

MARINE PLASTIC UNIT: Secondary Level

Grade: 10/11	Marine Plastic Unit
Big Ideas:	<ul style="list-style-type: none"> • Human practices affect the sustainability of ecosystems (Gr.11 Environmental Science) • Humans can play a role in the stewardship and restoration of ecosystems. (Gr. 11 Environmental Science) • Scientific understanding enables humans to respond and adapt to changes locally and globally. (Gr 11 Science for Citizens) • Energy change is required as atoms rearrange in chemical processes (Gr.10 Science) • Spending time outdoors allows us to develop an understanding of the natural environment and ourselves (Gr.11 Outdoor Education) • The distribution of water has a major influence on weather and climate (Gr.11 Earth Sciences) • An artist's intention transforms materials into art (Gr.10/11 Visual Arts : Art Studio)
Critical Questions:	<ul style="list-style-type: none"> • How do chemical processes, like those that create plastic, affect your life? How do they affect the lives of other animals? (Gr. 10) • In what ways does plastic “break down”? In what ways do atoms rearrange in the production of plastic? How does this rearrangement of atoms affect the strength of plastic and its ability to “break down”? (Gr. 10) • How does the individual as a consumer have an impact on political, economical and societal changes in your local community? (Gr. 10) • How does your audience change your communication strategy? (Gr.11) • How does economic, cultural, and physical background impact our opinions and perceptions? (Gr.11)
Unit Rationale:	<ul style="list-style-type: none"> • Plastics are polluting our oceans at a fast rate – and it’s not going away! Plastic pollution affects more than 660 marine species in our oceans. Some are snagged by fishing lines and nets; others are mistaking plastics for food, and; even more are exposed to the toxins released into our air and waterways. These plastics can suffocate animals, block their stomachs, cut their insides and even alter their DNA. We need to do our part to improve the environment for all living things in our ocean. • People’s perception of the ocean has changed. We once believed the ocean was endless, but scientific research and discovery has revealed that the ocean is finite. We are just beginning to understand the impact that the ocean has on our lives, and how we in turn impact the ocean. Humans rely on the ocean for nearly every aspect in our daily lives. Oxygen, food, medication, transportation, inspiration, entertainment, economy and industry are all sourced from the ocean. We are only just beginning to understand and familiarize ourselves with this intimate relationship, and it is our responsibility to communicate and educate others on the importance of ocean health for the global human population. • The ocean is a delicately balanced ecosystem that support life on this planet. This delicate balance is being damaged by plastic litter. It is human created problem, but there are person-centered solutions. We must work collaboratively and dedicatedly to uncover and communicate these solutions.
Students will do the following COMPETENCIES:	<ul style="list-style-type: none"> • Questioning and predicting; demonstrate curiosity, observe objects and events in similar contexts, ask questions, make predictions. • Planning and conducting; make and record observations, safely manipulate materials. • Processing and analyzing information; compare observations with predictions through discussions, identify patterns and connections.

	<ul style="list-style-type: none"> • Evaluating; compare observations with that of others, demonstrate an understanding. • Applying and innovating; transferring knowledge to real-life scenarios. • Communicating; share ideas and findings, reflect on learning.
<p>Students will know the following CONTENT:</p>	<ul style="list-style-type: none"> • Local and global impacts of energy transformations from technologies. (Gr.10) Ex: The production process of plastics includes the release of pollution which contributes to habitat destruction and increased Carbon Dioxide outputs. • Practical applications and implications of chemical processes (gr.10) • Simple and complex global food systems and how they affect food choices, including environmental, ethical, economic, and health impacts (Gr.10) • Influences of large bodies of water on local and global climates (gr.11) • Human actions and their impact on ecosystem integrity (Gr.11) • Beneficial scientific innovations (Gr.11) • Human impact on Earth’s system: natural resources and effects of climate change (gr.11) • Actions and decisions affecting the local and global environment, including those of First Peoples (gr.11) • Energy flow through ecosystems (Gr.11) • Human actions and their impact on ecosystem integrity (Gr.11) • Resource stewardship (Gr.11) • The hydrologic cycle (Gr.11) • Properties of the ocean and the ocean floor (gr. 11) • Water as a unique resource (Gr.11) • Evidence of climate change (Gr.11) • Effects of climate change on water sources (Gr.11) • Evidence-based decision making through science (gr.11) • Personal and public health practices (gr.11) • English language strategies and processes in new media (Gr.10 and 11) • New media functions; advocacy, propaganda (Gr.11) • Role of artist and audience (gr.10) • Influence of visual culture on self-perception and identity (Gr.10 and 11) Ex: how we view plastics and our relationships with plastics is influenced by media, marketing, community and social media

