes and knowledge inform our decision and impact our daily lives.	2, 3, 4, 5, and 6
	Environmental Science	Humans can play a role in stewardship and restoration of ecosystems.	1, 2, 3, 4, 5, and 6
		Human practices affect the sustainability of ecosystems.	1, 2, 3, 4, 5, and 6
		Complex roles and relationships contribute to diversity of ecosystems.	3 and 4
		Changing ecosystems are maintained by natural processes.	4
	Chemistry	Atoms and molecules are the building blocks of matter.	1
		Organic chemistry and its application have significant implications for human health, society, and the environment.	5
	Earth Sciences	The distribution of water has a major influence on weather and climate.	2 and 4
		The transfer of energy through the atmosphere creates weather, and this transfer is affected by climate change.	5
	Exploration in Social Studies	Indigenous peoples are reclaiming mental, emotional, physical, and spiritual well-being despite the continuing effects of colonialisms.	3, 4, and 6
		Understanding the diversity and complexity of cultural expressions in one culture enhances our understanding of other cultures.	2, 3, 4, 5, and 6
	Composition	Engagement with writing processes can support creativity and enhance clarity of expression.	2
	Engineering	Tools and technologies can be adapted for specific purposes.	2

GRADE	SUBJECT	BIG IDEAS	CONNECTED LESSON(S)
12	Specialized Science	Biodiversity is dependent on the complex interactions and processes between biotic and abiotic factors.	2, 3, and 4
		Chemical reactions are due to energy changes that result from the breaking and re-formation of bonds.	1
	Environmental Science	Living sustainably supports the well-being of self, community, and Earth.	2, 3, 4, 5, and 6
		Sustainable land use is essential to meet the needs of a growing population.	6
		Human activities cause changes in the global climate system.	5
		Human actions affect the quality of water and its ability to sustain life.	2, 3, 4, and 6
	Anatomy and Physiology	Organ systems have complex interrelationships to maintain homeostasis.	3
	Contemporary Indigenous Studies	Indigenous peoples are reclaiming mental, emotional, physical, and spiritual well-being despite the continuing effects of colonialism.	2, 3, 4, and 6
		Reconciliation requires all colonial societies to work together to foster healing and address injustices.	3, 4, and 6
		The identities, worldviews, and languages of indigenous peoples are renewed, sustained, and transformed through their connection to land.	2, 3, 4, 5, and 6
	B.C. First Peoples	The impacts of contact and colonialism continues to affect the political, social, and economic lives of B.C. First Peoples.	1, 2, 3, 4, 5, and 6
		Cultural expressions convey the richness, diversity, and resiliency of B.C. First Peoples.	2, 3, 4, 5, and 6
		The identities, worldviews, and languages of B.C. First Peoples are renewed, sustained, and transformed through their connection to the land.	2, 3, 4, and 6
	Social Justice	Individual worldviews shape and inform our understanding our understanding of social justice issues.	2, 3, 4, 5, and 6
		Social justice initiatives can transform individuals and systems.	6

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GRADE	SUBJECT	BIG IDEAS	CONNECTED LESSON(S)
12	Physical Geography	Interactions between human activities and the atmosphere affect local and global weather and climate.	5
	Human Geography	Human activities alter landscapes in a variety of ways.	2, 3, 4, and 6
	Industrial Coding and Design	Design for the life cycle includes consideration of social and environmental impacts.	5
	Economics	Tools and technologies can be adapted for a specific purpose.	1 and 2
	Engineering 12	Design for the life cycle includes consideration of social and environmental impacts.	1, 2, and 5

GLOSSARY

BIODIVERSITY

The variety and variability of life on a genetic, species, and ecosystem level.

CARBON SINK

Anything that absorbs more carbon from the atmosphere than it releases.

ECOSYSTEM

All organisms and the physical environment which they interact with.

FRACKING

The fracturing of bedrock by liquid pressure. Most often used to obtain natural gasses.

MICROFIBER

Synthetic fiber/microplastic that typically has a diameter of less than 10 micrometers.

MICROPLASTICS

Synthetic fiber/microplastic that typically has a diameter of less than 10 micrometers.

TRADITIONAL ECOLOGICAL KNOWLEDGE (TEK)

Refers to Indigenous and other traditional knowledge, practices, and beliefs concerning the relationship of humans and local resources.

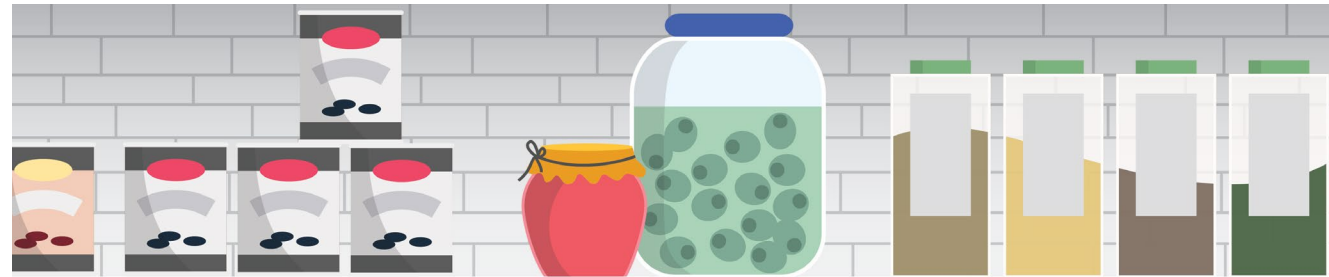
ZOOPLANKTON

Animals part of the plankton community that are so small they cannot swim and instead drift with ocean currents. They typically occupy lower levels of the food chain.

Lesson 1

The History Of Plastics





BACKGROUND

Since the beginning of time, humans have made objects and goods from materials naturally occurring in the environment. Between wood, rock, animal bones, and shells, the natural materials available to humans were countless. However, in 1907, after years of research in the manipulation of synthetic polymers, Leo Baekeland created the first synthetic plastic, changing the way we live. As chemical companies began to invest in the production of synthetic plastics, people no longer found the need to put hard work and money into the creation of goods from natural materials when cheap, durable, malleable, and multipurpose plastics could be used instead.⁵

When World War II began and natural resources became scarce, the production of synthetic materials, predominantly plastic, became a priority leading to a 300% rise in the production of plastic in the USA!⁵ As plastic was being manipulated during production, people soon discovered the endless possibilities that plastic provided as it could essentially be shaped into whatever humans desired. As plastics infiltrated the market and were transformed into products, they were almost always favored by consumers over their more expensive and intricate traditional material counterparts.

However, the untarnished reputation of plastic didn't last long. The same chemical properties that make plastic durable and useful also make it nearly impossible to dispose of. With most plastics taking thousands of years to decompose, our landfills rapidly became overwhelmed.⁶ Soon after, in the late 20th century, plastics were invading areas other than landfills like rivers, forests, and the ocean, harming both animals and humans. Since then, the reputation of plastic has suffered, and people, organizations, companies, and governments have become increasingly aware of the environmental impacts of this material. Nonetheless, despite the mistrust most of society has towards plastic, it remains a pillar of modern life.

STUDENTS WILL BE ABLE TO:

- Clearly understand the history and composition of plastics.
- Create an introductory understanding relating to the environmental impacts of plastics.
- Deepen their understanding of the omnipresence of plastics.

CRITICAL QUESTIONS:

- What makes plastics such a unique and useful material?
- Why have plastics become so prevalent in the world of consumer goods?
- What makes plastics such a powerful threat to the environment and Indigenous culture?

