Ocean Week Canada

Museum, Science Centre & Aquarium Toolkit

Activity Guide

Ocean Week Canada

Introduction

The health of the global ocean and freshwater ecosystems, as well as the biodiversity they each sustain, are critical for our community, cultural, and economic well-being. Pollution, climate change, habitat loss, and many other factors related to human activity pose a risk to our water systems and the species that live there. Action must be taken to not only protect these species, but to actively rebuild their populations. The issue of plastic pollution is a growing problem. Scientists have predicted that by the year 2050, there could be more plastic in the global ocean than fish (by weight). Plastic debris can lead to suffocation and entanglement for marine species. Its ingestion by wildlife can lead to starvation, stunted growth, and reproductive problems; plastics also pose a threat to human health as toxins and microplastics are introduced into our food web. Local waterways flow into watersheds that eventually lead to the ocean, acting as an avenue for any pollution or debris left to travel. Bottom line: we are all connected and our actions matter!

Dive into this hands-on toolkit developed by the Canadian Museum of Nature and Ingenium to promote the importance of aquatic health throughout Canada. A limited number of kits with materials are available to select museums, science centres, and aquariums across Canada; however, all the information and materials required to engage in the activities are detailed in the digital toolkit. You can do it yourself! The activities are targeted for general museum audiences of children, aged 6-12, and their families, and will help museum professionals interpret marine concepts in an encouraging and engaging way. Participants will have the opportunity to program their RiveBot (line tracking robot) to gobble up plastic garbage in a river; use handheld microscopes to investigate aquatic organisms and microplastics samples up close; and then test their knowledge with our water trivia game. By creating a memorable moment of discovery and investigation visitors will feel empowered to support ocean health.

Ingenium
Canada's Museums of Science and Innovation
Musées des sciences et de l'innovation du Canada

canadian museum of nature
nature
musée canadien de la nature

Canadian Ocean Literacy Coalition
La coalition canadienne de la connaissance de l'océan

Canada

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RiverBot Garbage Gulper

In this activity, visitors will program their RiverBot to mimic real life examples of pollution cleanup in aquatic ecosystems. Most local waterways eventually lead to the ocean, bringing any pollution or debris left on the ground along the way with them. We are all connected and our actions, wherever we live, matter. In order to effectively clean up ocean plastics, we need to help prevent new plastic from entering the ecosystem.

Learning Objectives

- We are connected to the ocean and the ocean connects us.
- There is only one big global ocean, and we have a responsibility to care for it.
- Life on land and life below water depend on a healthy ocean
- Our actions threaten ocean health, our health, and the health of future generations.
- Plastic pollution negatively affects aquatic ecosystems and can have an effect on biodiversity and species at risk.

Materials

- Charged Ozobots
- Markers
- Maps
- Instruction Sheets
- Colour Codes
- Line drawing examples
- Table, chairs, roll-up banner

Preparation

- Ensure Ozobots are charged (plug the mini USB charging cable into a computer or a multiport charger and plug the Ozobot into the other end. Ozobot blinks green when it is partially charged, and shows a solid green light when fully charged.)
- Make a demonstration path on a map to allow for an example of how the Ozobots work.
- Prepare a space with the maps, markers, instruction sheets, and colour codes laid out for visitors to create their own map.
- Keep the Ozobots near the facilitator, and hand them out for people to test their path as needed.

Try This

- Create a path for your Ozobot to leave the ship and return to the dock
- Collect 3 pieces of trash and take a photo of any aquatic animals you might see along the way

Accommodations

A lower working area, such as a short table, bench or clipboard, should be made available so that the activity is accessible for small children and people in wheelchairs.

Guiding Questions

How do you think cleaning up the river can help the ocean?

- Small streams and rivers will join together and eventually all this water runs into a large body of water like a large lake or the ocean.
- It is easier to prevent pollution from entering at the source rather than try to clean it up once it is already in the aquatic environment.
- Rivers have been found to be the primary source of ocean plastic pollution as they are the arteries that carry waste from the land to the ocean.

Why is plastic bad for the aquatic environment?

- Plastic can be ingested by aquatic species, which for some, can lead to their starvation, as their stomachs fill with debris that provides no nutrition.
- Plastics can cause entanglements of marine species.
- Plastic in the ocean can break down into particles due to the constant motion and harsh conditions. Particles smaller than 5mm in diameter are called microplastics and become effectively impossible to retrieve as they travel farther and deeper.
- Floating plastic contains harmful chemicals and absorbs even more pollutants. These make their ingestion even more dangerous for aquatic animals and anything along their food chain. As animals eat the plastic, and are in turn eaten by other animals, these toxins (along with the plastics) can travel up the food chain in a process called biomagnification.

Why do you think some species in Canada are identified as at risk?

