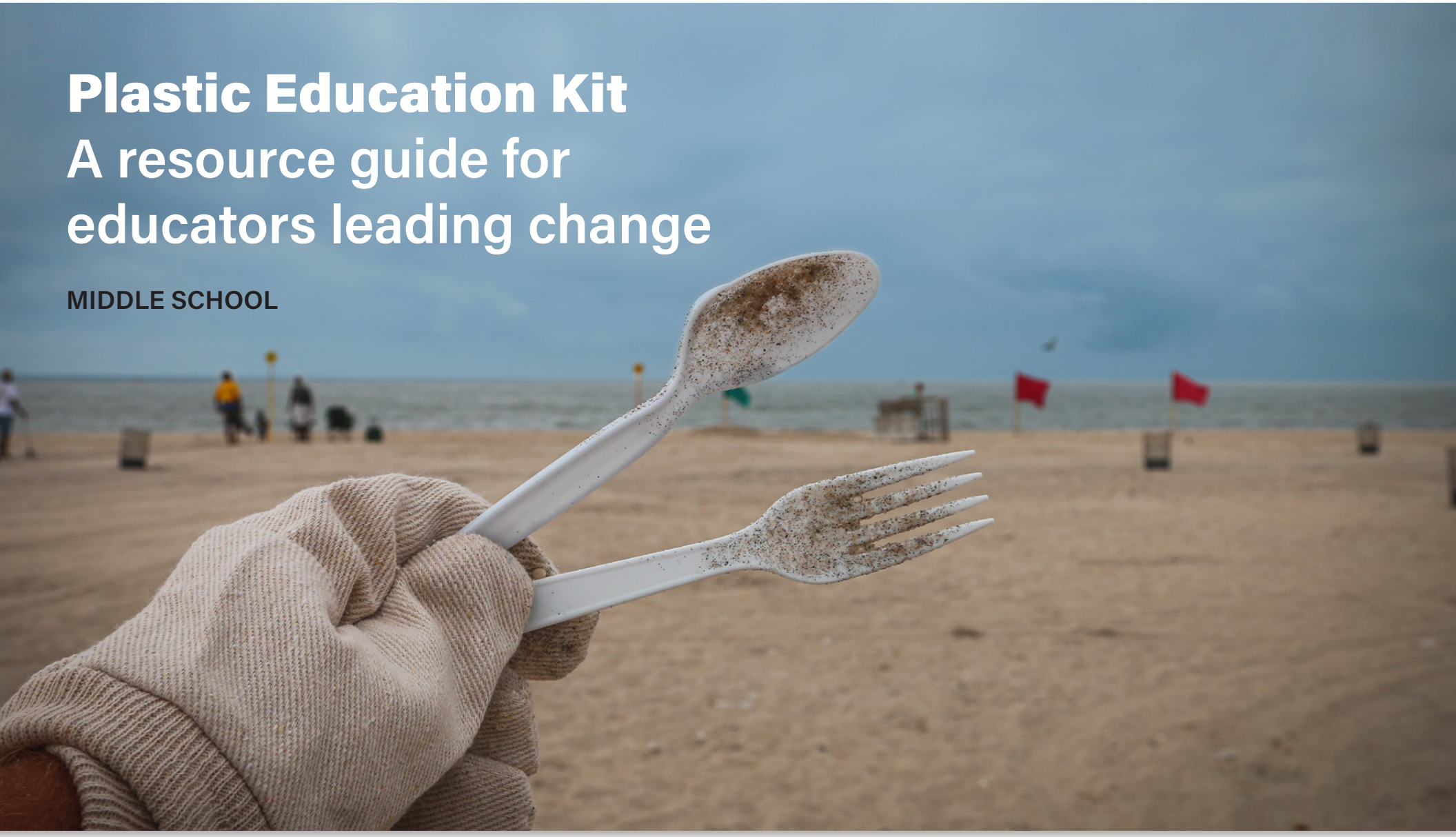
Waves of Change

Plastic Education Kit

A resource guide for educators leading change

MIDDLE SCHOOL



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We acknowledge that our work spans across the lands of many Indigenous Peoples. We understand that collaborating with Indigenous communities and intertwining Indigenous ways of knowing into our work is essential to decolonizing ocean conservation and realizing the full spectrum of benefits to both people, the land, and the ocean.

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INTRODUCTION

Help us inspire our youth to break the plastic pattern... and protect and restore our ocean.

Around 11 million tonnes of plastics leak into the ocean each year. This is equal to a dumping a garbage truck load of plastic into the ocean every minute! At this rate this number may triple by 2040.

