Forests and Fins

Salmon are a vital part of Pacific Northwest ecosystems: they are a keystone species upon which over 137 different species of wildlife depend. The **Greenway Education Program** invites youth and their families to learn about Pacific Northwest salmon by watching the *Forests and Fins* video series and completing the paired activities, which are designed for 5th-8th grade students. Each video covers one of the life cycles of salmon as well as a topic related to salmon and their environment. The topics include:

- Elements of a healthy salmon stream
- Identifying native and non-native plants in your area
- Macroinvertebrates (stream bugs)
- How to measure water quality (temperature, dissolved oxygen, pH, phosphate and turbidity)
- Current threats to salmon
- How salmon provide essential nutrients to the forest ecosystem, and
- How you can be a steward for salmon in your day-to-day life

***Forests and Fins* videos: mtsgreenway.org/get-involved/education/forests-and-fins.**

There is a list of vocabulary words at the end of this packet.

We would love to see what you create! Please email your creations to education@mtsgreenway.org and we may share them on our social media.

This video series is made possible with support from King County Lake Washington/Cedar/Sammamish Watershed (WRIA 8), King County Wastewater Treatment Division, and King County Councilmembers Reagan Dunn and Dave Upthegrove.

Video 1: Introduction

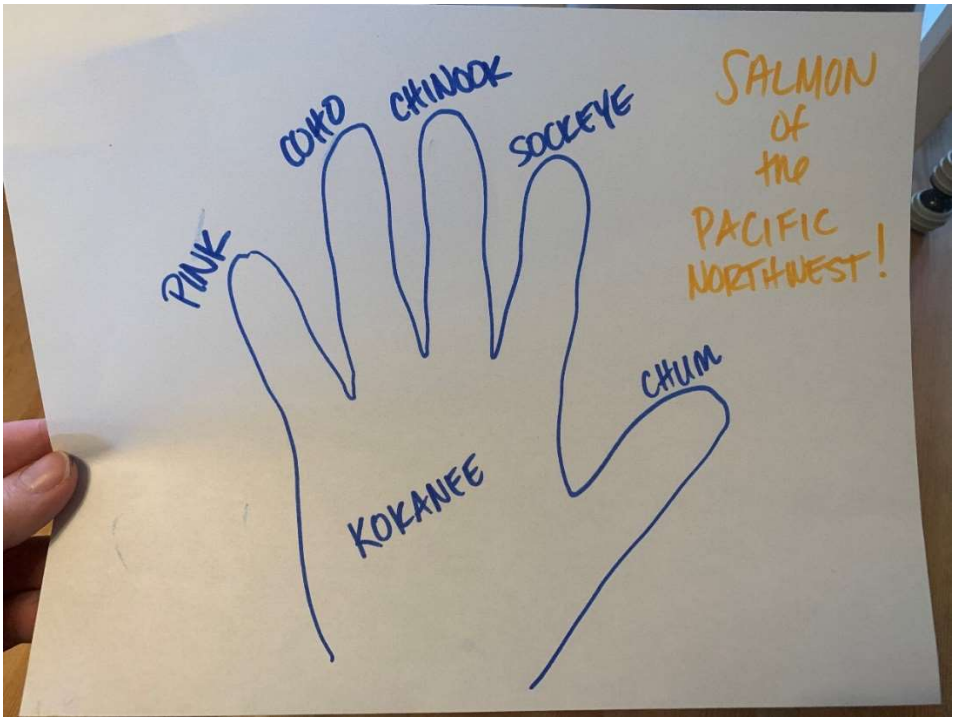
Activity: Salmon Fingers

There are six species of Pacific Northwest salmon, including the very special kokanee salmon that is native to Lake Sammamish in King County. To remember the names of the salmon, trace your hand and write their names next to each of your fingers. Write “kokanee” or “little red fish” on your palm to remember that this salmon spends its whole life in a freshwater system.

Optional: Look up what these salmon look like in their spawning adult phase and draw your favorite one!