- A species at risk is any naturally-occurring type of plant or animal that is in danger of extinction or of disappearing.
- Habitat loss and degradation are the primary factors that influence the endangerment of species today. In Canada, about 60% of species identified as being at risk are affected by habitat loss or degradation.
- It is not necessary that a habitat be destroyed for it to become unsuitable for some species. Any disturbance can cause some species to abandon their habitat or prevent them from breeding successfully.
- Environmental contamination can have a great effect on wildlife and their habitats. Chemicals released from industry into air or water, or leached off lands into water bodies, can have a great effect on many organisms.
- Climate change affects species in many ways. Warming temperatures, effects on food sources, sudden climatic events like extreme storms, all have an impact.
- The introduction of invasive plants and animals takes its toll on native wildlife.
- Outbreaks of diseases can radically affect populations.
- Over harvesting and excessive trade (for food or pelts) has a great effect on species survival.

Dive Deeper

Ozobots are little robots that were designed to provide an introduction to coding. They use downward facing cameras to detect the color of the line under it. They will follow the lines using a back-and-forth motion. Different colors give different commands via different combinations.

Our RiverBots cleaned up our plastic pollution during this activity. Technologies are being developed in the real world that will help us find solutions to plastic pollution accumulating in our aquatic environments. For more information on these real-life projects refer to the **Background Information for Science Interpreters**.

RiverBot Garbage Gulper

Instruction Sheet

PLEASE BE CAREFUL WITH THE OZOBOTS; THEY ARE FRAGILE!

***All lines and codes must look EXACTLY like they do on the colour code sheet! ***

The Ozobot will follow a black line, read the code, and perform each action. Draw a black line from the boat (your starting point) to the first objective you pick. **Remember, you need to collect 1 plastic bag, 1 surgical mask, 1 plastic straw, and take a photograph of any aquatic species you go by!** You must leave the starting point and make it to the dock at the other end. Use the legend of codes to figure out which code to use for each action.

Tips

- Make your lines the same thickness as on the example sheet
- **Go one step at a time!** Your Ozobot might end up off the path after doing an action so draw your route one piece after the other.
- TEST AFTER EACH STEP/ACTION
- When you are drawing the lines make sure you don't run over any objects, go around or else your bot will get confused.

Colour Codes

Collect a plastic bag

Collect a surgical mask

Collect a plastic straw

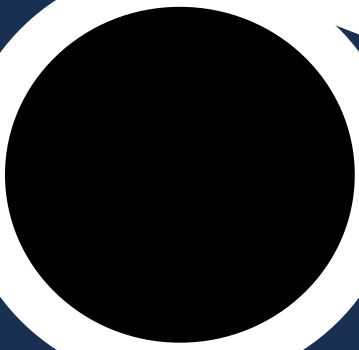
Take a photo

Move quickly

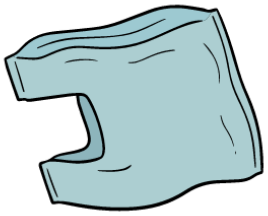
Slow down

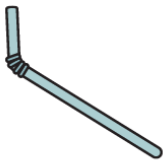
To run your Ozobot

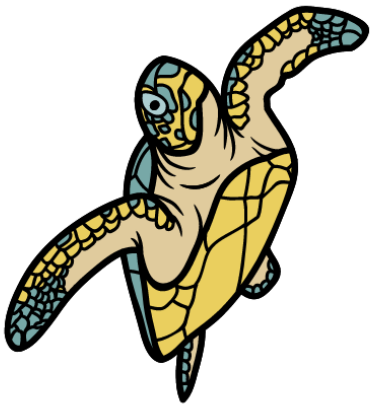
1. Press the button on the side.
2. Make sure to calibrate your Ozobot by holding the side button until a white light blinks. Then place the Ozobot on the black dot and the Ozobot will read the code, flash blue, move forward, flash green, and stop. If it flashes red, then try again.

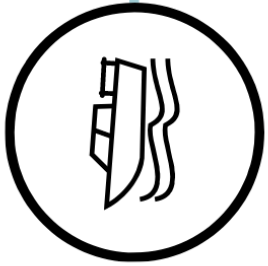


Map









Colour Codes

OzoCodes

ozobot COLOR CODE REFERENCE CHART

SPEED

SNAIL DOSE | SLOW | CRUISE

FAST | TURBO | NITRO BOOST

WIN/EXITS

WIN/EXIT (PLAY AGAIN)

WIN/EXIT (GAME OVER)

DIRECTION

GO LEFT | GO STRAIGHT | GO RIGHT

LINE JUMP LEFT | LINE JUMP STRAIGHT | LINE JUMP RIGHT

U TURN | U TURN (LINE END)

COUNTERS

FIVE DOWN TO STOP

ENABLE X-ING COUNTER

ENABLE TURN COUNTER

ENABLE PATH COLOR COUNTER

ENABLE POINT COUNTER

POINT +1

POINT -1

TIMERS

TIMER ON (30 SEC. TO STOP) | TIMER OFF | PAUSE (3 SEC.)