But why does the ocean matter?

No oceans, no us:

- Our oceans produce over 50% to 80% of the oxygen we breathe.
- Our oceans control and regulate the climate, weather, and temperature.
- Roughly 40% of carbon dioxide gets absorbed by our oceans.
- Over one billion people rely on seafood as their primary source of protein.

Why is plastic pollution a problem?

- More than 360 million tonnes of plastic are produced every year.
- 40% percent of all plastic produced is designed for single use.
- Plastic never disappears, instead it breaks up into smaller pieces (microplastics), absorbing other pollutants and releasing these poisons along the food chain as some animals mistake the microplastics as food.
- Over 800 marine and coastal species are impacted by plastic pollution.
- Plastic and other forms of pollution are ending up in our marine life, making its way into the food chain. When plastic is in the food chain, it ends up in our bodies when we eat fish and other seafood.

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DEAR EDUCATORS

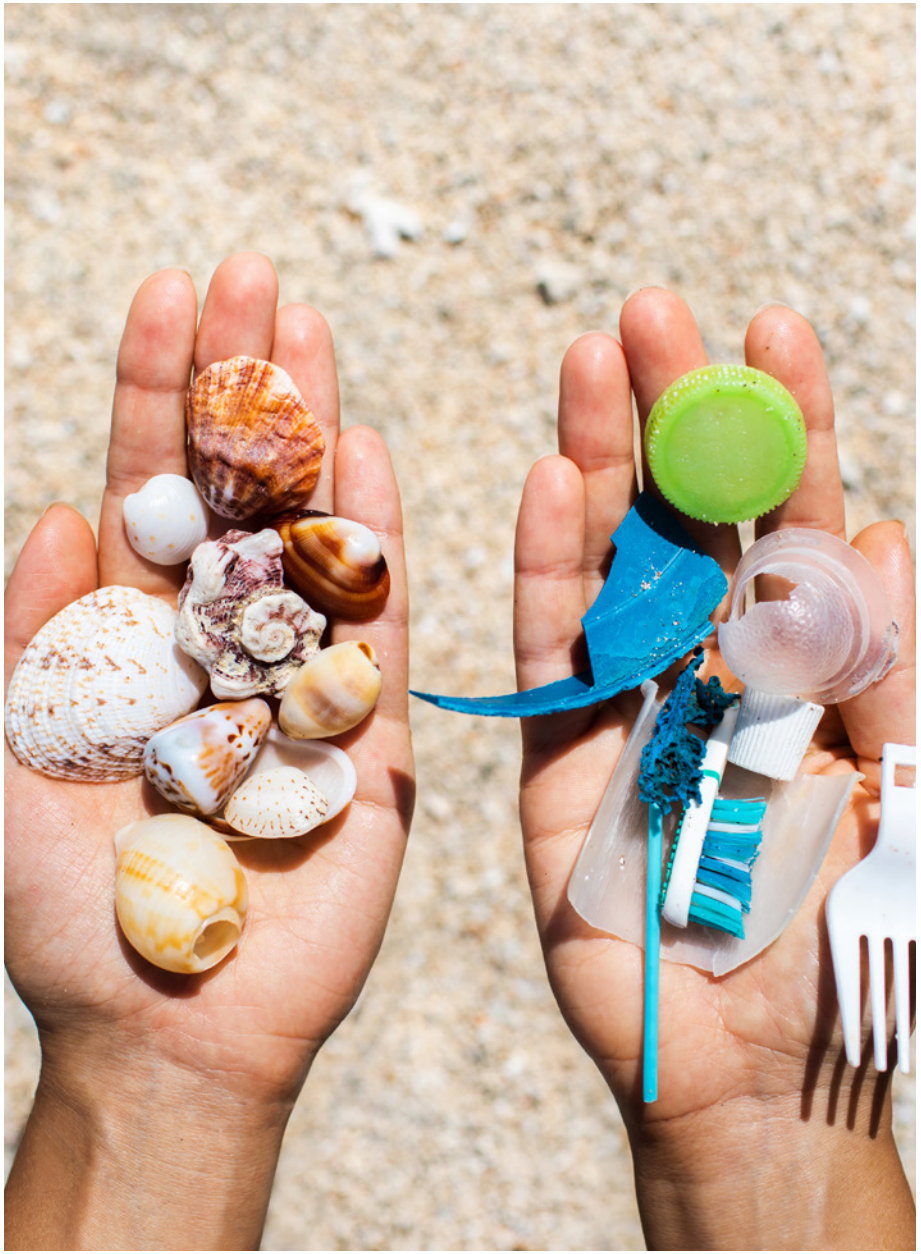
The oceans, and the interconnected cycle of water and waterways, are vital to all living things on Earth. Tragically, the health of our oceans, and by extension the well-being of all life on Earth, is at risk due largely to the impacts of human activity. Plastic is pervasive in our oceans and it's going to take a deep, transformational change in humanity's consciousness and activities to ensure healthy, sustainable life on this planet.

