Ocean Week Canada

Museum, Science Centre & Aquarium Toolkit

Activity #3: Beyond the Sea – Water Trivia Game

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
musée canadien de la nature

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

Canada

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.

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

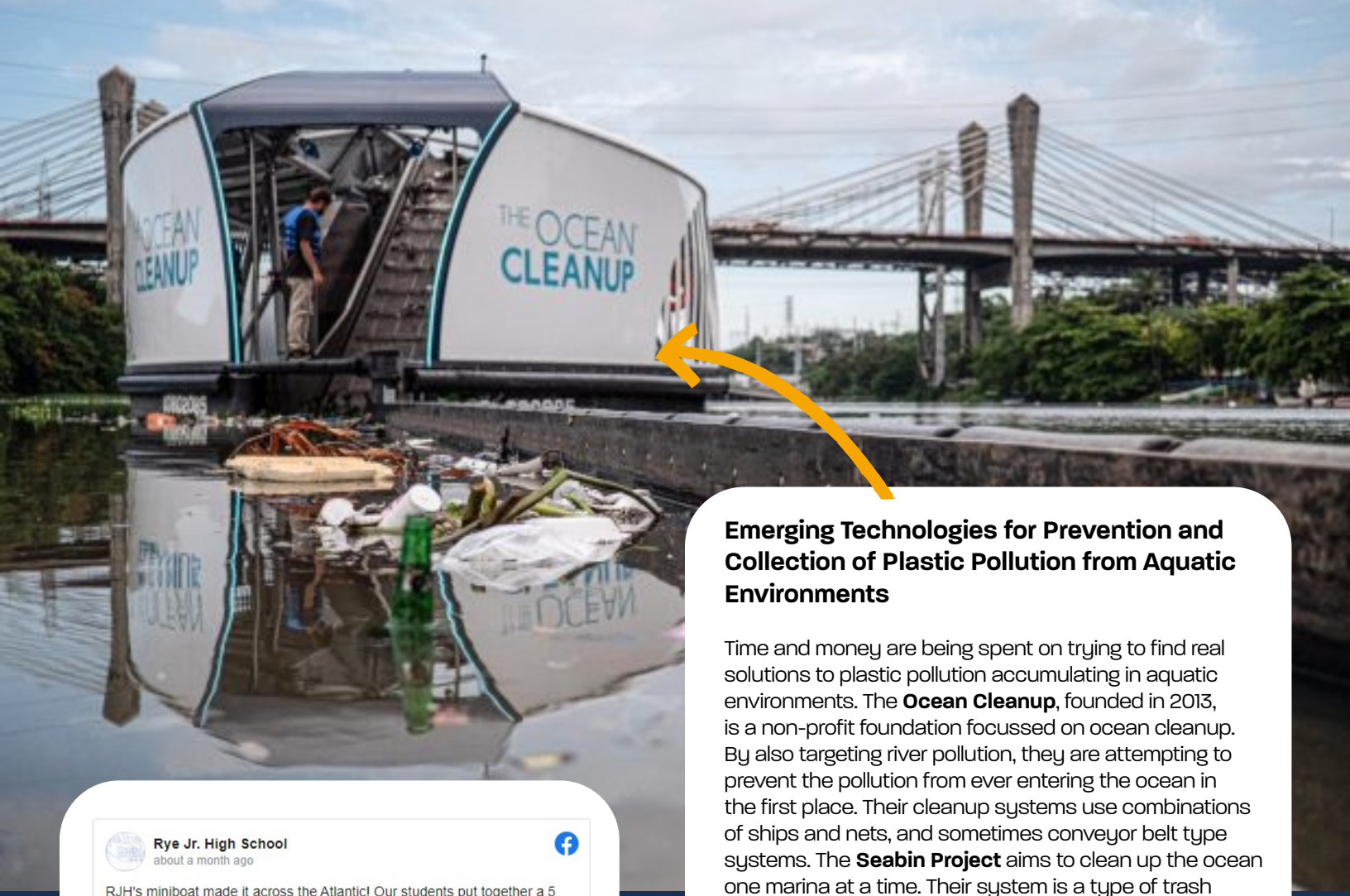
- Human activities can harm aquatic life and are degrading the ocean and waterways.
- This undermines coastal communities' livelihoods and has a negative impact on human health.
- Every year more than 8 million tonnes of plastic are dumped into the ocean.
- Oceanic pollution includes toxic chemicals 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?

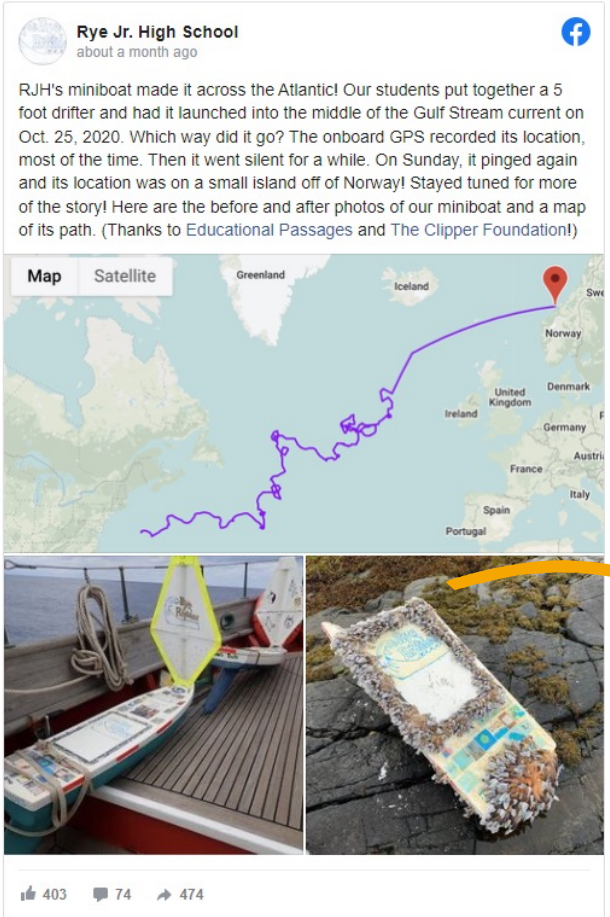
- In 2017, the World Economic Forum and Ellen MacArthur Foundation estimated that by the year 2050 there could be more plastic in the global ocean than fish (by weight).
- In the great garbage patches in the Pacific and Atlantic Ocean, plastic already outnumbers living organisms by 180:1.
- As plastics 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

Ocean Week Canada

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