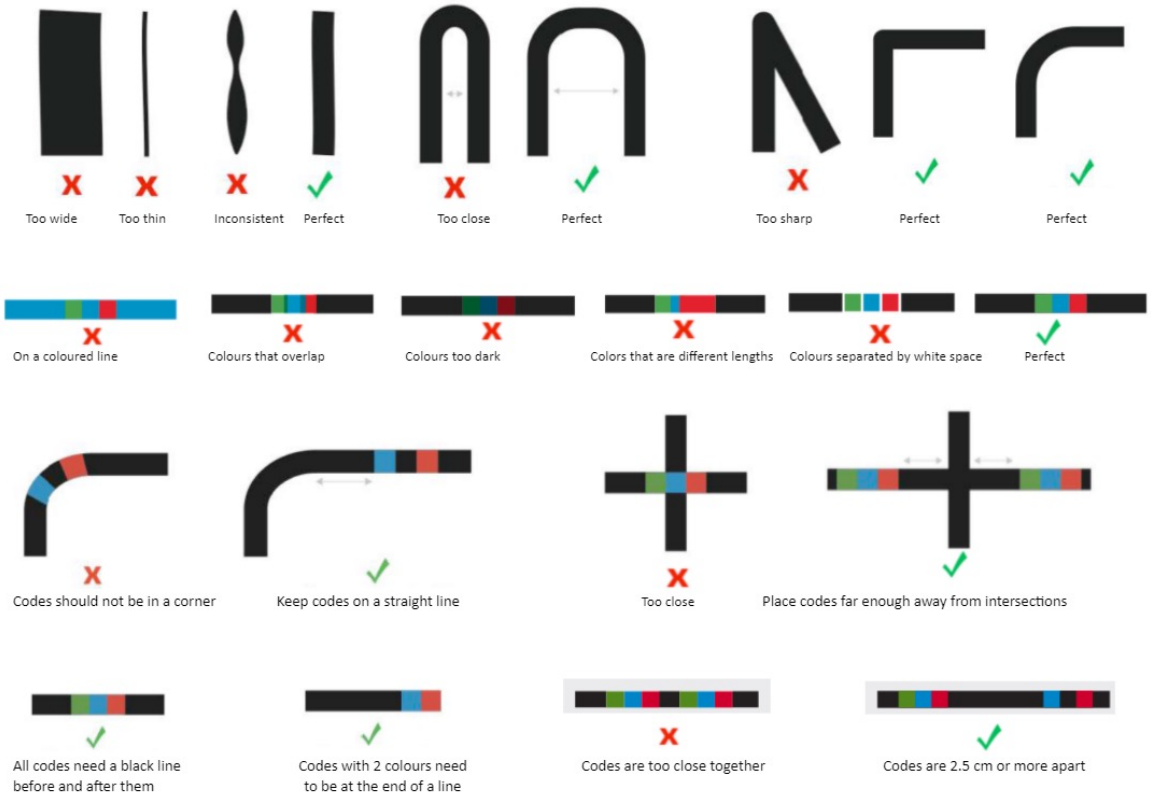
COOL MOVES

TORNADO | ZIGZAG | SPIN | BACKWALK

ozobot.com

Tracking Lines

How to draw the lines



CODES COULEURS

VITESSE


Vitesse escargot


Vitesse lente


Vitesse de croisière

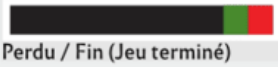

Vitesse rapide


Turbo


Boost

FIN DE JEU


Gagné / Fin (Rejouer)


Perdu / Fin (Jeu terminé)

DIRECTION


Aller à gauche


Aller tout droit


Aller à droite


Sauter de ligne à gauche


Sauter de ligne tout droit


Sauter de ligne à droite


Demi-tour


Demi-tour (Fin de ligne)