We believe this is possible. But we need your help! Our youth need to be aware of their own plastic use and empowered to take action that will have a positive impact on the environment around them. We recognize that individual action should be coupled with systemic change, so we aim to engage students through active approaches and creative problem solving. Through these lessons, we hope youth will become leaders of change – starting in your classroom. Thank you for helping us break this pattern.

Each lesson follows the same format:

- First students consider **Critical Questions** in parallel with engaging Activities informed by Western Science and Indigenous Knowledge.
- Next the **Thought Book** will prompt students to journal about each Lesson. Through this reflection students consider their role in mitigating plastic pollution and consider various perspectives on these issues.
- Finally, students are encouraged to become change makers within their community. Each lesson offers ways to **Take Action** as well as inviting educators and students to create their own.

Keeping in mind that systemic change is a crucial and necessary step in ending plastic pollution, this kit aims to empower youth to learn, inspire, and shift habits to contribute to solving the plastic crisis.



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LESSON ONE:

HOW PLASTIC TRAVELS TO SEA

BACKGROUND

Water is everywhere! It covers 71% of the earth's surface and 97% of water is found in the ocean. There are five major ocean basins around the world and all of these basins together form one big world ocean. Water in the ocean continuously flows across the globe with movement from waves, tides, and the rotation of the earth. This movement helps to maintain balance in the world and keeps the planet healthy by circulating heat and nutrients. In this lesson, students explore a brief history of plastic and learn how it is a threat to healthy ocean ecosystems. Furthermore, they will investigate how water within the ocean moves across waterways, carrying animals, plants, nutrients, and unfortunately, plastic.

Indigenous communities are forced to adapt to many environmental pressures while simultaneously fighting to sustain and cultivate their Traditional Ecological Knowledge (TEK). The threat of TEKS's extinction is an ongoing danger to many Indigenous populations, exacerbated by the direct and daily impacts of climate change and man-made destruction such as plastic pollution. In this lesson, students will contemplate the ongoing impact that plastic pollution and related environmental issues have on Indigenous populations around the world.

OBJECTIVES

Students will be able to:

- Clearly understand the history and composition of plastics.
- Develop a sound understanding of how plastics move across land and end up in the ocean.

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CRITICAL QUESTIONS

1. What makes plastic such a unique and helpful material? How could those same features make plastics harmful to animals and ecosystems?
2. What are the most significant ways plastic pollution is impacting ocean health?
3. What are different ways we can prevent plastic from reaching the ocean?
4. How might a plastic bag, straw, or cup make its way from your school to the ocean?

MATERIALS

- Student Workbook
- Pen/Pencil
- Audio visual system
- Post-it notes
- Posters – Giant Pacific Garbage Patch

ACTIVITIES

Engage

1. After a class viewing of the video: What really happens to the plastic you throw away, divide the class into small groups. Have students discuss the possible journey of plastics from a place they know to the ocean.
2. Show students the Giant Pacific Garbage Patch poster. After reading it over, compose a class list of all the questions that come to mind about the Giant Pacific Garbage Patch.
3. Take students outside and clean up garbage from the school yard and surrounding area. Invite students to create a comic strip (see Student Workbook pages 3 and 4) that shows a piece of plastic garbage as it travels from your schoolyard to the ocean. Encourage students to feature garbage they found around the school in their comic.
4. Read The Narwhal: Inuit researchers are on the lookout for migrating microplastics and watch Ocean Wise: Yukon Ikaarvik. Discuss ways that plastic pollution interferes with the Inuit traditional ecological knowledge, including how pollution would impact their cultural ways of life (hunting, fishing, etc.).
5. Organizing students in teams, offer them a stack of post-its to do a rapid brainstorm session on innovative alternatives to single use plastics. Imagine that your class had access to lots of different resources and support from governments, scientists, Indigenous communities, and companies from around the world. What would you do to help solve the plastic crisis?