RESOURCE GUIDE LAYOUT

Page 1: Cover Page; Marine Plastic: A Resource Guide for Teachers Leading Change
Page 2: Table of Contents
Page 3-4: Importance of the Ocean, facts on plastic, facts Canada’s coastline
Page 5: Connections to Canada-wide curriculum
Pages 6-12: Seven Lesson Plans for teachers – all aligned with the 7 Ocean Principles
Page 13: Resource Page

- Links to other ocean education- related organizations, initiatives and networks in Canada
- Does your class have a story you would like to share? Send it here and share it with our news section! <https://ocean.org/plastic-wise/>

LESSON PLANS: #1-7

	Topic	Objectives	Information & Activities	Resources	Assessment
1	<p>The ocean and life in the ocean shapes the earth ~</p> <p><i>Plastic is changing the ocean environment.</i></p>	<p>Students will be able to:</p> <p>[1] Explain ways the ocean is a unique resource.</p> <p>[2] Understand how we are harming the oceans through the production of plastics.</p> <p>[3] Explain what makes up a healthy ocean some aspects of the environment within it – focus on how we can advocate for this through social media.</p>	<p>Critical Questions: <i>How does the ocean help us? How can we help the ocean? What happens when plastic is added to an ocean environment?</i></p> <p>Background Information: The action of the ocean changes the shape of the land. It does this by the slow, continuous movement of seawater, erosion of land deposition of the ocean sediments across geological eras worked together to create the landscape. Not only has the ocean changed our landscape, we also rely on it for our every day life. It gives us food, energy, medicine, transportation, recreation, travel, tourism and even our climate! In this lesson students will reflect on the importance of our oceans, the ways we harm the ocean and what we can do to help it. This lesson should be interactive, where students can communicate their thoughts with the class.</p> <p>Task:</p> <p>1) Watch the videos Oceans are Life and The majestic plastic bag</p>	<ul style="list-style-type: none"> • OW: Take the Pledge • OW: Virtual Meeting • C3: Oceans are Life • C3: Richness, Abundance, and Transects, Oh My! ~65 minutes • UNESCO: Ocean Literacy For All Tool Kit Pg. 135 • Heal The Bay: The majestic plastic bag 	<p>Formative; can students identify ways that the ocean helps us? Opportunity to use an exit slip or a 1-2-3 response.</p>

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			<p>2) Workbook Page __: Give the students 5 minutes to brainstorm each bubble and then come back as a class and share their ideas. Ensure they add the ideas of others to their own map. <i>Ex. Water is a unique resource as it gives us a variety of benefits; food, medicine, travel, climate, etc.</i></p> <p>3) Workbook Page __: Discuss aspects found in the ocean; plants, animals, oxygen, sand, rocks, etc. Have the students consider what makes the ocean healthy and how plastic litter will lead to an unhealthy ocean environment. Once complete, have students draw out their healthy ocean.</p> <p>4) Discuss the ocean promise; to respect the ocean and appreciate what it gives me. Ask the students – what does this mean? Why is this important? Have the students discuss what it means to be respectful versus disrespectful to the ocean environment.</p> <p><i>Want to start the unit with a bang? Schedule a virtual meeting with the Vancouver Aquarium and get a tour on how plastics are harming the ocean environment. More info at onlinelearning@ocean.org.</i></p> <p>Action: <i>I pledge to respect the ocean and appreciate what it gives me.</i></p>		
2	<p>The ocean made the earth habitable ~</p> <p><i>Marine life consumes plastics everyday.</i></p>	<p>Students will be able to:</p> <p>[1] Explain what a simple versus a complex food chain is.</p> <p>[2] Understand how the flow of food energy moves from one organism to another.</p> <p>[3] Understand the environmental, ethical, economic, and health impacts of plastic</p>	<p>Critical Questions: <i>How has the ocean made the earth habitable? How does plastic impact the food chain? What happens if plastic is mistaken as food? What happens when an animal is taken out of the food chain?</i></p> <p>Background Information: Scientists have theorized that life on Earth most likely originated in the sea. The ocean is not only where life is thought to originate but it has also generated much of the oxygen that is required by many of Earth’s organisms. Phytoplankton living in the ocean’s surface waters produce oxygen through photosynthesis. They are the base of the aquatic food chain as they are consumed by zoo plankton, which are consumed by fish larvae, consumed by small fish, consumed by other predators. This lesson will introduce the students to the food chain and will encourage discussion around the flow of energy from one organism to another. Students will also consider how plastic</p>	<ul style="list-style-type: none"> • OW: Reusable Containers! • OW: Article: All About Lunches • WE: Go Green Action Campaign • OW: Our People • FNESC: Unit 8 Ocean Connections • Mysteries of Ancient Clam Gardens 	<p>Formative; Can students identify a simple and complex food chain? Can they explain why the introduction of plastics is harmful to the animals?</p>