COMPTEURS


Compteur X-ing enclenché


Compteur de virage enclenché


Compteur de chemin colorisé


Compteur de points enclenché


+1 point


-1 point

TEMPS


Chrono allumé, 30s puis STOP


Pause, 3s

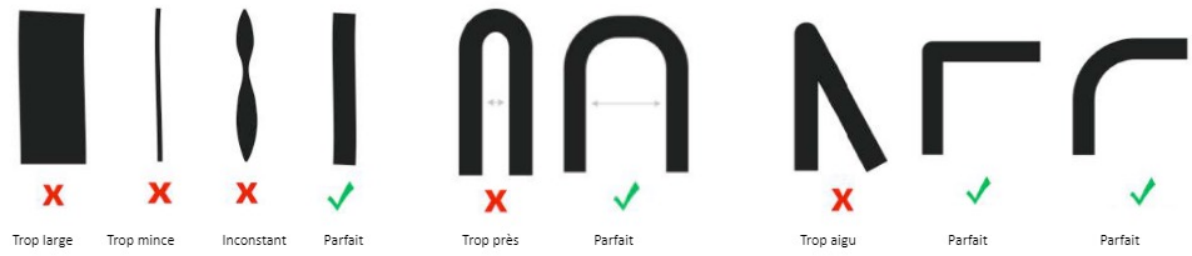
MOUVEMENTS SPECIAUX

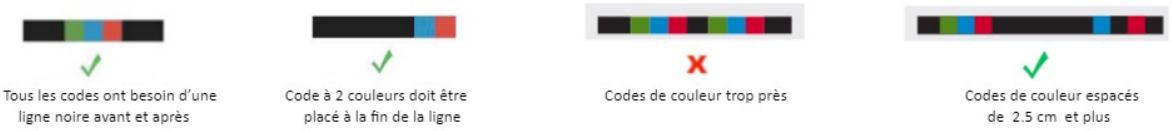

Tornade


ZIGZAG


Tourner sur soi-même

Comment dessiner les lignes





Focus on the Ocean

Marine Life & Microplastics Magnified

Feeling connected to the ocean and better understanding the impact of our actions on the ocean, can help inform us on how to make better choices to support ocean health. In this activity, we give visitors a chance to see marine animals up close and investigate plastics and microplastics under a microscope.

Instruction Sheet

Learning Objectives

- Feel more connected to marine life and the ocean.
- Gain an increased awareness of the negative impacts of plastics in our waterways.
- Understand the importance of reducing plastic waste to better support ocean health.
- Identify sources of microplastic pollution and ways to mitigate it.

Materials

- 4 hand-held microscopes
- 6 marine animal resin samples
- 4 PetriSlide microplastic samples
- Instruction sheet
- Table
- Roll-up banner

Preparation

- Prepare a space with the microscopes and samples laid out for visitors to investigate
- Setup the roll-up banner nearby
- Ensure microscopes and samples do not leave the area

Try This

1. Use the microscope to look at plastics of different sizes. Microplastics can be smaller than the human eye can see.
2. Look at the marine animal specimens and the microplastics. Use the microscope to closely investigate the animals' mouths and the sizes and shapes of the microplastics.
3. Discuss and compare which animals will be most affected by marine plastics. Discuss the sources of the microplastics. Think about how this may affect us.

Guiding Questions

How do these animals feed? How might they accidentally ingest plastic?

- Sea stars eat algae, sponges, bivalves, and other benthic invertebrates. Sponges and bivalves are filter feeders who ingest microplastics floating in the water. Sea star polyps (juvenile) feed on phytoplankton and may ingest microplastics during this phase of their life cycle.
- Algae can sometimes grow on, and adhere to, ocean plastics. This can make the plastic look and smell like phytoplankton (food for animals like fish and crabs), who may accidentally ingest it.

Do you recognize these microplastics? Where might they come from?

- Microplastics come from a variety of sources including clothing made from synthetic fibers, small beads in toothpaste, soaps, and other hygiene and cosmetic products, as well as from the breakdown of larger pieces of plastic.

What are the impacts on the ocean and on the food chain if these animals ingest too much plastic? How does this affect us?

- Toxins can adhere to ocean plastics. As animals eat the plastic, and are in turn eaten by other animals, these toxins (along with the plastics) can travel up the food chain in a process called biomagnification. The animals in resin can all bioaccumulate and biomagnify microplastics.
- As the concentration of plastics in the ocean increases, we are starting to find plastics in animals we harvest for food. Recently, scientists in the Netherlands have found plastic particles in human blood. Eating shellfish and other seafood can increase our chances of eating microplastics.
- Toxins that adhere to plastics can cause many problems by harming our organs. The effects of plastic itself are still poorly understood. Plastic has only been widespread on Earth for around 50 years and scientists need more data on how plastics interact with our bodies' various systems before we fully understand the associated risks.

How can we all help to reduce the amount of microplastics that get into the environment?

- Stop using single-use plastics: drinks in plastic bottles; shopping bags; sandwich bags; plastic straws.
- Buy products made from natural elements when possible (organic or recycled cotton clothing; compostable fast-food containers; paper or wax packaging).
- Avoid purchasing or wearing clothing made from synthetic fibers (like polyester).
- Don't use cosmetic products (soaps, toothpaste) containing microplastics (check the ingredients list for words like polyethylene or polypropylene).

Accommodations

The microscopes and resin samples should be on a short table so that they are accessible for small children and visitors using wheelchairs or other mobility aids.

Focus on the Ocean
Marine Life & Microplastics Magnified

Dive Deeper

Ocean plastics are found in a wide range of sizes - from big pieces of plastic to microplastics. Microplastics refers to any piece of plastic smaller than 5mm. Some microplastics are microscopic and cannot be seen with the human eye.

As plastics drift through the ocean, they break down into smaller pieces. The waves, water, and sun all contribute to the mechanical breakdown of plastics. Some plastics sink to the bottom of the ocean while others float at the surface; however, most ocean plastics are suspended in the water column. Since plastics are found in many different ocean ecosystems, they affect a wide range of animals - from benthic (where organisms living on or in the bottom) to pelagic (where swimming and floating organisms live) to coastal marine animals.