Resources

VISIT ▶ What are plastics? to access videos on the history of plastic at Eco 360, Green Learning. Sign in, for free, to access the following resources:

- National Geographic: Plastic 101
- TED Ed: A Brief History of Plastic
- Orange Plastics Academy: 7 Different Types of Plastic and Their Uses

WATCH ▶ TED Ed's video: What really happens to the plastic you throw away

WATCH ▶ Ocean Wise's video: Yukon Ikaarvik

a. Read this article by the Narwhal: Inuit researchers are on the lookout for migrating microplastics

WATCH ▶ The Economist's video: How to Stop Plastic Getting into the Ocean

WATCH ▶ Ocean Wise's video: Take The Pledge

FOR EDUCATORS ▶ Weaving Traditional Ecological Knowledge into Biological Education: A Call to Action, Robin Wall Kimmerer

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THOUGHT BOOK

Through journaling, students will explore their understanding of, and connection to, the diverse concepts within this kit to plastic pollution and its implications.

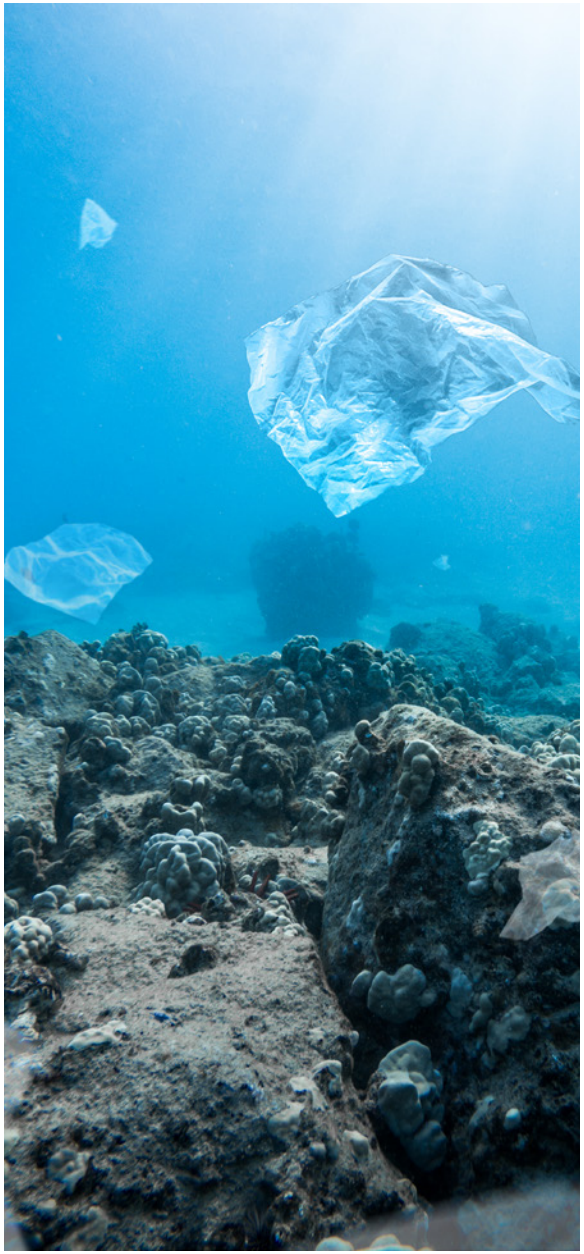
Reflect

1. How might we better show love, care, and respect for the ocean and all it provides to us?
2. Describe different ways Indigenous communities have been impacted by plastic pollution. In what ways can we apply TEK to better understand impacts and solutions to the world's plastic problem?
3. How could we prevent 90% of plastic from entering the ocean?

TAKE ACTION

➜ Watch the Ocean Wise video Take The Pledge and take the pledge, individually or as a class. Go over the different steps and consider how to stay accountable in this challenge.

THE WHY Reducing your plastic footprint is the best way to help, according to the experts in Ocean Wise's Plastic Lab. Removing plastic from oceans and waterways is important, but if there is always more plastic being added, we'll have to keep removing it! 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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LESSON TWO:

SMALL PLASTICS, BIG IMPACT

BACKGROUND

Ocean ecosystems are numerous and diverse. They are defined by environmental factors and by the organisms that live under the water. Environmental factors include available oxygen as well as nutrients, salinity, temperature, pH, light, pressure, substrate and circulation. Ocean organisms range from microbes and invertebrates, to fishes, marine mammals, plants, and birds. Ocean ecosystems are interconnected and impacted by environmental factors, including plastic pollution.

