PROTECTING OUR WATER

BACKGROUND

Not all water pollution is dumped directly into water bodies. Almost anything we put on the land or release into the air can end up in groundwater, rivers, lakes and oceans. Activities such as gold and silver mining, manufacturing plastics, using pesticides, and burning fossil fuels, plastics, wood and peat all release persistent pollutants into the environment. These pollutants are called "persistent" because, instead of breaking down into something harmless, they remain toxic for decades. Plastic litter can also release persistent pollutants. When plastic litter enters a river, lake or ocean, sunlight and wave action break the plastic into fragments and tiny microplastics. When fish or other animals ingest plastic, it can foul up their digestive systems and may also leach toxic chemicals into their bodies. In aquatic ecosystems, persistent pollutants from plastic and other sources can travel all the way up the food chain from tiny aquatic plants to top predator fish. The longer a consumer (such as a fish) lives, the more of these pollutants it can eat and store in its body.

CURRICULUM CONNECTIONS

Key concepts include:

- Habitats provide plants and animals with food, water, shelter and space.
- All living things can be classified as producers (plants) or consumers (animals that eat plants and/or other animals).
- Consumers can be classified as herbivores, omnivores or carnivores.
- A food pyramid is a way to show that, in order to sustain a small number of top predators, a habitat must contain a large number of small consumers and an even larger number of plants.
- Pollutants can travel through food chains, and animals at the top of the food chain are likely to contain more pollutants than animals lower down in the food chain.
- In a watershed, surface water runs off into rivers, which run into a lake or ocean.
- Just as forces causing erosion turn rocks into sand, they also turn plastic litter into microplastics.
- Human activities can have both positive and negative impacts on habitats and communities.

The activities below allow students to observe, compare, contrast, classify, record, evaluate, and use various communication skills.

Discussion Starter

Watch ClearWaterKids Challenge – Clean Up On Aisle Water (3:33)

Ava, Ari and Potato the Chicken try to solve this riddle: What does a rubber ducky have to do with a tuna sandwich? They give a demonstration of how not filtering stormwater can cause plastics and chemicals to wash into water bodies and affect plant and animal life there, and how the food chain includes what humans eat – like tuna sandwiches! Their exploration includes a look at some of the ways nature filters water and tips on how kids can help reduce water pollution.

Pre-viewing Probes

- *Who likes to eat fish and chips? What other kinds of fish or seafood do you eat?*
- *Do you know where the fish you eat come from?*
- *What do fish eat?*
- *What do you think a rubber ducky might have to do with a tuna sandwich? Let's watch the video to find out.*

Post-viewing Prompts

- *Did anything in the video surprise you? What and why?*
- *What do rubber duckies and other plastic things have to do with what we eat?*
- *Where do we sit in the food chain/web?*
- *What actually happens to food and garden scraps in a compost pile or composter? How does it happen?*
- *How does water quality affect us?*
- *What can we do at home and at school to help keep pollutants out of water?*

Explore Outdoors

Aquatic Investigation

Take a trip to a wetland, pond, river or lake to explore, observe and record the different plants and animals found in an aquatic ecosystem.

Before Heading Out

Activate the students' prior knowledge and curiosity about aquatic habitats through discussion and/or related videos and picture books (see page 5). Brainstorm lists of:

- Non-Living (Abiotic) and Living (Biotic) parts of an ecosystem
    - o Non-Living (Abiotic) – sun, water, air, climate, weather, rocks, minerals (Many aquatic organisms are affected by abiotic factors such as water temperature, velocity, depth, turbidity and the chemical make-up of the water. Most litter is also abiotic or non-living!)
    - o Living (Biotic) – plants, animals, microorganisms
- Plants and animals that might live in the aquatic habitat you're about to visit. Also speculate about their roles: producers, consumers, herbivores, omnivores, carnivores.

During the Field Trip:

- Check off, list, draw, and/or photograph Non-Living (Abiotic) factors. This might include taking some measurements e.g. water and air temperature; water depth; water clarity. Consider how these factors might be significant to the plants and animals living there.
- Check off, tally, list, draw, and/or photograph plants and animals.

Follow-up: Our Discoveries

Back in the classroom, discuss:

- *How do the lists we prepared before our visit compare to what we observed?*
- *Did anything surprise you?*
- *Do you have questions about what you saw, heard, smelled, felt?*
- *Research the organisms you spotted to find out who eats whom.*
- *Draw or create computer graphics of food chains, webs, or pyramids containing these organisms.*

Try This

Watershed Wake-up Call

Students create a watershed model and place pollution sources around the watershed. Then the students become rain clouds and see for themselves where all of that pollution ends up!

What You Need

- Large sandpit or boxes of sand, one per group of students
- Digging tools
- A lightweight reusable plastic sheet (white works well to make "pollutants" visible)
- Spray bottles full of water
- Bucket of water to pour into the "lake"
- Objects to represent sources of pollution (e.g. model farm animals; model cars/trucks; coloured blocks to represent lawns; factories)
- Substances to represent the pollution (e.g. instant coffee, food colouring, coloured drink crystals, bits of plastic garbage)
- Optional: Reference map showing lakes and rivers in your local watershed

What to Do

1. Scoop out an area that will be a lake.
2. Create some flat, smooth areas around the lake, and some hills and valleys.
3. Dig out some rivers, leading to the lake.
4. When completed, cover your watershed with a large plastic sheet.
5. Press the plastic sheet into the valleys, rivers and lake.
6. Pour a bucket of water into the lake.
7. Place items on the watershed to show sources of pollution. Drip food colouring, or other substances, beside each item.
8. Using the spray bottles, "rain" all over the watershed. Where is the pollution going? (They will see it flowing into the rivers and into the lake).