While many microplastics are formed when larger pieces of plastic break down, there are direct sources of microplastic pollution as well. Canada has banned the use of microbeads since 2018, but many companies still use microplastics in cosmetic products to improve texture or for other uses. Synthetic clothing releases plastic microfibers into the environment when it is worn and washed. Filters are being developed around the world to reduce the amount of plastic microfibers released from washing synthetic clothing, but this is not enough. To protect the health of the ocean, we should avoid using products that contain microplastics.
The unique properties of plastic allow other toxins floating in the ocean to adhere (stick) to the plastic and conglomerate. As microplastics become more abundant in the ocean, they begin to mix into the food web along with the toxins adhered to them. These toxins, and the microplastics themselves, can bioaccumulate in marine animals and cause organ damage. This accumulation of plastic and toxins can affect marine animals' reproduction, metabolism, growth, and more. The plastics and toxins are also biomagnified up the food web, sometimes all the way up to us humans.

Crustaceans, like the crabs and shrimp provided in the resin samples, feed on plankton floating in the water. As algae grows on microplastics, these animals can mistake it for tasty phytoplankton and will ingest it. Zooplankton also mistakenly ingest microplastics, and they are in turn eaten by fish, who can biomagnify the plastic up the food chain. Sea stars are benthic animals that feed on mussels, who are filter feeders and may ingest plastic. While sea stars, crabs, and fish live in different oceanic habitats, they are all affected by ocean plastics. This indicates the depth of the effects of this problem.

Very recently, in March 2022, scientists in the Netherlands detected plastic particles in human blood. Of the 22 people whose blood they sampled, 17 of them had a quantifiable number of plastic particles in their blood. While this is a shocking discovery, we still don't fully understand the associated health risks due to a lack of evidence. Eating shellfish and other seafood increases your chances of ingesting plastic.

Preparing microplastic samples

- PetriSlides purchased from www.emdmillipore.com
- Microplastics made from shredded plastic bag
- Microfibers taken from polyester clothing

Background Information for Science Interpreters

There is one big ocean global ocean:

- Local waterways and watersheds eventually lead to the ocean and all the worlds' oceans are connected.
- Local activities can affect the global ocean.
- It is the responsibility of everyone to take care of the ocean.

Oceans play a crucial role in mitigating climate change

- The global ocean acts as a climate regulator and as a sink for atmospheric carbon dioxide (CO_2).
- Atmospheric carbon dioxide (CO_2) diffuses naturally with water (it mixes into the ocean). Here, it undergoes several chemical reactions with water and forms carbonate ions (CO_3^{2-}) and hydrogen ions (H^+). Microscopic planktonic organisms combine these carbonate ions with calcium ions (Ca^{2+}) (rocks dissolved by weathering are the main source of calcium in the ocean) to create calcium carbonate ($CaCO_3$) which they use to build shells and plates necessary for their survival. When these organisms die, they sink to the bottom of the ocean and are buried, taking the CO_2 with them. This is why the ocean is a sink for CO_2. These tiny marine organisms are the basis of the marine food chain. Many of these organisms are phytoplankton and, through photosynthesis, are responsible for producing 50-80% of the world's oxygen.
- With more carbon dioxide in the atmosphere, more is diffused into the ocean. Increased carbon dioxide increases the amount of H^+ ions in the ocean. These extra H^+ ions begin to react with the carbonate (CO_3^{2-}) and create bicarbonate (HCO^{3-}). This reduces the amount of carbonate available for marine organisms to use in building their shells. These extra H^+ ions reduce the pH of the ocean, making it more acidic - this is why the process is called ocean acidification. Normally, since the ocean is so big, it is very difficult to change the equilibrium of its chemistry. But human activities have added so much carbon dioxide to the atmosphere that the ocean cannot keep up. Between 1751 and 2021, the ocean's pH has dropped from 8.25 to 8.1. This represents a 30% increase in H^+ ions in that time (remember, pH is a logarithmic scale, so a change of unit of pH is equal to a tenfold change in H^+ ions). Freshwater environments also seem to be acidifying, but this is much more complex and less understood.
- Climate change has a negative impact on the ocean including: rise in ocean temperature, ocean acidification, deoxygenation, sea level rise, the decrease in polar ice coverage, coastal erosion, and extreme weather events.
- The ocean plays a crucial role in the water cycle.

Health of marine and freshwater ecosystems are critical for our country and they are at risk

- The health of our water systems (marine and freshwater) and the wildlife they sustain are critical to our community, cultural, and economic well-being.
- Climate change, habitat loss, pollution and many other factors related to human activity pose a risk to the species that find their homes in our water systems.
- Action must be taken to not only protect these species, but to actively rebuild their populations.