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		<p>pollution on the food chain.</p>	<p>will impact this food chain – especially considering many animals will eat it, mistaking it for food.</p> <p>Task:</p> <ol style="list-style-type: none"> 1) Discuss favourite foods. What do you eat? Why? What kind of energy does this give you? Do you get the same energy from sugar as you would from meat? Relate this to simple and complex food chains. 2) Workbook page __: Choose from the pictures and draw out a food web – focus on simple and complex food chains. 3) Work book page: __: What happens when plastic is added to the food chain? Explain how this might affect the animals. <i>Consider bioaccumulation, trophic levels and impacts on people that rely on seafood as a resource.</i> <p>Take it to the Lab (option): Dissect a seafood species such as squid, herring or clams. Connect anatomy, physiology and fishing practices.</p> <p>Action: <i>I pledge to reduce the amount of plastic in my lunches.</i></p>	<ul style="list-style-type: none"> • OW: Dissection Worksheets 	
3	<p>The earth has one big ocean with many features ~</p> <p><i>Plastic litter knows no borders.</i></p>	<p>Students will be able to:</p> <p>[1] Describe how objects in the ocean move from one place to another.</p> <p>[2] Understand the negative impact of single use plastics.</p> <p>[3] Find alternative options for reducing</p>	<p>Critical Questions: How does plastic end up in the ocean? What does it do when it's in the ocean? How do the animals respond to this?</p> <p>Background Information: Water is everywhere! It covers 70% of the earth's surface. Of all that water 97% is found in the ocean. There are 5 major ocean basins around the world and all of these basins together form one big world ocean. Water in the ocean is always moving, all around the world. Waves, tides and the rotation of the earth move the water, nutrients and even animals all over the planet. This movement helps to maintain balance in the world, and keeps the planet healthy. In this lesson students will look at how the ocean moves from place to place and carries animals, plants and plastic with it. Students will consider how their own litter can end up in the ocean and take time to consider the three big R's, as well as ways to take action on reducing litter at home.</p>	<ul style="list-style-type: none"> • OW: How does plastic end up in the ocean? • OW: How does plastic end up in the Arctic? • OW: A Year of Ocean Stories • UN Clean Seas: Turn the Tide on Plastic • OW: Here's How Videos • OW: Vortex 	<p>Formative; workbook responses on movement of objects in the ocean.</p>

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		single use plastics at home.	<p>Task:</p> <ol style="list-style-type: none"> 1) Watch video; How does plastic end up in the ocean? 2) Workbook page ___: Answer questions on movement of objects to the ocean. 3) Workbook page ___: Think-Pair-Share - Make a list of ways you can reduce using single use plastics at home, ex. Watch video: Here's How on making microplastics at home. 4) Optional Plastic Challenge: For 3 days, carry with you a clear plastic jar/container. Every time you use a piece of single-use plastic, put it into the jar. After the three days, empty your jar and evaluate what items you used. Write a blog about the experience. <p>Action: <i>I pledge to reduce my use of single use plastics.</i></p>	<ul style="list-style-type: none"> • OW: Vortex Virtual AquaClass EN/FR • CS: taking the pledge 	
4	<p>The ocean supports a great diversity of life and ecosystems ~</p> <p><i>Plastic is changing the ecosystems of marine life.</i></p>	<p>Students will be able to:</p> <p>[1] Explain the properties of the ocean and the ocean floor.</p> <p>[2] Explain the affects the plastic pollution has on an ecosystem.</p> <p>[3] Explore their own ideas on how to take care of plastic pollution.</p>	<p>Critical Questions: <i>How has plastic impacted the ecosystem of the animals in the ocean? How could they adapt to this? How could it harm them?</i></p> <p>Background Information: The ocean has a lot of diversity in its plants and animals. These adaptations are based on the ecosystem in which they are living in. In this lesson students will learn about biodiversity and ecosystems. They will consider the properties of the ocean and ocean floor and discuss how plastic will have a direct impact on this. Students will take action by organizing a shore-line clean-up in their area – whether they live near a beach or not.</p> <p>Task:</p> <ol style="list-style-type: none"> 1) Mind map: Write the word “Ocean Ecosystem” on the board and brainstorm aspects of this with the students; ask - what is an ecosystem? What does it require? What are the properties of and ocean ecosystem? 	<ul style="list-style-type: none"> • OW: Saving Sea Lions: Why Marine Plastics Matter • OW: Videos on specific Animals; Seals and Killer Whales • C3: Oceans are Life • Article “Plastic Pollution May Change Cattle DNA” - Scientific American • OW: Shoreline Clean-up • OW: Ocean Bridge Leaders 	Formative; are students participating in organizing the clean-up? Have the created roles or assigned tasks?