A great variety of plastics can be found throughout the ocean, with microplastics being the most pervasive. Microplastics can be found as small fragments, sheets, fibres, pellets, and granules, and have the ability to negatively harm every aspect of the ocean ecosystem. Indeed, it was shown that microplastics are being eaten by species of zooplankton, highlighting the vulnerability of ocean food webs and the potential for microplastics to get into Indigenous, commercial, and recreational seafoods. Furthermore, there is a concerning trend of wildlife ingesting microplastics in seabirds, whales, turtles, seals, and more. 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 (and prevent it from getting there in the first place!)

OBJECTIVES

Students will be able to:

- Understand the ways that plastic litter impacts an ecosystem and the animals and other organisms within it.
- Develop a clear understanding of how plastic pollution negatively impacts ocean health.

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CRITICAL QUESTIONS

1. What are the various ways that plastic impacts animals and ecosystems in our oceans?
2. How does microplastic pollution impact ecosystems?
3. What are meaningful and equitable ways to reduce and remediate plastic pollution around the world?

MATERIALS

- Student Workbook
- Pen/Pencil
- Audio visual system
- Access to computers for research (in small group)

ACTIVITIES

Engage

1. Watch Saving Sea Lions: Why Marine Plastic Matters and in small groups, have students answer the questions and discuss the methods used to assist the sea lions (see Workbook page 6).
2. In small groups, invite students to choose a marine animal affected by marine plastic. Consider that sea turtles and seabirds often mistake plastic for food, and that sea lions, seals, and humpback whales are regularly entrapped or entangled by plastics. Have students fill out the Plastics and Marine Animals Investigation Worksheet (see Workbook page 7). Please note: students will need time to conduct internet research.
3. Have students present their animal investigation with the class. Encourage them to have fun with their presentation (Use props! Act it out! Create a skit!)

Resources

WATCH ▶ Ocean Wise's video: Saving Sea Lions
WATCH ▶ Ocean Wise's video: Microplastics: Too small to see TOO BIG TO IGNORE
WATCH ▶ Ocean Wise's video: What happens to microplastics in the ocean? | Ocean Wise
READ ▶ Scientific American's article: Plastic Pollution May Change Cattle DNA
READ ▶ Ocean Wise's report: Research_MicrofibersReport_191002.indd (ctfassets.net)
WATCH ▶ C3's video: Oceans are Life