RESOURCES:

Watch ▶ [Plastic. The good, the bad and the ugly by Ocean Wise](#)

Watch ▶ [Plastics and Polymers Film by Royal Society of Chemistry](#)

Read ▶ [Plastic: It's Not All The Same by Plastic Oceans](#)

Watch ▶ [The Story of Plastic by The Story of Stuff Project](#)

Read ▶ [Trade Goods of The Fur Trade by The Canadian Encyclopedia](#)

ADDITIONAL RESOURCES:

Read For Educators ▶ [Weaving Traditional Ecological Knowledge into Biological Education: A Call to Action by Robin Wall Kimmerer](#)

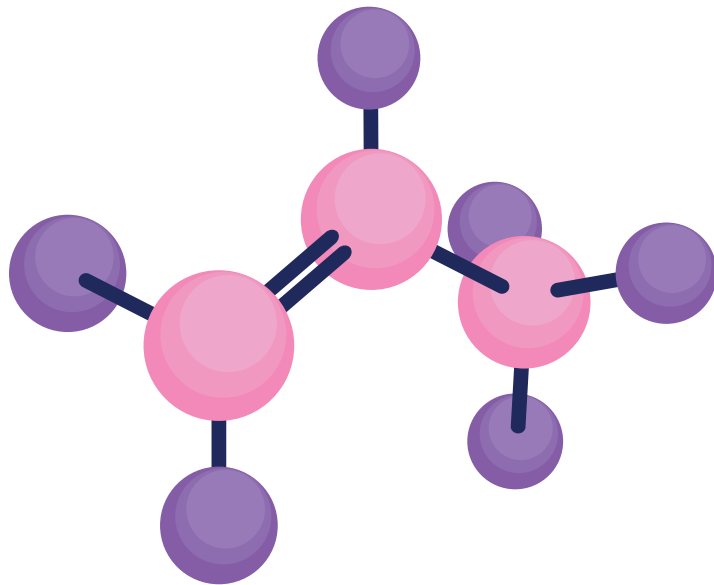
Visit ▶ [The Life Cycle of Plastics by WWF](#)

Watch ▶ [8 Incredible Inventions of The Indigenous Peoples of America by HISTORY](#)



ACTIVITIES

- 1 a) As a class, watch [Plastics and Polymers Film by The Royal Society of Chemistry](#). Task students with reading [Plastic: It's Not All The Same by Plastic Oceans](#). In their workbooks, students should identify the polymers illustrated and list some of their chemical and physical properties.
- b) Ask students to find plastic products or waste items in their surroundings that are composed of each polymer illustrated. Each plastic object they find should be recorded in their workbook under the appropriate polymer.



- 2 a) Task students with reading [Trade Goods of The Fur Trade by The Canadian Encyclopedia](#). After their independent reading, call on students to write on the board some of the fur trade goods mentioned. Each student should select a fur trade good to answer the questions in their workbook. Note that independent research may be required for this activity.
- b) Discuss with students their research findings. Refer to the guiding questions below during the discussion.

Guiding Questions:

- What is the historical relationship between Indigenous peoples and the colonizers? How did the trading of goods benefit the colonizers?
- Why did colonizers eventually change the way trade goods were made?
- How did changing the way trade goods were made harm Indigenous culture, Traditional Ecological Knowledge, and the environment?

- 3 a) As a class, watch [The Story of Plastic by The Story of Stuff Project](#). Discuss with students what surprised them the most about the video and take notes of their comments on the board. Refer to the guiding questions below.

Guiding Questions:

- How many students were aware that most plastics can only be recycled once?
- How may this video have changed your opinion on the efficiency of recycling facilities?
- Why do you think plastic producing corporations would push plastic products onto developing countries?
- Why would first world countries export their plastic waste to developing countries? Is this fair to developing countries?

- b) Watch [Plastic. The good, the bad and the ugly by Ocean Wise](#) and answer the questions in the video. We encourage pausing the video so students can have the opportunity to discuss as a class or reflect on potential answers.

THOUGHTBOOK



REFLECT

1. What makes plastics such a unique and useful material?
2. Why have plastics become so prevalent in the world of consumer goods?
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





BACKGROUND

Water is everywhere! Sixty percent of our body is water, it covers 71% of the Earth's surface, and 97% of it is found in the ocean. There are five major ocean basins around the world which are all interconnected, forming one large world ocean. But how does all this water end up in the ocean? In the hydro-cycle, rain, rivers, streams, and groundwater are responsible for filling the ocean with water, which proceeds to flow around the globe with the movement of the waves, tides, and rotation of the earth.

With water covering such a large area of the globe and entering the ocean from a variety of sources, it inevitably interacts with one of the most dominant forms of pollution on Earth... plastic. However, with the rise of plastic production and consumption, we

aren't just finding plastic in our ocean... but rather, plastic is becoming our ocean! Every year, 13 million tons of plastic enters our ocean in different ways. And today, there are more pieces of plastic in our ocean than there are stars in our galaxy.⁷ This demonstrates that far too much plastic is traveling to the ocean.

Additionally, plastic pollution disproportionately harms Indigenous communities and is infiltrating the natural ecosystems that sustain their traditional way of life.⁸ Indigenous peoples are already fighting to sustain and cultivate their Traditional Ecological Knowledge in the face of many other environmental pressures. Plastic pollution is further complicating these issues and making them more challenging.

STUDENTS WILL BE ABLE TO:

- Understand how plastic goods become ocean pollutants.
- Understand how plastics move across biospheres and end up in the ocean.
- Develop a meaningful connection to the adverse impacts Indigenous communities face from plastic pollution.

CRITICAL QUESTIONS:

- How might a plastic bag, straw, or cup make its way from your school to the ocean?
- What are the different ways we can prevent plastic from reaching the ocean?
- In what ways can Traditional Ecological Knowledge (TEK) be applied to better understand the impacts and solutions to the world's plastic problems?

RESOURCES:

Watch ▶ [Yukon Ikaarvik by Ocean Wise](#)

Visit ▶ [Ocean Wise's Plastic Lab](#)

Watch ▶ [What Really Happens to Plastic When You Throw It Away by TED Ed](#)

Read ▶ [How Does Plastic End-Up in The Ocean by WWF](#)

Read ▶ [Inuit Researchers Are on The Lookout for Migrating Microplastics by The Narwhal](#)

Watch ▶ [How to Stop Plastic Getting into The Ocean by The Economist](#)



ACTIVITIES

- 1 a) After a class viewing of [What Really Happens to Plastic When You Throw it Away by TED Ed](#), divide the class into small groups and task them with discussing the possible journeys of plastics from a place they know to the ocean.

b) Individually or in teams, task students with composing a creative literary piece. The plot of their story should describe a piece of plastic which becomes an ocean pollutant as it travels to the ocean. Encourage students to explore different literary styles including songs, poetry, short stories, plays, comic strips, etc. Their story should include one of the three ways plastic ends up in the ocean described in [How Does Plastic End-Up in The Ocean by WWF](#).
- 2 a) As a class, watch [How to Stop Plastic Getting Into the Ocean by The Economist](#). Organizing students in teams, offer them a stack of post-its to do a rapid brainstorm session on innovative alternatives to single use plastics.

b) Imagine that your class had access to lots of different resources and support from government, scientists, Indigenous communities, and companies from around the world. What would you do to help solve the plastic crisis? Task students with creating a system that will help solve the plastic crisis. Encourage students to conduct research and refer to traditional ecological knowledge concepts. Their inspiration and thought process should be detailed in their workbook.
- 3 Read [Inuit Researchers Are on The Lookout For Migrating Microplastics by The Narwhal](#) and watch [Yukon Ikaarvik by Ocean Wise](#). Discuss ways that plastic pollution interferes with Inuit Traditional Ecological Knowledge (TEK), including how pollution would impact their cultural ways of life (hunting, fishing, etc.).