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			<p>2) Shoreline Clean-up: Consider the shoreline and how this has a direct impact on the ocean environment. Have the students organize a shoreline clean-up in their area. Information found here: OW: Host a Clean-up and resources here; Shoreline Clean-up Note: <i>There are lesson guides found here as well ~ Students do not have to live near a beach to host a clean-up!</i></p> <p>3) Workbook Page ___: Down the Drain Challenge. To contextualize human impact on the environment and demonstrate how individual action can have both a negative and positive affect on the ocean health. More info found here: https://www.youtube.com/watch?v=k16zjz1Fz2k</p> <p>Action: <i>I pledge to pick up litter when I'm outside and try plogging (picking up litter while jogging).</i></p>	<ul style="list-style-type: none"> OW: Host a Clean-up OW: Shoreline Lesson Guides 	
5	<p>The ocean is a major influence on climate and weather ~</p> <p><i>Plastic in our ocean is impacting the climate and weather.</i></p>	<p>Students will be able to:</p> <p>[1] Explain how the ocean acts as a massive water source; focus on the hydrologic cycle.</p> <p>[2] Explain how the ocean influences climate and weather.</p> <p>[3] Understand how the impact of plastic in the ocean climate and weather.</p>	<p>Critical Questions: How does the ocean influence the earth's climate? How would plastic in the ocean change the climate and weather? How does this impact us?</p> <p>Background Information : The oceans are the prime regulators of climate, they absorb 90% of the planet's heat, 30% of the planet's carbon dioxide and give the planet 50% of the oxygen that we need. Ocean currents allow the ocean to absorb, store and transfer of heat. These abilities allow the ocean to have a major influence on climate. Most rain that falls on land originally evaporated from the ocean. As water evaporates from the ocean it transforms into water vapor that is incorporated into the atmosphere. Some of this water vapor rises and helps to form the clouds from which rain falls. In this lesson, students will learn about the hydrologic cycle and will consider the impact of plastic in the ocean on climate.</p> <p>Task: 1) Workbook page ____: Introduce the hydrologic cycle and complete questions on this.</p>	<ul style="list-style-type: none"> OW: How is Climate Change Affecting Arctic Communities? OW: What happens to your plastic bottle when you recycle it? UNESCO: How does ocean acidification occur? 	Formative (or summative if preferred); responses to worksheet on the hydrologic cycle.

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			<p>2) Workbook page ___: Set up science experiment on warm and cold currents in the ocean;</p> <ul style="list-style-type: none"> ▪ Temperature differences create currents – cooler water sinks and flows towards the tropics to cool the water there down and the warmer water from the Tropics flows to the poles to take its place, where it is cooled. ▪ Demonstrate all this using ice cubes with blue dye, hot water that is dyed red using food colouring. Set a clear bucket/tub of water the night before your experiment (to have room temperature water the next day). ▪ Place blue water with ice cubes in the room temperature water and pour hot red water in the tub. Watch where the coloured water moves. <p>3) Watch video; How is Climate Change Affecting Arctic Communities?</p> <p>4) Worksheet page ___: Discuss how plastic heats up the ocean and changes the climate.</p> <p>Action: <i>I pledge to use reusable water bottles at school and at home.</i></p>		
6	<p>The ocean is largely unexplored ~ <i>Microplastics are everywhere!</i></p>	<p>Students will be able to:</p> <p>[1] Understand that plastic pollution begins early in the “plastic lifecycle” starting with the production process.</p> <p>[2] Explain practical applications and implications of chemical processes to create plastics; the way that plastics break down depends heavily on how</p>	<p>Critical Questions: What aspects of the ocean have not been explored? What are microplastics? How do they end up in the depths of the ocean?</p> <p>Background Information: Our lives are connected to the ocean depths. There are challenges and opportunities in this previously hidden realm, and yet, despite the size and importance of the ocean, less than 10% of it has been explored. The global map of the ocean floor is less detailed than maps of Mars, the Moon or Venus. Still, large organisms in the depth of the ocean are being found with plastics in their stomachs. These come from plastics breaking down, from microbeads in cleaners and microfibres from our clothes. In this lesson, students are going to look at physical and chemical ways of changing materials and how this relates to microplastics in the ocean.</p>	<ul style="list-style-type: none"> • OW: What happens to Microplastics in the Ocean • C3: microplastics video • ON: Endeavour Hydrothermal Vents: Canada's First Marine Protected Area 	<p>Formative; can they name some plastics that can be reduced or replaced at home?</p>