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THOUGHT BOOK

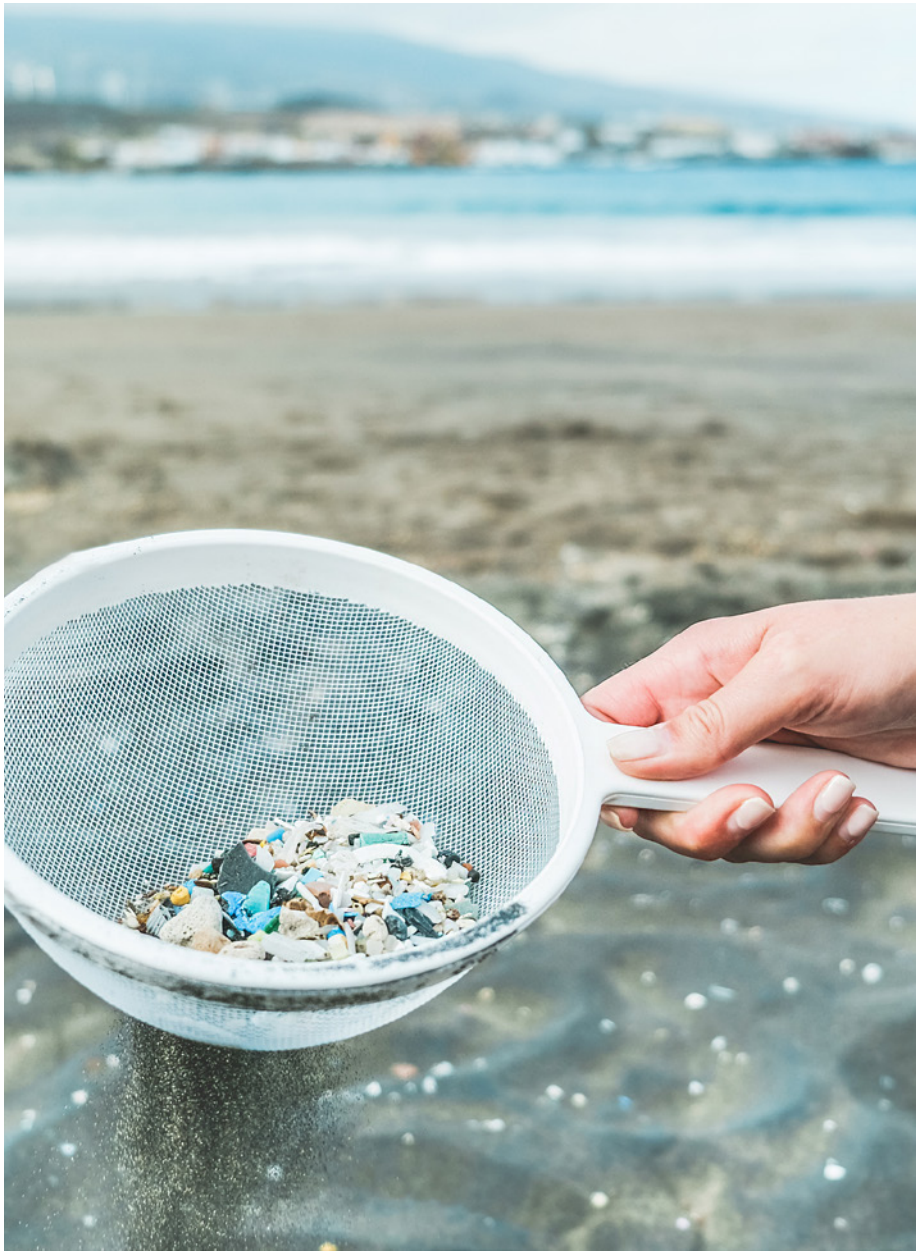
Reflect

- What are the various ways that plastic impacts animals and ecosystems in our oceans?
- How does microplastic pollution impact ecosystems?
- 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 and washing synthetic items less often (try spot cleaning!).

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.



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LESSON THREE:

CURRENTS, CLIMATE, AND PLASTIC

BACKGROUND

The ocean is the prime regulator of climate, absorbing more than 90% of the planet's heat and 40% of the planet's carbon dioxide. As an important carbon sink, the ocean sequesters carbon, stopping the production of greenhouse gasses and thus, the rise of global temperature. Plankton, kelp, and other marine organisms are at the center of this process, sequestering carbon on the ocean floor until disturbed.

The ocean releases 50% to 80% of the world's oxygen into the atmosphere. Currents help to absorb, store, and transfer heat, making the ocean a major influence on weather and climate. Most of the rain that falls on land originally evaporated from the ocean. As water evaporates from the ocean, it transforms into water vapor and is incorporated into the atmosphere, helping to form clouds and produce rain.

Microplastics inhibit the ability of crucial marine photosynthetic bacteria, considered the most abundant photosynthetic organism on Earth, to draw down carbon from the atmosphere. Reducing plastic pollution not only supports the health of the ocean but promotes its ability to regulate the world's climate. This lesson will deepen students' understanding of the role the ocean plays in climate change, how plastic impacts the ocean's ability to regulate climate, and how plastic can spread to the most remote parts of the ocean.

OBJECTIVES

Students will be able to:

- Develop a sound understanding of how plastics can increase the temperature of water
- Make connections between plastic pollution and the ocean's role in climate change.
- Informatively explain how plastics move throughout the oceans and travel across the world.

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CRITICAL QUESTIONS

- What is the connection between the ocean and the Earth's climate?
- How does solving plastic pollution help protect ocean health and the fight against climate change?
- How does plastic move around the world? How do these forces affect the overall goal of removing all plastic from the ocean?

MATERIALS

- Student Workbook
- Pen/Pencil
- Audio visual system
- World maps, large enough to draw several pathways out

ACTIVITIES

Engage

1. Watch the video: The Ocean – A Driving Force for Weather and Climate and How Do Ocean Currents Work and collect questions that are raised. Discuss as a class how the ocean impacts our climate.
2. Show students the Thermocline Circulation map (Workbook page 9). Have students research and fill out the worksheet, individually or in small groups.
3. Have students read Plastic Bag Found at the Bottom of World's Deepest Ocean Trench. As a class, scroll through The Deep Sea to get a sense of where deep plastic has been spotted. Discuss what forces have led to plastic being found inside the Mariana Trench, at a depth of 10,975 meters (36,000 feet)!
4. Watch the video: How does your Plastic end up in the Arctic and discuss the impacts of plastic in this remote area.
5. Have students work in pairs to trace multiple pathways of plastic litter moving from their community, along global routes across oceans, in a series of scenarios (Workbook page 10).
6. Watch the videos: Humans are turning the world into Plastic and It's Not Me, It's You and read the article: Nations sign up to end global scourge of plastic pollution. As a class, discuss what you foresee as the future outcome for plastic pollution in the ocean, considering the best and worst scenarios. Writing notes on the board, describe the best-case scenario for the future. Then, write out the steps needed to reach that goal.