THOUGHTBOOK



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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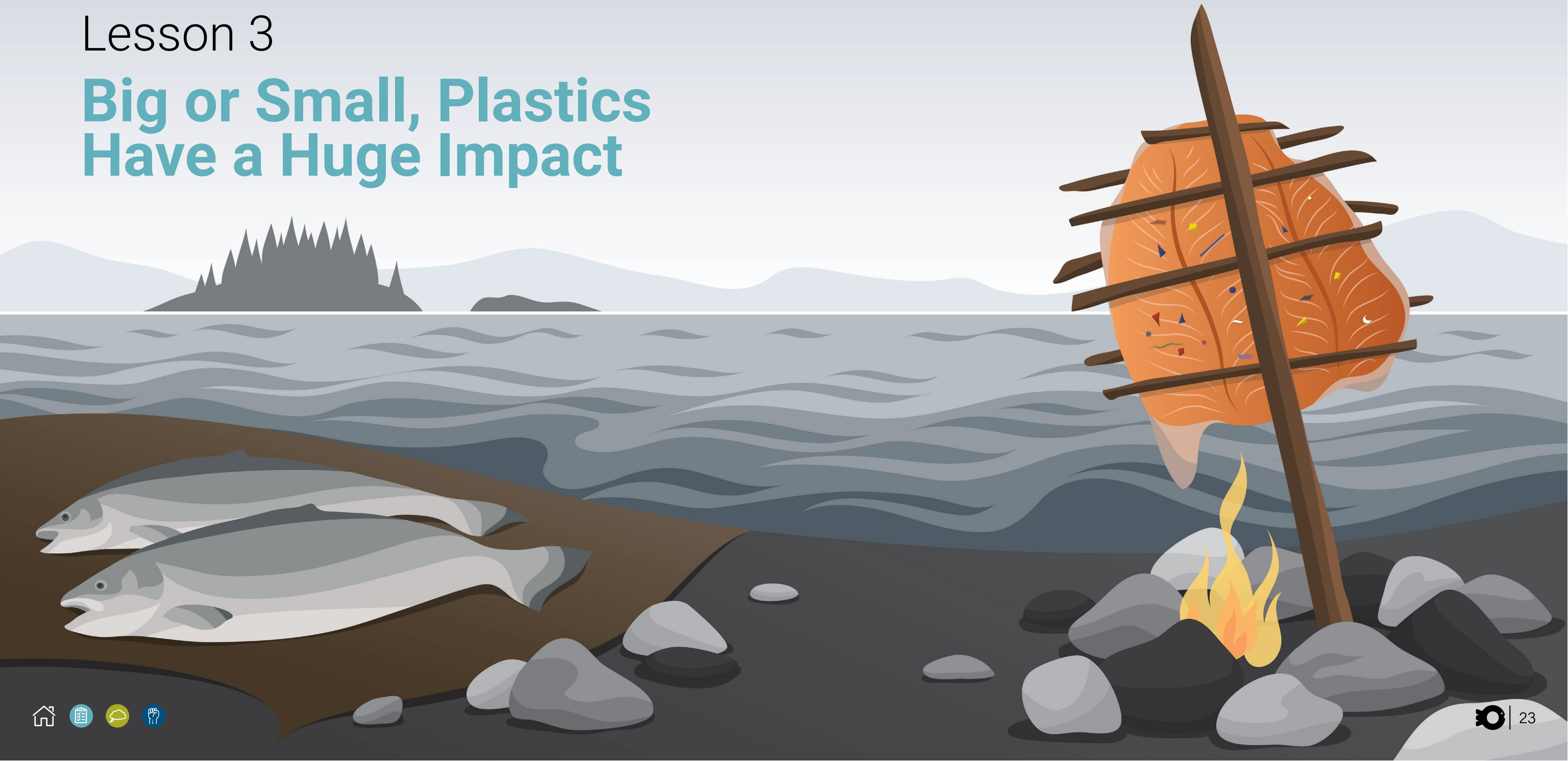
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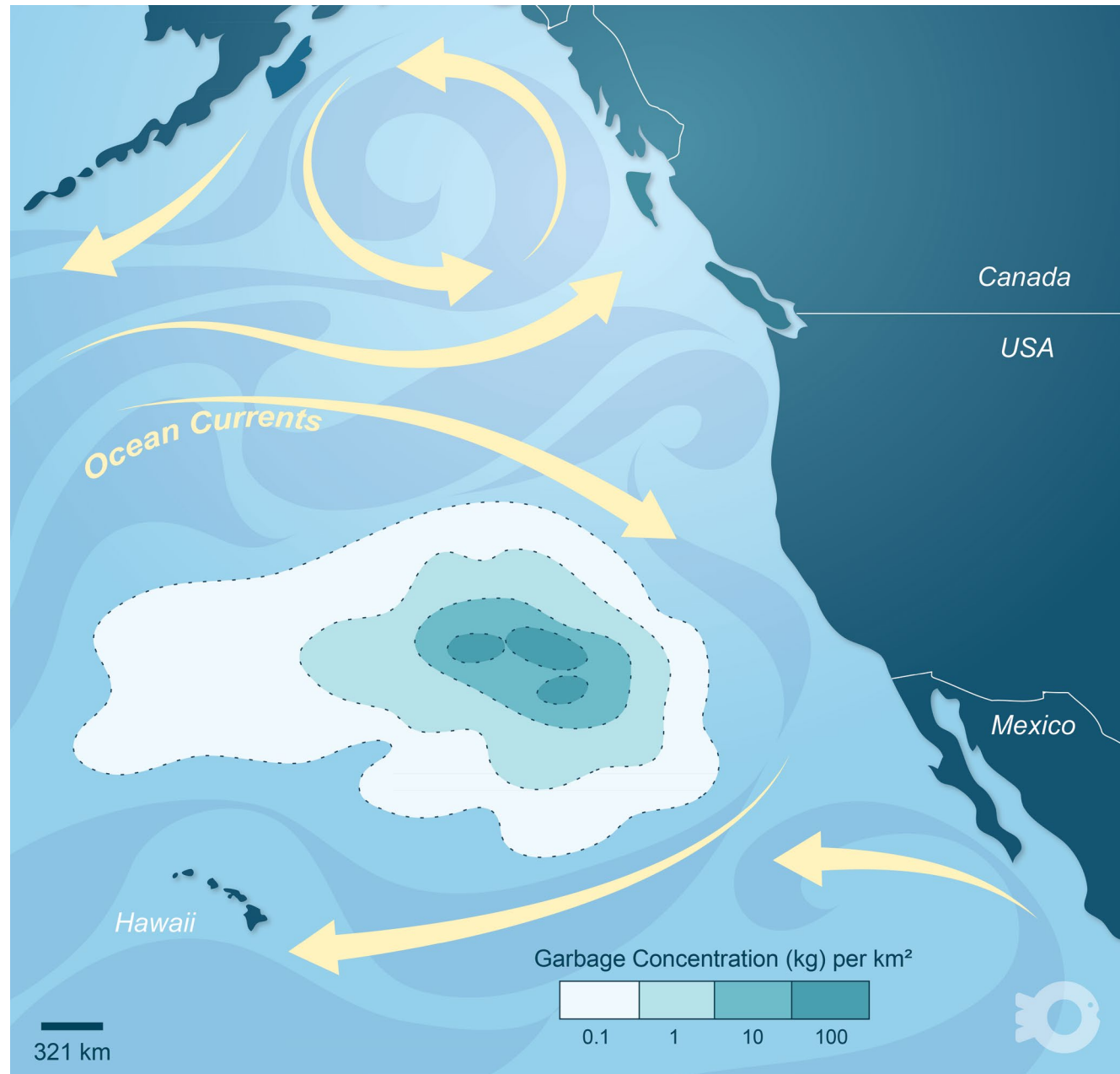
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Lesson 3

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BACKGROUND

Ocean ecosystems are diverse and defined by varying environmental factors including available oxygen, nutrients, salinity, temperature, pH, light, pressure, substrate, and circulation. Ocean organisms ranging from microbes and invertebrates to fishes, marine mammals, plants, and sea birds have adapted to these environmental factors. Ocean ecosystems are interconnected and impacted by environmental factors, and recently a new factor has been added to the list... plastic pollution.