Materials:

- Paper
- Markers or crayons



Video 2: Egg

Activity: Modeling a Healthy Salmon Stream

The stronger and healthier the salmon, the better their chances are of surviving the remarkable journey from saltwater to freshwater to their home spawning grounds. In this video, we discuss key elements of a healthy salmon stream and invite you to create your own model of a salmon stream using paper.

Parts of a Healthy Salmon Stream:

- Curvy stream
- Salmon eggs
- Redd (salmon nest)
- Cobbles
- Gravel
- Riffles
- Oxygen

Materials:

- Paper
- Markers or crayons
- Scissors
- Tape or glue

Video 3: Alevin

Activity: Plant Fact Sheets

An important part of a healthy salmon stream is the plants growing alongside the stream in the riparian zone. Make fact sheets for native and non-native invasive plants. Salmon depend on native trees and shrubs growing alongside streams, in what is called the riparian zone, to provide shade and to prevent erosion. See our example fact sheets below.

Include these things on your native plant fact sheet:

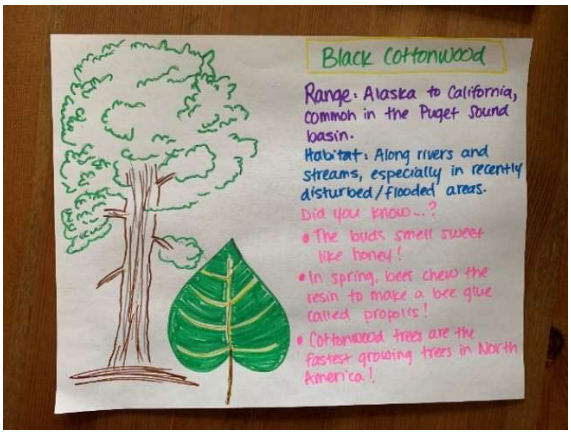
- Name of the plant
- Where it can be found (its range)
- Habitat needs
- Three interesting facts about it
- Drawing of the plant

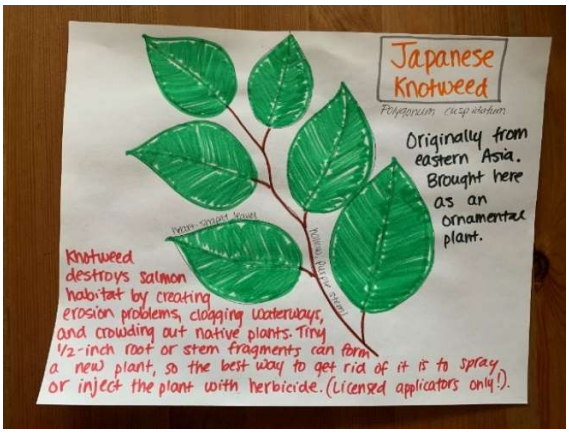
Include these things on your non-native invasive plant fact sheet:

- Name of the plant
- Where it came from
- How it got here
- Why it is a problem
- How to get rid of it
- Drawing of the plant

Materials:

- Paper
- Markers, crayons
- Optional: our Native Plant ID Sheet (https://rb.gy/wfkf1q) and Non-Native Invasive Plant ID Sheet (https://rb.gy/voxbwk) to identify plants in your neighborhood