Human activities are harming Canadian water systems – plastics

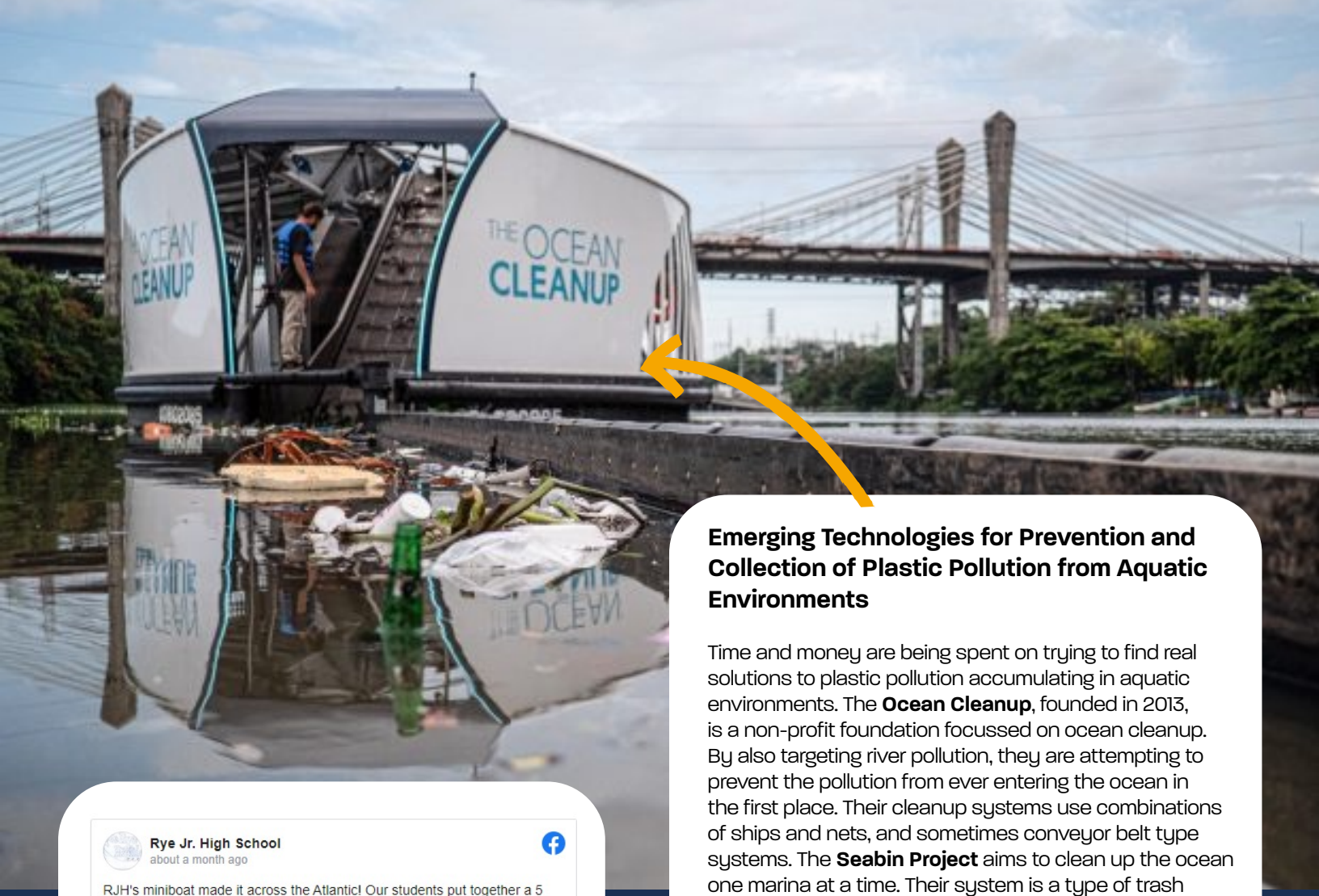
- Human activities can harm aquatic life and are degrading the ocean and waterways.
- This undermines coastal communities' livelihoods and has a negative impact on human health.
- Every year more than 8 million tonnes of plastic are dumped into the ocean.
- Oceanic pollution includes toxic chemicals from industries (including oil, lead, and mercury), land run-off (including fertilizers, petroleum, and pesticides), wastewater, oil spills, and littering.
- Pollution in the ocean has a negative impact on human health, through contaminated water supplies and food chains through affected marine life.
- Pollution has a negative effect on the economy as natural resources are destroyed by pollution.
- Pollution can reduce the ecological benefits of a recreational area and in some cases render it completely unusable, negatively impacting culture.

Where do plastics come from?

- Plastic pollution needs to be stopped at the source
- Alternatives need to be found to single-use plastics; not only are they killing aquatic animals, but they are made using fossil fuels which are affecting our climate.
- Plastic production is projected to quadruple in the next 30 years, and we cannot recycle our way out of that.
- Only 9% of every piece of plastic ever made has been recycled, and some of that is not even recycled – it's downcycled.
- Customers need to be provided a choice of plastic-free options.
- Pollution, including plastics, gets washed down from our streets, parks, and parking lots and into storm drains and small creeks which make their way to bigger waterways, and eventually the ocean.
- Microplastics are found in many of our cosmetic products and microfibers are released from synthetic fabrics. When synthetic plastics are laundered these microplastics find their way into our wastewater. To protect the health of the water systems we should limit our use of products that contain, or are made from, synthetic materials. Microplastic filters that you can attach to your washing machine are being developed. The performance of these filters is still being investigated. This work is important since scientists are saying that textiles may be responsible for up to 35% of microplastic pollution in the ocean.

Why are plastics a problem?