Not all plastics are the same, they can have different chemical compositions, shapes, and especially, sizes. There are two broad classifications of plastic sizes: 1) Macroplastics, which are relatively large pieces of plastic greater than 5 mm in length. This can include items like water bottles, water bottle caps, plastic bags, etc.⁹ And 2) Microplastics, which are small fragments, sheets, fibers, pellets, and granules, less than 5 mm in length and typically are residue of a fragmented macroplastic since plastic doesn't decompose but breaks up into smaller and smaller pieces.⁹

Both macro- and microplastics can be found throughout the ocean, and while they both threaten the health of the environment, microplastics are much more pervasive, leading to more extensive impacts. For example, Ocean Wise research has shown that species of zooplankton are taking preference for algae look-alike micro-fibers over their typical diet. This highlights the vulnerability of ocean food webs as microplastics contaminate food chains and bioaccumulate in higher trophic level species which are targets for Indigenous, commercial, and recreational fisheries. In other words, by producing plastic litter, we are enabling plastic to enter our bodies from the seafood we eat as we too are members of the ocean food web. The best way to reduce this harm to humans, animals, and other organisms is to remove plastic and other litter in and around our waterways or, even better, to prevent it from getting there in the first place!

STUDENTS WILL BE ABLE TO:

- Differentiate microplastics from macroplastics based on their physical characteristics and environmental impacts.
- Create an understanding of the detrimental impacts related to the pervasiveness of microplastics.
- Develop a personal connection to how plastic pollution negatively impacts ocean health.

CRITICAL QUESTIONS:

- What are the various ways that plastic impacts animals and ecosystems in our ocean?
- How do microplastics pose a more extensive and widespread threat to the environment and humans than do macroplastics?
- What are meaningful and equitable ways to reduce and remediate plastic pollution around the world?

RESOURCES:

Read ▶ [Smart Wash Cycle Design Can Reduce Microfiber Shedding Report by Ocean Wise](#)

Watch ▶ [Why 99% of Plastic Pollution is Missing by VOX](#)

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

Watch ▶ [Bioaccumulation and Biomagnification: Increasingly Concentrated Problems by Catalina Island Marine Institute](#)

Watch ▶ [Australian Herring Dissection by Marine Waters – DPIRD](#)

Watch ▶ [The Oceans Are Life by Canada's C3](#)

ADDITIONAL RESOURCES:

Read ▶ [Microplastics Have Found Their Way Into Our Compost by Ocean Wise](#)

Read ▶ [Researchers Find Microplastics in Nearly Every Sample Taken in The Eastern Canadian Arctic by Canadian Geographic](#)

Watch ▶ [Microplastics, Too Small to See, Too Big to Ignore by Ocean Wise](#)

Watch ▶ [What Happens to Microplastics in The Ocean by Ocean Wise](#)



ACTIVITIES

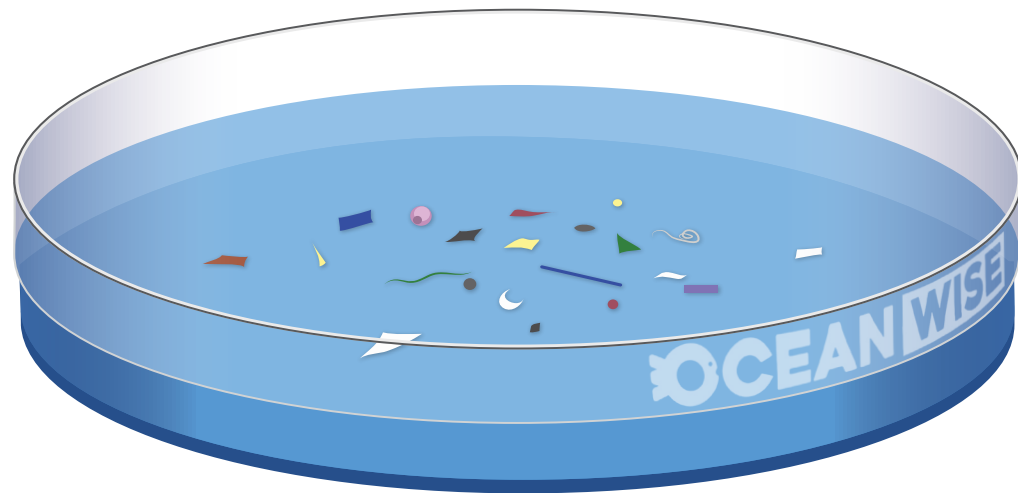
- 1 a) As a class, watch [Why 99% of Plastic Pollution is Missing by VOX](#). Students will independently read [The Other Source: Where Does Plastic in The Great Pacific Garbage Patch Come From by Ocean Cleanup](#).
 - b) In their workbook, students should come up with a list of the different types of macroplastics that they may expect to find in the Great Pacific Garbage Patch. For each macroplastic listed, students will need to identify its respective source(s), and how it impacts a marine species. For each marine species, they will need to specify the physical and/or behavioral characteristics which result in their interaction with the associated macroplastic.

- 2 Watch [Bioaccumulation and Biomagnification: Increasingly Concentrated Problems by Catalina Island Marine Institute](#). Considering the concepts of bioaccumulation and bio-magnification, dissect a seafood species such as a squid or herring. Have students in groups refer to the dissection sheet in their workbook to explore the relation of food chains and plastic pollution. Consider the connection of anatomy, physiology, and fishing practices, and the impact of involuntary plastic consumption by marine animals. You can find the answer sheet in the Appendix at the end of this guidebook.

If unable to perform the dissections in class, watch [Australian Herring Dissection by Marine Waters – DPIRD](#). In groups, have students refer to the worksheet as they follow along and note down their observations from the video. Consider the connection of anatomy, physiology, and fishing practices, and the impact of involuntary plastic consumption by marine animals.

- 3 a) Watch [The Oceans Are Life by Canada's C3](#) As a class, discuss the following:
 - When was the last time you stopped to appreciate the lands and waters around you?
 - When was the last time you stopped to think and thank the ocean and trees for the breaths you are able to breathe because of them?
 - Encourage your class to take the time to write in their student workbook their gratitude and thanks for either the lands or waters near your school/community.

THOUGHTBOOK



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%.



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

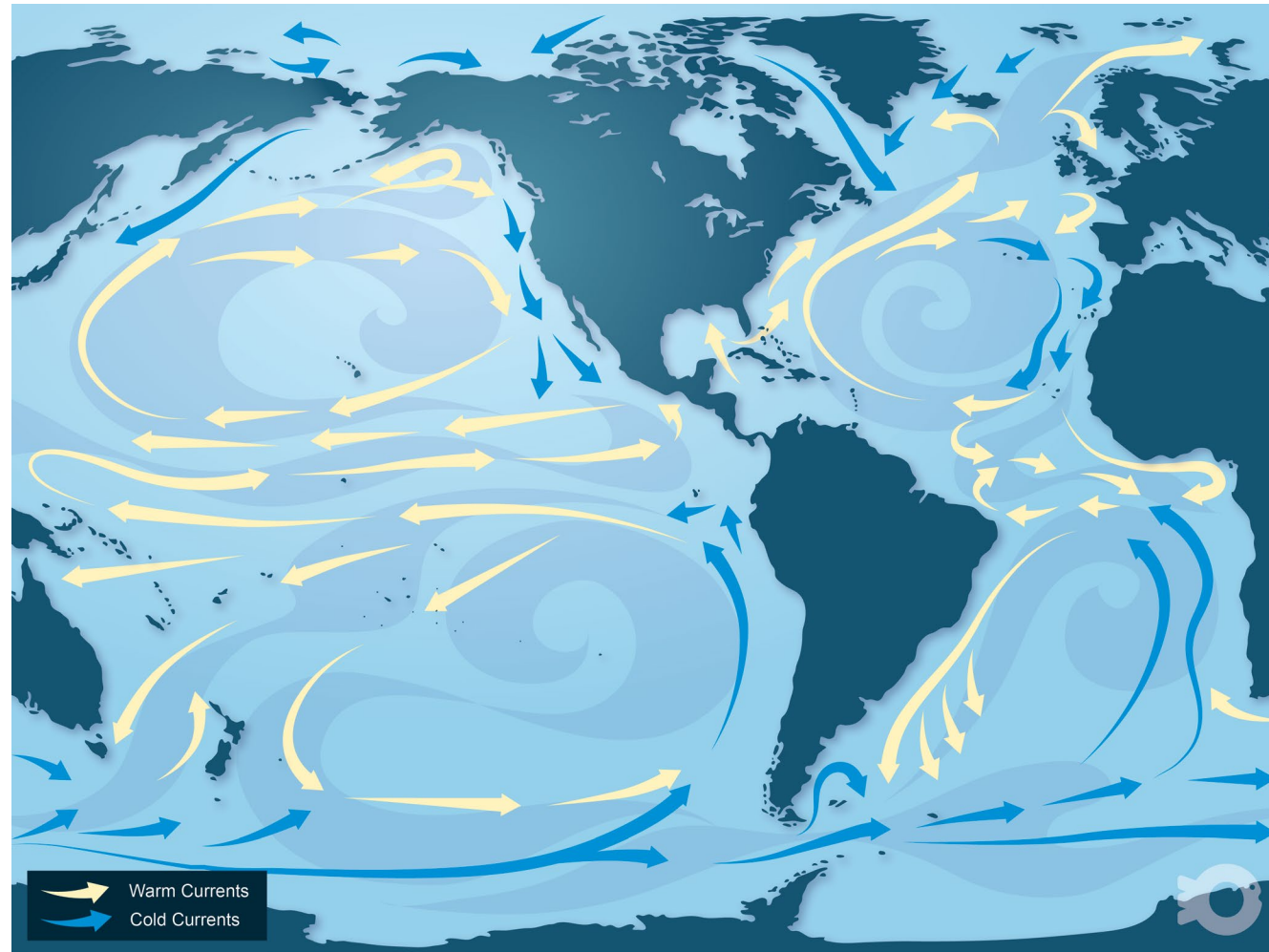
LESSON 5
Plastics and Climate Change,
a Never Ending Cycle