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		<p>(processes) and with what (raw materials/chemicals) they are made.</p> <p>[3] Identify major differences between the seven different classifications of plastics and which are recyclable in their community.</p>	<p>Task:</p> <ol style="list-style-type: none"> 1) Watch video: What happens to Microplastics in the Ocean 2) Students go for a walk in small groups around the school in search of different types of litter or recycling and bring them back to the class. 3) Workbook page __: Students will decide if each piece of litter or recycling was made with plastic. Sort items into three categories: contains plastic, may contain plastic and definitely does not contain plastic. Discuss how we know that something does NOT contain plastic – what qualities to we look/feel for? 4) Sort through your “contains plastic” pile and divide them into smaller groupings (i.e. purpose, strength/durability, standard classifications, recyclable in your city etc.). Discuss whether each grouping was created differently than the others. How? Have your students choose a piece of plastic and do some research into the chemicals and processes required to create it. <p>Try it in the lab:</p> <ul style="list-style-type: none"> • Students try their hand at making Casein Plastic – a simple and natural plastic-like substance from household ingredients. • Students research some of the current ways that we are reusing, repurposing and recycling plastics today. • Students are divided into pairs and provided with pens, paper, building materials (i.e. cardboard, masking tape, etc.) and tasked with the creation of a contraption that would help humans or animals reuse, repurpose and recycle plastics. <p>Action:</p> <p><i>Go for a walk around your house and pick up the plastic in your neighbourhood. Make sure to recycle what you can (see standard classifications for plastics.)</i></p> <p><i>I pledge to repurpose a plastic I was going to throw away.</i></p>		

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7	<p>The ocean and humans are connected ~</p> <p><i>We can all become wiser with our use of plastic.</i></p>	<p>Students will be able to:</p> <p>[1] Understand the importance of ocean resource stewardship.</p> <p>[2] Connect actions and decisions on plastic use to the impact on the local and global environment, including those of First Peoples.</p> <p>[3] Understand the influence of visual culture on self-perception and identity through plastic use poster campaign.</p>	<p>Critical Questions: How can we respect the ocean? What can we do to help it?</p> <p>Background Information: Water is not just a resource – it also has a cultural importance to Indigenous communities in Canada. For Indigenous peoples, water is a living thing and a spiritual entity with “life-giving” forces. With this there are certain duties and responsibilities to ensure that it is respected, protected, and nurtured. For Indigenous peoples, water quantity and quality are not only ecological and health issues but also parts of a much broader holistic perspective which recognizes that all aspects of creation are interrelated. Water is not only for drinking but also has traditionally and continuously been used in ceremonies, to grow medicines, and for cleansing and purification. (Excerpt taken from The Solutions Journal: Found here). In this lesson, students will consider how actions on plastic use impacts the indigenous communities. They will do a reflection activity and consider their own connection to the ocean. After this they will apply their learning to a poster to share with their peers.</p> <p>Task:</p> <ol style="list-style-type: none"> SEL reflection activity – students visualize they are at the ocean. <i>What do you hear and what can you see? What does it smell like to you? Describe the sensations you feel on your skin and what you feel in your heart when you think of the Ocean.</i> Workbook Page __: Love Letters to the Sea Watch Video: “it’s not you it’s me” Workbook Page __: How to Build a Campaign (link to be attached) Create Campaign Posters to share the student learning around the school. <i>Ex: how we view plastics and our relationships with plastics is influenced by media, marketing, community and social media</i> <p><i>Schedule a virtual meeting to see Douglas Coupland’s Vortex on Marine Plastic. More info at onlinelearning@ocean.org.</i></p>	<ul style="list-style-type: none"> OW: Reduce, Reuse, Recycle video C3: Expedition Videos UN Clean Seas: “it’s not you it’s me” OW: Vortex Art Exhibit 	<p>Summative; See rubric for campaign – individually or in groups.</p>

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			<p>Action: <i>I pledge to spread my knowledge about using plastics with others.</i></p>		