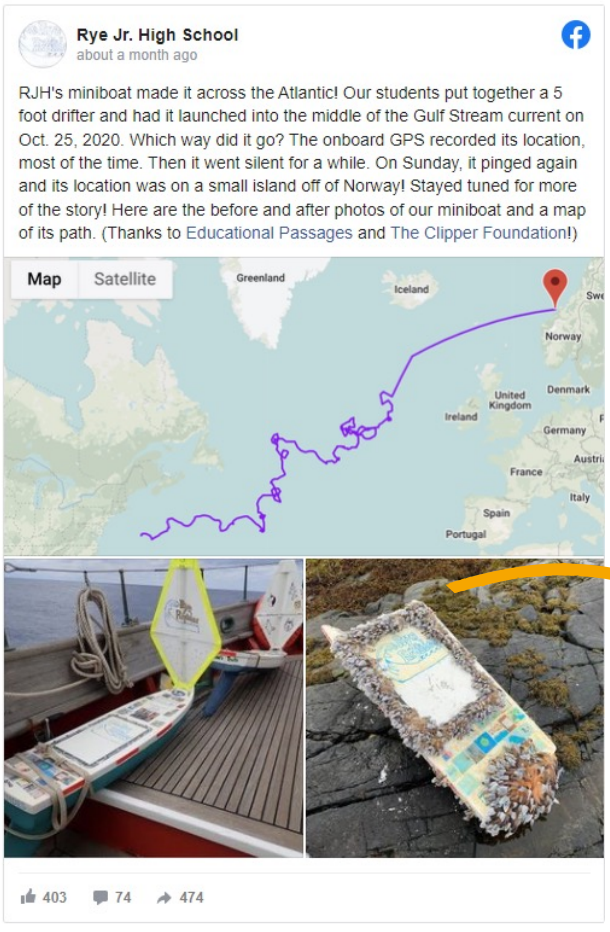
- In 2017, the World Economic Forum and Ellen MacArthur Foundation estimated that by the year 2050 there could be more plastic in the global ocean than fish (by weight).
- In the great garbage patches in the Pacific and Atlantic Ocean, plastic already outnumbers living organisms by 180:1.
- As plastics float around in the ocean, they are broken down into smaller pieces; pieces of plastic smaller than a quarter are called microplastics.
- Microplastics are easily ingested by marine life and produce a series of toxic effects and can lead to starvation as stomachs become filled with plastic.
- Toxins can adhere to plastics and biomagnify up the food chain.
- Plastic can release harmful chemicals into the water and into animals that ingest it.
- Microplastics have been found in Arctic ice, human blood, and even embedded in human lung tissue.



Emerging Technologies for Prevention and Collection of Plastic Pollution from Aquatic Environments

Time and money are being spent on trying to find real solutions to plastic pollution accumulating in aquatic environments. The **Ocean Cleanup**, founded in 2013, is a non-profit foundation focussed on ocean cleanup. By also targeting river pollution, they are attempting to prevent the pollution from ever entering the ocean in the first place. Their cleanup systems use combinations of ships and nets, and sometimes conveyor belt type systems. The **Seabin Project** aims to clean up the ocean one marina at a time. Their system is a type of trash skimmer that is designed to be installed in the water in areas with calm environments, such as marinas. The **Jellyfishbot** is a remote-controlled device that collects marine waste in areas that are inaccessible for cleaners that use nets. The **WasteShark** is an electric marine drone that scoops up floating debris. It can be used in rivers, lakes, and along coastlines. **FRED (Floating Robot for eliminating Debris)**, developed by Clear Blue Sea, runs on solar power, and collects marine debris using booms, belts, and bins.

Photo Credit - The Ocean Cleanup



A small boat made by middle schoolers in New Hampshire made its way to Norway!

In October 2020, a small boat fitted with a GPS tracking device aboard set sail from a small town in New Hampshire. Some 462 days and 13,400 km the boat made its way to the shores of the small Norwegian island of Smøla.

Photo Credit - @RyeJrHigh

Beyond the Sea

Water Trivia Game

Instruction Sheet

This game will test visitors' understanding of Canada's water systems and help strengthen ocean knowledge in an engaging way. The laminated cards have an aquatic-themed trivia question printed on one side with the answer on the back. An interpreter, who will be able to provide additional context and information about the answer, can lead the activity, or visitors can take the opportunity to test each other. Alternatively, a video version of the game can be projected on a screen as a background or self-guided activity.

Learning Objectives

- Learn about the key messages of ocean health:
  - Water shapes us. We are connected to the ocean and the ocean connects us all.
  - Life on land and life below water depend on a healthy ocean.
  - Our actions threaten ocean health, our health, and the health of future generations. There is only one big global ocean, and we have a responsibility to care for it

Materials

- Laminated cards and/ or digital slide show on a looping video
- Instruction sheet
- Table; chairs; roll-up banner

Preparation

- Prepare the trivia game at a table with chairs for visitors to sit, or alternatively play the looping video on an available screen.