Try This

Toxin Tag

A game to play in a large outdoor or indoor area.

What You Need

- Large Food Pyramid graphic: Top: 1 Osprey; Middle: 3 Perch; Bottom: Nine Mosquito Larvae (You can adjust these numbers based on your class size; try to maintain as close a ratio of 1:3:9 as possible. You may wish to colour-code each layer of the pyramid to match the armbands or coloured labels the players will wear.)
- Arm bands or labels in three different colours
- Tokens in three different colours (equal proportions)
- Each mosquito-larva student will need a paper lunch bag or light-weight reusable container for collecting tokens

What to Do

1. Establish boundaries.
2. Establish a "Digestion Zone" where animals go if they are "eaten."
3. Mix the different colours of tokens together and place them in small piles of five to ten tokens throughout the playing area. One of the colours will be designated as a toxin (persistent pollutant), but do not tell the students until the game is finished.
4. Show the class the Food Pyramid Graphic and divide them into a group of ospreys, a group of perch, and a group of mosquito larvae, using a ratio of 1:3:9.
5. Use arm bands or coloured labels to distinguish each organism.
6. Give each mosquito-larva student a container for collecting tokens.
7. Explain that, in order to survive, mosquito larvae must eat zooplankton.
    - They do this by collecting tokens of any colour. Perch must eat mosquito larvae by tagging them and playing a round of Rock-Paper-Scissors. If the perch wins the game of Rock-Paper-Scissors, the perch takes the mosquito larva's whole container of tokens, and the mosquito larva sits out in the "Digestion Zone." If the mosquito larva wins, then the perch gets no tokens and must wait 5 seconds before trying to tag another mosquito larva. Likewise, ospreys try to eat perch by tagging them and playing a round of Rock-Paper-Scissors. If the osprey wins, the perch must hand over their whole container of tokens to the osprey and head to the "Digestion Zone." If the perch wins, the osprey must wait 5 seconds before hunting again.
8. Optional: Challenge the students in the "Digestion Zone" to create a digestion chant, dance and/or tableau to perform for the class after the game.
9. The game will last 5 minutes.
10. Give the mosquito larvae a 10-15 second head-start to collect tokens. Then allow the other organisms to begin playing.
11. When 5 minutes are up, have students return to their starting positions/seats.

12. Ask students to count the number of tokens they have. They need to note the number of each colour of token collected.
13. Once all students have counted their tokens, explain that two colours are food, but one colour represents contamination by a toxic persistent pollutant (e.g. mercury, DDT, dioxin, PCBs).
14. Discuss how smaller concentrations in lower organisms might cause death or damage to those organisms, but toxins can accumulate in larger, higher-level organisms.
15. Any mosquito larvae with three or more of the toxic tokens are dead. Any perch with more than half of their tokens in the toxic colour are also dead.
16. Higher-level organisms are capable of storing higher concentrations of persistent pollutants, but any ospreys who have toxic tokens are no longer able to reproduce.
17. Compare the number of designated coloured tokens at each level of the food pyramid. The osprey should have many more of the toxic tokens than the mosquito larvae.

Follow-up Discussion

- Relate the outcome of the game back to the initial riddle: What does a rubber ducky have to do with a tuna sandwich?
- What can we do at home and at school to help keep pollutants out of water?

Take Action

Be a Water Protector!

- Research how persistent pollutants get into water. Then brainstorm ideas about how our daily choices – including what we buy, how we dispose of things we no longer need, and how we get from one place to another – can have either positive or negative impacts on both our local water sources and those far from us, including oceans.
- Connect with your local conservation authority and local environmental groups to find out how you can take action to protect your local watershed.
- Educate your school community about how both plastic production and plastic pollution affect wildlife and us.
- Organize a school yard/community clean-up and teach others about how litter on land also pollutes water and aquatic habitats.
- Start a school-wide campaign to promote a switch from single-use plastics to reusable snack, lunch and drink containers.
- Plan a visit to your local wastewater treatment plant. Before the trip, create a list of questions to ask e.g. What are some pollutants that wastewater treatment facilities cannot remove from water? What are some things people do that make it harder to clean wastewater so it can be reused? What can we do to help?

More to Explore

- Try a ClearWater Kids Mini-Mission! Students can try an experiment with dirty dishes, soap, and water and compare their results with others at **clearwaterkids.org**
- Look for these theme-related books:
  - ***Do Fish Fart? Answers to Kids' Questions about Lakes*** written by Keltie Thomas and illustrated by Deryk Ouseley, Firefly Books, 2016. Kids can play a game of the same name on the ClearWater Kids website, **clearwaterkids.org.**
  - ***City of Water*** written by Andrea Curtis and illustrated by Katy Dockrill, Groundwood Books, 2021
  - ***Design by Nature: Biomimicry for a Healthy Planet*** written by Megan Clendenan and Kim Ryall Woolcock, Orca book Publishers, 2021
  - ***Every Last Drop*** by Michelle Mulder, Orca Book Publishers, 2015
  - ***Over and Under the Pond*** written by Kate Messner and illustrated by Christopher Silas Neal, Chronicle Books, 2017
  - ***Pondwater Zoo*** written by Peter Loewer and illustrated by Jean Jenkins, Atheneum Books, 1996
  - ***Trash Revolution: Breaking the Waste Cycle*** written by Erica Fyvie and illustrated by Bill Slavin, Kids Can Press, 2015
  - ***The Water Walker*** written and illustrated by Joanne Robertson, Second Story Press, 2017
  - ***Who Needs a Swamp?*** By Karen Patkau, Tundra, 2012
  - *ClearWater Kids Booklist* for more great Canadian books on nature and science.
- Visit Science North for more hands-on, curriculum-linked learning resources and lesson plans.