LESSON 6
Cleanup Your Shoreline for
a Cleaner Ocean

Lesson 4

Plastics at the Wheel, Driving Through Ocean Currents





BACKGROUND

The ocean is the prime regulator of our world’s ecosystems. It acts as an important carbon sink by sequestering 40% of the world’s carbon dioxide production and 90% of the planet’s heat, mitigating the increase of greenhouse gasses and thus, the rise of global temperature. At the center of these processes are ocean currents which help absorb, store, and transfer heat, making the ocean a major influence on weather and climate. The deep underwater currents are known as the thermohaline conveyor belt as they move massive currents of cold and warm water to the tropics and the poles to prevent extreme temperatures from occurring in either region.¹⁰

While ocean currents are undoubtedly essential to life on earth, they enable the transportation of plastic pollution around the world. In

lesson 2, we addressed how plastics travel to the ocean, but what happens once they reach the ocean? Do they sink, float, move around? Unfortunately, both macroplastics and microplastics do all the above. When plastics enter the ocean, they hitch a ride with ocean currents which travel around the world making the possibilities for a final destination endless. For example, a piece of plastic entering the ocean in North America can end up on a beach in Asia. Via ocean currents, plastic can go from one side of the world to the other, end up on the shoreline of some of the most remote areas, or even stay in the ocean for thousands of years before breaking up into smaller pieces or getting eaten by a marine animal.

STUDENTS WILL BE ABLE TO:

- Develop an understanding of the functioning of ocean currents and their role in sustaining life on Earth.
- Explain the mechanisms responsible for the transport of plastics in the ocean.

CRITICAL QUESTIONS:

- What is the connection between the ocean and the Earth's global temperature?
- How does plastic pollution move around the world?
- How do ocean currents affect the overall goal of removing all plastics from the ocean?

RESOURCES:

- Watch** ▶ [Hokulea Sailed Around The World, But Couldn't Escape Plastic – Ocean Stories by Ocean Wise](#)
- Watch** ▶ [The Ocean – A Driving Force for Weather and Climate by NASA](#)
- Read** ▶ [The Journey of Forgotten Plastics Through Our Ocean Currents by Ocean Blue Environmental News Blog](#)
- View** ▶ [Pollution Tracker by Ocean Cleanup](#)
- View** ▶ [Marine Debris – Environmental Science GeoInquiries by ArcGIS](#)
- Watch** ▶ [The Epic Journey of The Plastic Ducks by Emma Dobken](#)
- Watch** ▶ [How Our Trash Reaches Remote Beaches by Earth Fix Media](#)

ADDITIONAL RESOURCES:

- Listen** ▶ [Short Stuff: Friendly Floatees by Stuff You Should Know](#)
- Watch** ▶ [Plastic Bag Found at The Bottom of The World's Deepest Ocean Trench by National Geographic](#)
- Read** ▶ [Plastics in The Arctic: Back in Sight, Back in Mind by Arctic Council](#)



ACTIVITIES

1 As a class, watch [The Ocean – A Driving Force for Weather and Climate by NASA](#) and collect questions that are raised. As a class, discuss how the ocean impacts our climate.

2 The Ocean Traveling Rubber Duckies Activity:

- Have students read [The Journey of Forgotten Plastics Through Our Ocean Currents by Ocean Blue Environmental News Blog](#) and visit [Pollution Tracker by Ocean Cleanup](#).
- Introduce to the class the Friendly Floaties Spill:
 - As a result of a cargo container falling off a ship near China during a storm, 29,000 rubber ducks have traveled the ocean for 15 years.*

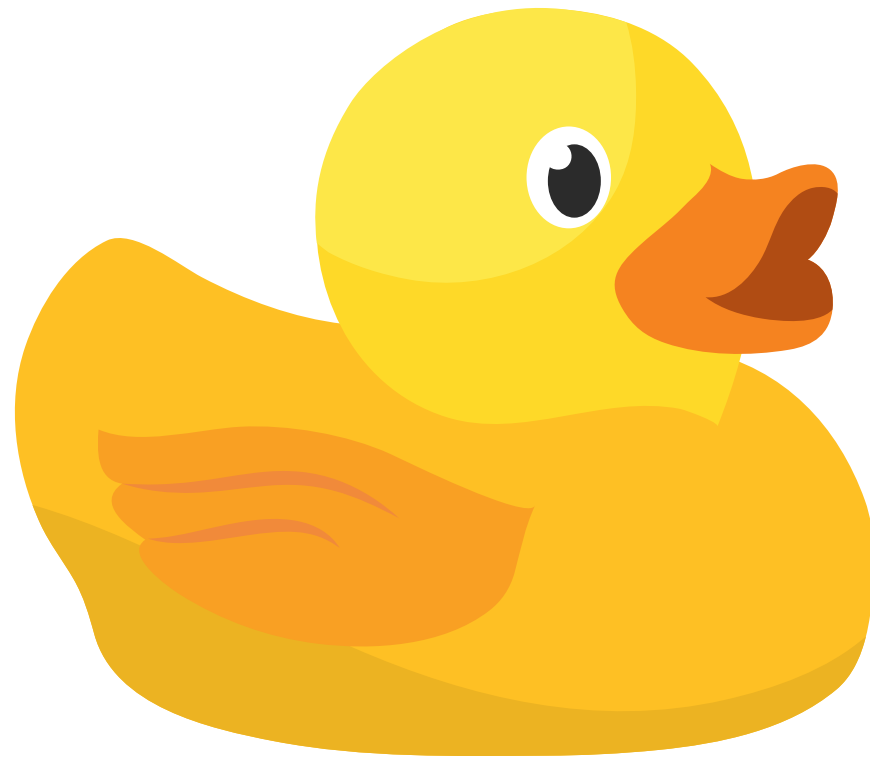
Show students the location of the spill by projecting the [Marine Debris – Environmental Science Geoinquiries by ArcGIS](#) and inserting the coordinates of the spill (44.7N, 178.1E) where it says *Find address*. On the left side of the screen, you should see the *Content Menu* (if not, click *Details* in the upper left corner and select *Content*). Ensure that both *Major Ocean Currents* and *Map Notes* are checked.