Try This

1. The interpreter can deliver the questions to the visitors. This will spark discussion of ocean health and ensure visitors get the most out of the activity.
2. Visitors can challenge each other's knowledge related to aquatic environments in Canada when the interpreter is unavailable.
3. The questions (and answers) could cycle through on a digital screen when the interpreter is not able to be at the station with the material.

- Be sparked to learn more about our water systems and the importance of supporting ocean health.

Definition of Terms

Aquatic Environment is an environment that is in and surrounding any body of water. This is as opposed to an environment that is land-based.

Aquifer is a body of permeable rock which can contain or transmit groundwater.

Benthic, pelagic and coastal marine animals
Benthic animals live in the benthic zone (on, in or near the bottom of the water column). Pelagic animals live anywhere within the water column of an ocean. Coastal marine animals are those that live close to the coast (where the land meets the ocean) as opposed to living in the open ocean.

Biodiversity is a word derived from 'biological diversity' and it refers to the variety of life on Earth. It refers to all living things including plants, animals, and even microorganisms.

Climate regulation is provided by nature through the long-term storage of carbon dioxide. The ocean is a huge climate regulator as are trees, soils, and vegetable biomass.

Filter Feeder (of an aquatic animal) feeds by straining suspended matter and food particles from water, usually by passing the water over a specialized filtering structure.

Fossil Fuels
Natural fuels are oil, coal, and natural gas that were formed in the distant past from the remains of living organisms. These are considered non-renewable.

Freshwater system
Freshwater habitats are not salt water and can be either still, such as lakes and swamps, or running-water, such as rivers, or groundwaters, which flow in rocks and aquifers.

Garbage Patch is a large area in the ocean where litter and other debris (marine debris) collects. They are formed in areas around gyres (a large system of rotating ocean currents). Much of the debris is small pieces of floating plastic that are not necessarily even noticeable to the naked eye.

Groundwater is water that is held underground in the soil or in pores and crevices in rock.

Land-based sources (of marine pollution) come from activities on land and can be dumped into the ocean or any other waterway. These sources can include waste (commercial, residential, or industrial), sewage, runoff from farms, or waste from mining among others.

Marine environment refers to the environment near the shore, offshore, and in deep water zones of the ocean.

Marine Protected Area (MAP) is a part of the ocean that is protected by laws to achieve the long-term conservation of nature.

Microfibers are synthetic fibers that are quite fine. They have a diameter of less than ten micrometers. Microfibers can be a type of microplastic.

Microplastics refers to any piece of plastic smaller than 5mm. Some microplastics are microscopic and cannot be seen with the human eye. As plastics drift through the ocean, they mechanically break down into smaller pieces. The waves, water, and sun all contribute to the mechanical breakdown of plastics. Some plastics sink to the bottom of the ocean, but most ocean plastics are suspended in the water column.

Ocean Gyre is a large system of circular ocean currents that are formed by the combination of the Earth's rotation and wind patterns. There are 5 main ocean gyres.

Plankton are the diverse organisms found in water that cannot swim (they just float around). Plankton are found in marine and freshwater environments and include organisms like bacteria, archaea, algae, protozoa, and other floating animals. While many planktonic species are microscopic in size, plankton includes species of a wide range of sizes. Phytoplankton are microscopic plants, but they play a huge role in the marine food web. Like plants on land, phytoplankton perform photosynthesis to convert the sun's rays into energy to support them, and they take in carbon dioxide and produce oxygen. Because they need the sun's energy, phytoplankton are found near the water's surface. (see Zooplankton below)

Renewable freshwater is water that is part of the water system such as in lakes, rivers, and swamps. Water that is held captive such as in soils, aquifers, and glaciers is not considered renewable.

Species at Risk are categorized as vulnerable, endangered or critically endangered species. A species at risk is any naturally occurring type of plant or animal in danger of extinction or of disappearing. A vulnerable species is threatened with extinction unless the circumstances that are threatening its survival and reproduction improve. An endangered species is very likely to become extinct in the near future. A critically endangered species is considered to have an extremely high risk of extinction in the wild

Wastewater is water that has been used and is being discarded. This can be either as part of an industrial process, in a business or in the home.

Watersheds are also known as drainage basins. Any area of land that drains off into a common outlet is known as a watershed. Any debris or pollution within a given watershed will drain into that common body of water. Areas of high elevation separate watersheds from one another. Each watershed has smaller and smaller ones within it. A large river watershed, such as the St. Lawrence, has many smaller rivers and streams that contribute to it. It in turn connects the Great Lakes to the North Atlantic Ocean.

Zooplankton include microscopic animals (krill, sea snails, pelagic worms, etc.), the young of larger invertebrates and fish, and weak swimmers like jellyfish. Most zooplankton eat phytoplankton, and most are, in turn, eaten by larger animals (or by each other). Krill may be the most well-known type of zooplankton; they are a major component of the diet of humpback, right, and blue whales. During the daylight hours, zooplankton generally drift in deeper waters to avoid predators. But at night, these microscopic creatures venture up to the surface to feed on phytoplankton. This process is considered the largest migration on Earth; so many animals make this journey that it can be observed from space.

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