Resources

WATCH ▶ TED-Ed's video: How Do Ocean Currents Work
WATCH ▶ NASA's video: The Ocean – A Driving Force for Weather and Climate
WATCH ▶ Ocean Wise's video: Hokulea Sailed Around the World, But Couldn't Escape Plastic | Ocean Stories
VISIT ▶ Scroll through: The Deep Sea
READ ▶ Read the National Geographic article: Plastic Bag Found at the Bottom of World's Deepest Ocean Trench
WATCH ▶ Clean Seas' video: Humans are turning the world into Plastic
WATCH ▶ Clean Seas' video: It's Not Me, It's You
READ ▶ United Nations' news article: Nations sign up to end global scourge of plastic pollution

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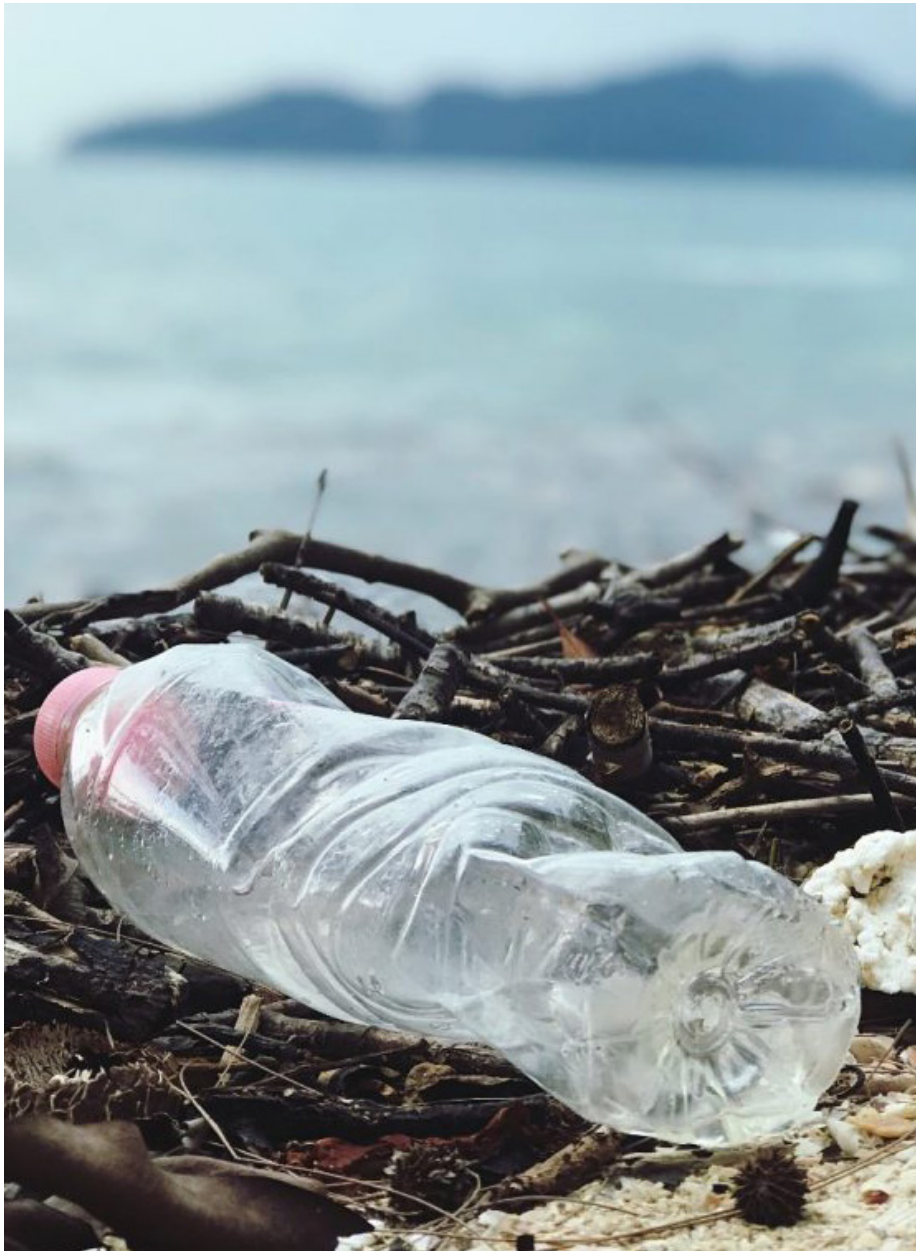
THOUGHT BOOK

- What is the connection between the ocean and the Earth's climate?
- How does solving plastic pollution help protect ocean health and the fight against climate change?
- How does plastic move across the world? How do these forces affect the overall goal of removing all plastic from the ocean?