- By considering the map, direction of major ocean currents, and the location of the Friendly Floaties Spill, task students with hypothesizing how and where the rubber ducks may have ended up by circling regions on the world map in their workbook.
- Watch [The Epic Journey of The Plastic Ducks by Emma Dobken](#) and discuss with students how their hypotheses are similar and/or different with the information presented in the video.

3 Watch [Hokulea Sailed Around The World, But Couldn't Escape Plastic – Ocean Stories by Ocean Wise](#) and [How Our Trash Reaches Remote Beaches by Earth Fix Media](#). Discuss with students how plastics impact Indigenous communities and the most remote areas of the world. In their workbook, students should complete the questions relating to these videos.



THOUGHTBOOK

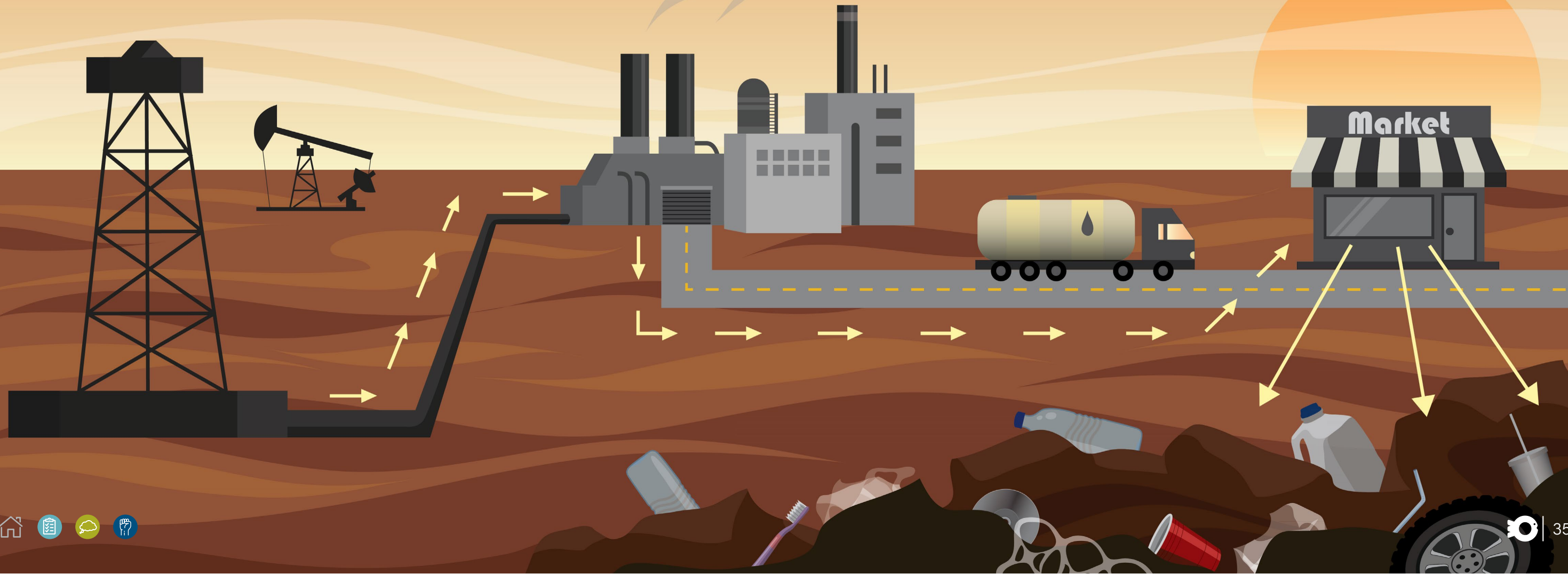


Reflect

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

Lesson 5

Plastics and Climate Change, a Never Ending Cycle





BACKGROUND

The impacts of climate change on our ocean are numerous. For the purpose of this education kit, they will be separated into three broad groups: ocean warming, rising sea levels, and ocean acidification. Ocean warming occurs as a result of the ocean absorbing the excess heat trapped in the earth's atmosphere by the increased production of greenhouse gasses from human activities.¹¹ As a result of ocean warming and the thermal expansion of sea water, climate change is also causing a rise in sea levels which is threatening coastal habitats and the species which rely on coastal regions for feeding and breeding.¹¹ Additionally, as the ocean absorbs heat, it also absorbs carbon dioxide. This excess uptake of carbon dioxide fuels a chemical reaction which decreases the pH of seawater, thus increasing acidity. As the ocean becomes more acidic, species which rely on carbonate to make their shells and skeletons, like corals and oysters, are threatened as this compound is less available in acidic waters.¹¹

Plastic leaves quite an impact on our environment. With properties which make them virtually impossible to decompose and instead break up into millions of micro particles, they have managed to infiltrate ecosystems, food chains, and even humans! In brief, the physical impacts of plastic pollution cannot go unnoticed. But did you know that plastic also contributes to climate change? To make matters worse, plastics release greenhouse gasses throughout every phase of their lifecycle. Whether it be during their production, consumption, or disposal, plastics are polluting the environment before they are even considered litter by humans! In brief, plastics are leaving their mark in more ways than one as they contribute to the climate crisis.

STUDENTS WILL BE ABLE TO:

- Create an understanding of the chemistry behind the greenhouse gas effect.
- Explain the different stages of the plastic lifecycle.
- Describe how the production, consumption, and disposal of plastics contribute to climate change.

CRITICAL QUESTIONS:

- What aspects of the plastic life cycle contribute to the release of greenhouse gasses?
- How does plastic harm the environment before it physically enters the environment as pollution?
- How is the extinction of TEK directly impacted by plastic waste and climate change?

RESOURCES:

Read ▶ [Greenhouse Effect 101 by NRDC](#)

Read ▶ [6 Reasons to Blame Plastic Pollution for Climate Change by World Bank](#)

Read ▶ [More Than Just Litter: Plastic and Climate Change by Foodprint](#)

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

ADDITIONAL RESOURCES:

Read ▶ [Plastic Waste and Climate Change – What’s The Connection? by WWF](#)

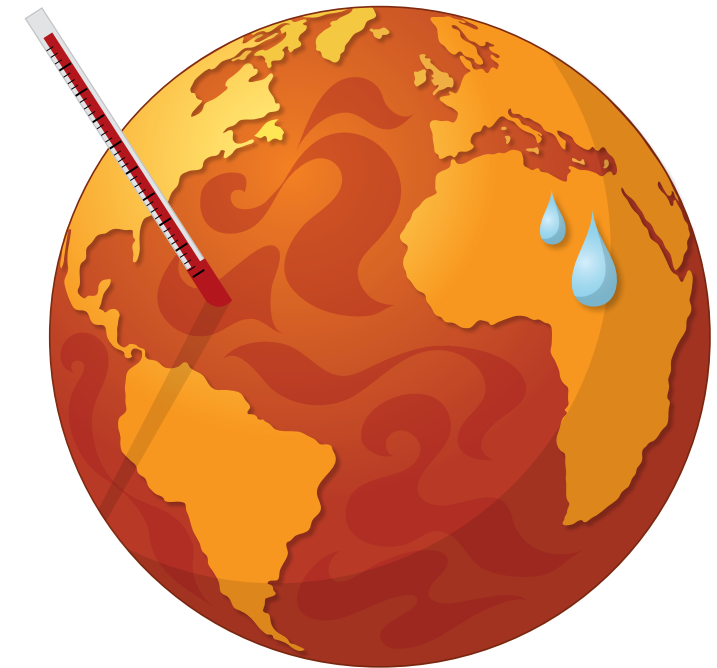


ACTIVITIES

- 1 a) Independently, students should read [Greenhouse Effect 101 by NRDC](#).
- b) As a class, conduct the greenhouse effect experiment. You will need; 1 tall plastic soda bottle with the bottom cut out and the cap still on, 2 glass jars small enough to fit inside the cut out soda bottle, and 2 thermometers. Place one thermometer in a glass jar and cover it with the soda bottle (treatment 1). Place the second thermometer in the second glass jar with no cover (treatment 2). Leave both treatments in the sun (or other heat source) and observe as treatment 1 gets considerably warmer than treatment 2.
- c) Task students with completing the questions in their workbook related to the experiment.

- 2 As a class read through [6 Reasons to Blame Plastic Pollution for Climate Change by the World Bank](#). Divide the class into six groups and assign each group with a different reason presented in the article. Task students with creating a report about how the physical activities and chemicals used/released during their designated plastic lifecycle stage contributes to climate change. They should follow the guidelines and requirements in their workbook and refer to [More Than Just Litter: Plastic and Climate Change by Foodprint](#). Students should present their report to the class.

- 3 Have student's read [Plastic Suffocation: Climate Change Threatens Indigenous Populations and Traditional Ecological Knowledge by Samantha Chisholm Hatfield](#) and answer the questions in their workbook.



THOUGHTBOOK



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





Ocean Wise | Shoreline Cleanup

BACKGROUND

In 1994, employees and volunteers at the Vancouver Aquarium decided to clean up a beach in Stanley Park to protect the city's shorelines from garbage, especially plastic. In 2002, the Ocean Wise Shoreline Cleanup became a national conservation initiative with tens of thousands of volunteers helping restore and protect our world's ocean. As public support for this initiative grew, people became increasingly aware of the harmful effects of shoreline litter on ecosystems, wildlife, and people.¹² Altogether, Shoreline Cleanups have become an opportunity for people to learn, protect, and connect with nature.

Today, the Ocean Wise Shoreline Cleanup is one of the largest recognized direct action conservation programs in Canada committed to inspiring people to keep all shorelines free of litter. And the impact? Since

1994, Ocean Wise, along with more than 972,000 volunteers during 30,542 cleanups, have collected over 2.1 million kg of trash over 48,428km of freshwater and marine shorelines in Canada and the United States!¹² That's equivalent to the weight of 700 killer whales in garbage and the same distance as walking around the planet!

Shoreline cleanups are a valuable tool for environmental remediation and conservation. They directly address the issue of plastic pollution by contributing to the physical removal of litter from an environment which has the potential to transport it anywhere in the world. Whether it be on the shoreline of a river, stream, lake, ocean, or any other waterway, shoreline cleanups are effective in preventing plastic pollution from continuing their journey and harming wildlife.

STUDENTS WILL BE ABLE TO:

- Understand the positive environmental impacts of removing plastic pollution from the environment.
- Deepen their sense of leadership and influence when taking direct action for a cleaner future.
- Lead or participate in a Shoreline Cleanup and know how to #BePlastic Wise.

CRITICAL QUESTIONS:

- How does taking direct action to protect the environment benefit the environment and yourself?
- How can you influence the state of the environment and the lives of the people who rely on it, including yourself?
- How can direct action, especially shoreline cleanups, help and be informed by Traditional Ecological Knowledge?

RESOURCES:

Read ▶ [Ditching the Dirty Dozen by Ocean Wise](#)

Watch ▶ [Living Plastic Wise – Ocean Stories by Ocean Wise](#)

Read For Educators ▶ [Shoreline Cleanup Site Coordinator Guide by Ocean Wise](#)

Watch ▶ [Clean a Shoreline – #BePlasticWise by Ocean Wise](#)

Watch ▶ [How to Host a Shoreline Cleanup by Ocean Wise](#)

View ▶ [Ocean Wise Clean Up Data Card](#)

Watch ▶ [Ahousaht Territory Shoreline Cleanup by Coastal Restoration Society](#)

Watch ▶ [T'Sou-ke Territory Shoreline Cleanup by Coastal Restoration Society](#)

Read ▶ [Everyone Working Together for a Good Cause by Coastal First Nations Great Bear Initiative](#)

ADDITIONAL RESOURCES:

Read ▶ [Sneaky Plastics – How to #BePlasticWise with Ocean Wise this Plastic Free July by Ocean Wise](#)

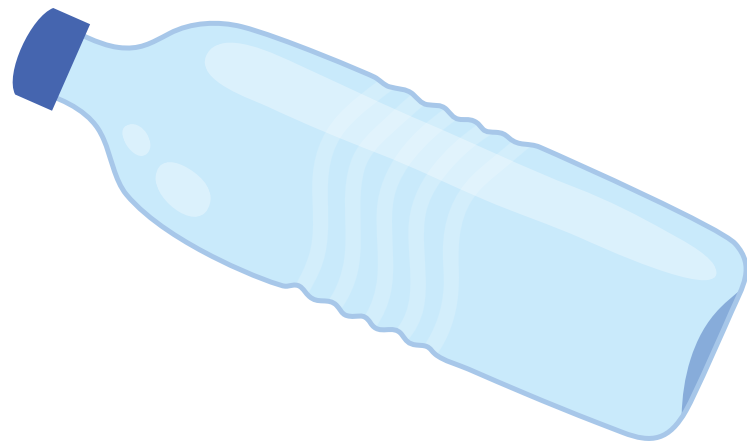
Read ▶ [The Great Canadian Shoreline Cleanup 2021 Impact Report by Ocean Wise](#)



ACTIVITIES

1 As a class, read through [Ditching the Dirty Dozen by Ocean Wise](#) and watch [Living Plastic Wise – Ocean Stories by Ocean Wise](#).

- In their workbooks, task students with writing down some of the *Dirty Dozen* items that they use on a weekly basis. For each item that they write down, students should propose non-plastic alternatives.
- In their workbooks, students should select one of the *Dirty Dozen* items they listed and create a prototype for a sustainable non-plastic alternative product that is not yet on the market. Encourage students to conduct market research.



2 School Yard or Community Cleanup: You will lead a garbage clean up with your class, whether that be on school property or in your local community. Review the [Shoreline Cleanup Site Coordinator Guide by Ocean Wise](#).

- Before your garbage clean up, as a class, watch [Clean a Shoreline – #BePlasticWise by Ocean Wise](#) and [How to Host a Shoreline Cleanup by Ocean Wise](#).
- Ask students to identify the different types of plastic products gathered during your clean up, and record their observations in the [Ocean Wise Clean Up Data Card](#) found in their workbook.
- Once observations are recorded, and garbage is collected, assist students with garbage triage and proper disposal.

3 Watch [Ahousaht Territory Shoreline Cleanup by Coastal Restoration Society](#) and [T'Sou-ke Territory Shoreline Cleanup by Coastal Restoration Society](#) and read [Everyone Working Together for a Good Cause by Coastal First Nations Great Bear Initiative](#). Discuss with the class the different perspectives and approaches of Traditional Ecological Knowledge compared to that of the western world. Refer to the guiding questions below during the discussion.

Guiding Questions:

- How would you describe the Indigenous relationship to nature? How would it differ from non-Indigenous people?
- How would you describe the Indigenous perspective of the benefits of a shoreline cleanup for and beyond the environment?

THOUGHTBOOK



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!