TAKE ACTION

➜ Find ways to eliminate single-use plastic in your daily life. Reusable bags, cups and cutlery can easily replace single-use products.

THE WHY Think about when, where, and why you use plastic. Do you have to use it? Or is it easy, convenient, or the way you've always done things? Not that long ago, we did not have plastic at all, so let's rethink how we can cut down on our use. Think about buying in bulk, using reusable containers, or even trying out different products such as shampoo bars.



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APPENDIX - RESOURCES

LESSON ONE

- **Giant Pacific Garbage Patch** – National Ocean Service: https://marinedebris.noaa.gov/what-we-know-about-garbage-patches
- **What are Plastics?** – Green Learning: https://programs.greenlearning.ca/
- **What really happens to the Plastics you throw away?** – TED Ed: https://www.youtube.com/watch?v=_6xlNyWPpB8&ab_channel=TED-Ed
- **Yukon Ikaarvik** – Ocean Wise: https://www.youtube.com/watch?v=lOUDG01dLIk&ab_channel=OceanWise
- **Inuit researchers are on the lookout for migrating microplastics** – The Narwhal: https://thenarwhal.ca/inuit-researchers-microplastics/
- **How to Stop Plastic Getting into the Ocean** – The Economist https://www.youtube.com/watch?v=D7EdgCxFZ8Q&ab_channel=TheEconomist
- **Take The Pledge** – Ocean Wise: https://plasticreduction.ocean.org/individuals/
- **Weaving Traditional Ecological Knowledge into Biological Education** – Robin Wall Kimmerer, Bioscience – https://academic.oup.com/bioscience/article/52/5/432/236145
- **Ocean Wise's Plastic Lab** – Ocean Wise: https://ocean.org/pollution-plastics/plastics_lab/

LESSON TWO

- **Saving Sea Lions** – Ocean Wise: https://www.youtube.com/watch?v=KGh-gMEGGPI&t=5s&ab_channel=OceanWise
- **Microplastics: Too small to see, TOO BIG TO IGNORE** – Ocean Wise: https://www.youtube.com/watch?v=_6h11PipBrg&ab_channel=OceanWise
- **What happens to microplastics in the ocean?** – Ocean Wise: https://www.youtube.com/watch?v=Y0Ks8oSUgIs&t=20s&ab_channel=SciShow
- **Plastic Pollution May Change Cattle** – Scientific American: https://www.scientificamerican.com/article/plastic-cattle-dna/
- **Microfibers Report** – Ocean Wise: https://assets.ctfassets.net/fsquhe7zbn68/4MQ9y89yx4KeyHv9Svynyq/8434de64585e9d2cfbcd3c46627c7a4a/Research_MicrofibersReport_191004-e.pdf
- **Oceans are Life** – Canada C3 – https://canadac3.ca/en/video/sam-ford-fiord-nunavut/

LESSON THREE

- **How Do Ocean Currents Work** – TED-Ed: https://www.youtube.com/watch?v=p4pWafuvdrY&ab_channel=TED-Ed
- **The Ocean – A Driving Force for Weather and Climate** – NASA: https://www.youtube.com/watch?v=6vgvTeuoDWY&ab_channel=NASAGoddard
- **Hokulea Sailed Around the World, But Couldn't Escape Plastic** – Ocean Stories – Ocean Wise: https://www.youtube.com/watch?v=ygAmcULO3Ro&ab_channel=OceanWise
- **The Deep Sea** – Neal Agarwal: https://neal.fun/deep-sea/
- **Plastic Bag Found at the Bottom of the World's Deepest Ocean Trench** – National Geographic: https://www.nationalgeographic.org/article/plastic-bag-found-bottom-worlds-deepest-ocean-trench/
- **Humans are turning the world into Plastic** – Clean Seas, United Nations: https://www.youtube.com/watch?v=RS7IzU2VJIQ&ab_channel=Kurzgesagt%E2%80%93InaNutshell
- **It's Not Me, It's You** – Clean Seas, United Nations: https://www.youtube.com/watch?v=MBc8nESSzf0&ab_channel=UnitedNations
- **Nations sign up to end global scourge of plastic pollution** – United Nations: https://news.un.org/en/story/2022/03/1113142

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