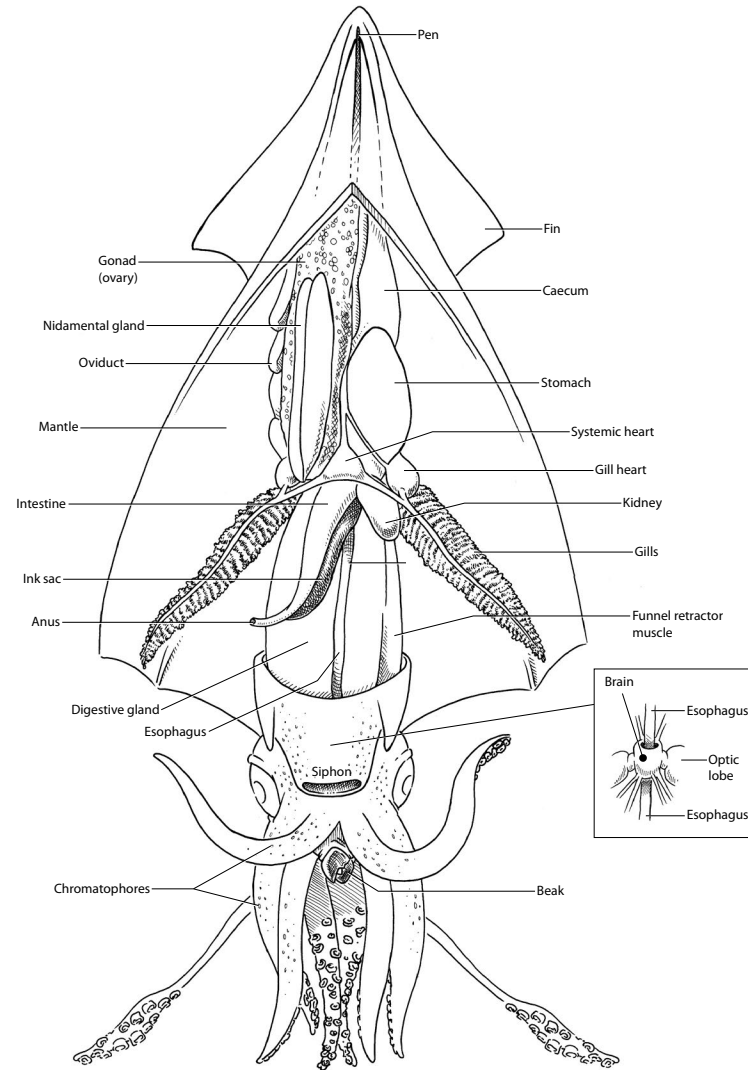


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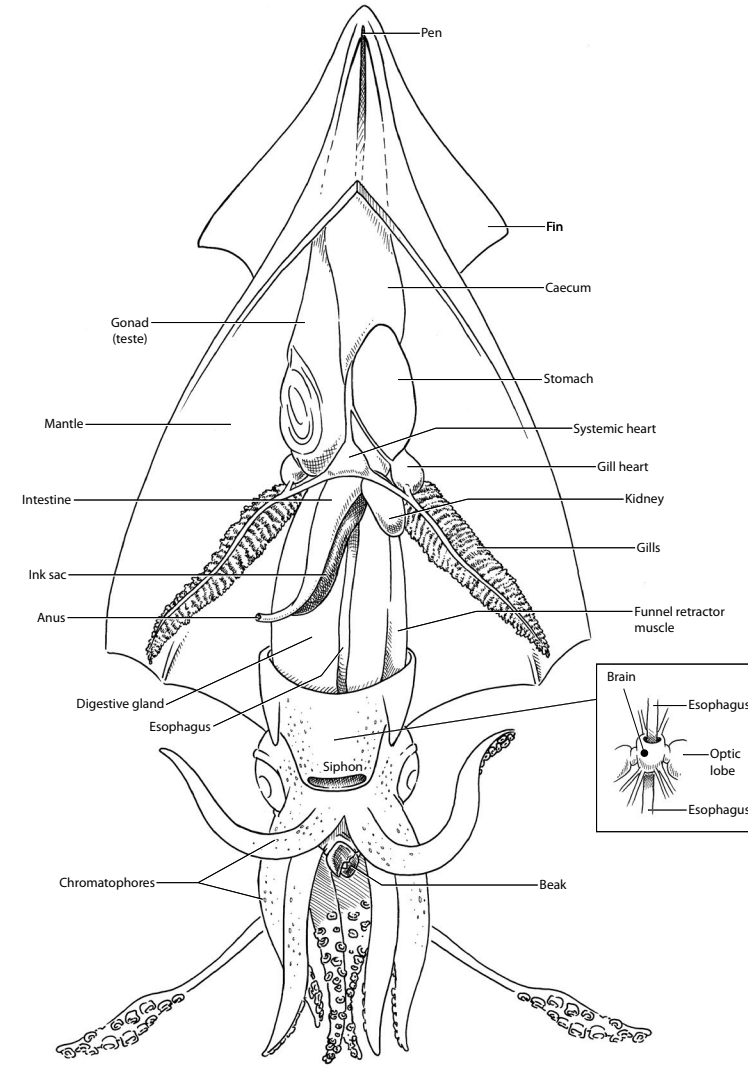
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APPENDIX- LESSON 3

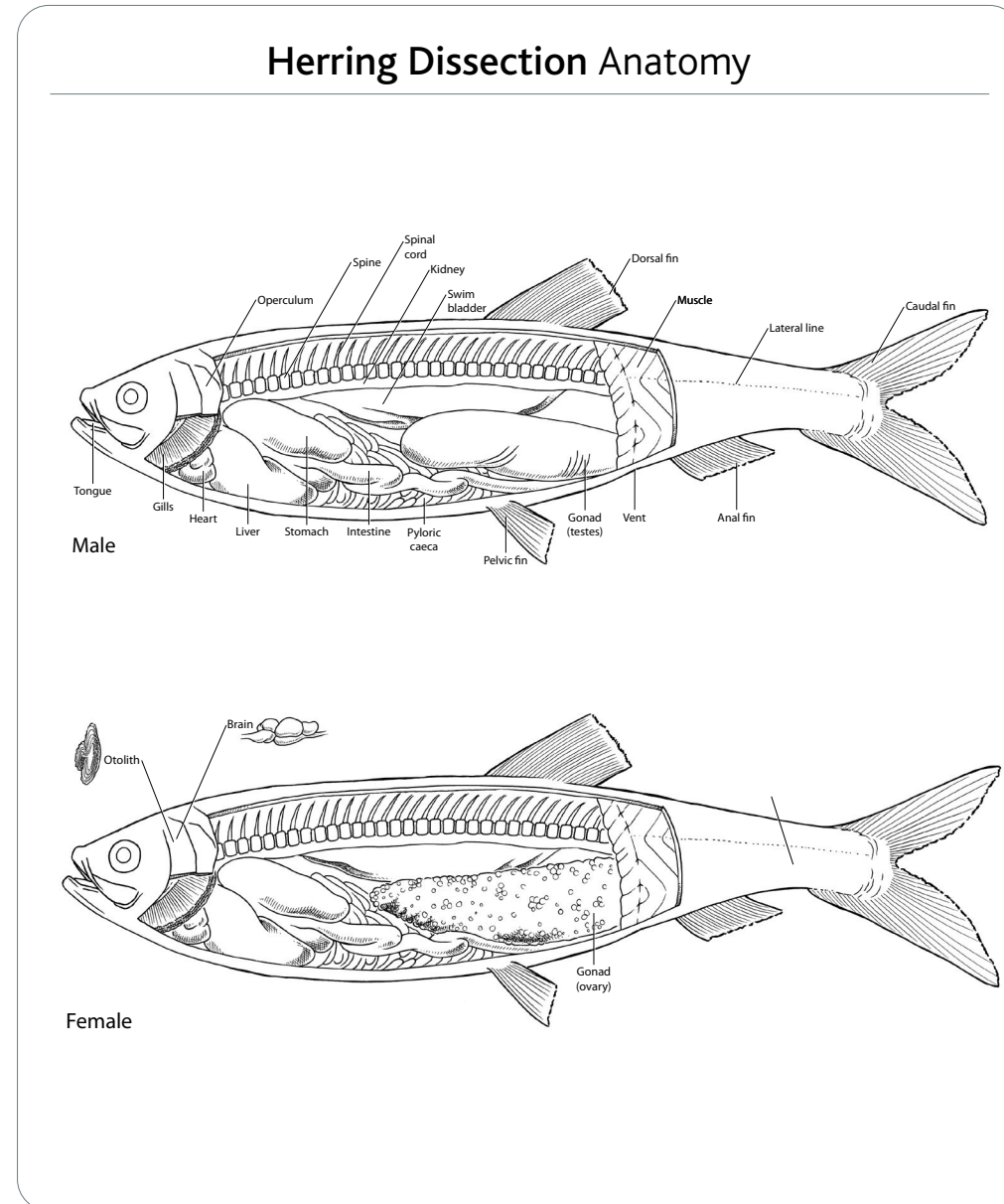
Squid Dissection Female Anatomy



Squid Dissection Male Anatomy



APPENDIX- LESSON 3



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.

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