Video 4: Fry

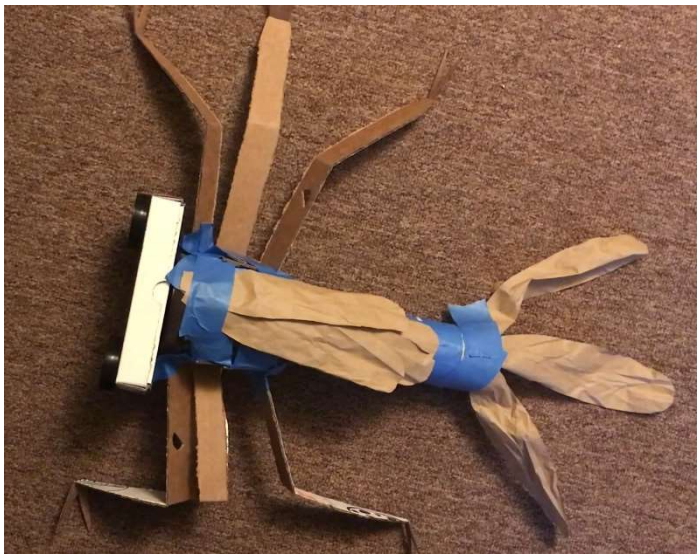
Activity: Build a Macroinvertebrate

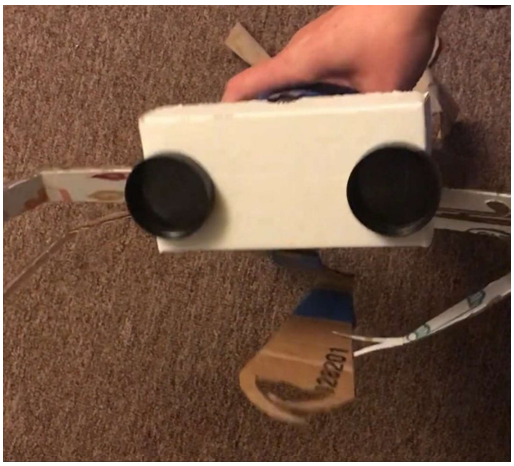
At this stage, salmon start venturing out of their redd (their nest) to explore their habitat and hunt for bugs. These bugs, called aquatic macroinvertebrates, are a vital food source for salmon. They are called an indicator species because they indicate the quality of their environment. Specifically, the type and quantity of macroinvertebrates found in a stream tell us something about the quality of the water. They give us a sort of shortcut way to figure out whether the water is healthy if we don't have the tools to measure it directly. In this video, we invite you to create your own macroinvertebrate using household items.

Materials:

- Clean household recyclable items – get creative!
- Tape
- Markers

Example of a damselfly nymph model:





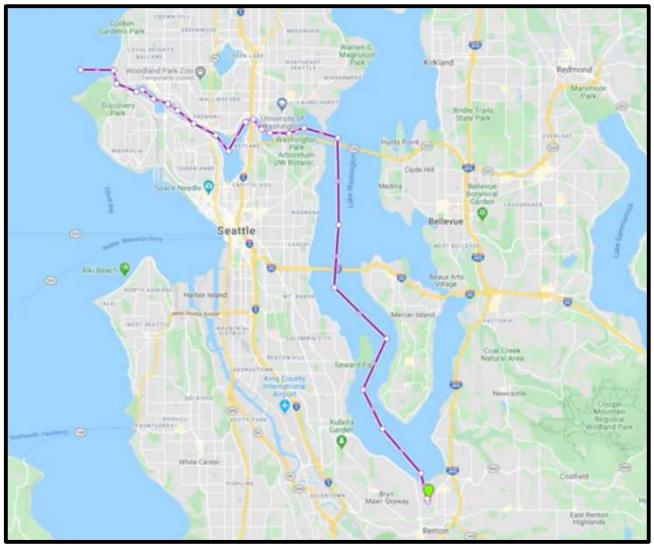
Video 5: Smolt

Activity: Pollution and Water Quality

Salmon can travel hundreds of miles to get to the ocean. Throughout this journey, they rely on cold, clean, clear water — which we can measure! In this video, learn how the Greenway Education Program measures the temperature, dissolved oxygen, pH, phosphate, and turbidity. A common threat to cold, clean, clear water is pollution.

Point source pollution is usually easy to identify and address because it comes from a single place. This can include drainage ditches, smokestacks, discharge pipes, factories, and power plants. Nonpoint source pollution is much harder to identify and address because, as its name suggests, it comes from many places and all at once. This can include runoff of excessive fertilizer from farms, oil and toxic chemicals from urban runoff, or sediment from improperly managed construction sites.

Using Google Maps to find a stream near your home and follow it to the Puget Sound, looking for potential sources of source and non-point source pollution along the way:



1. Find your home, school, or another special place on Google Maps.
2. Locate a nearby stream on the map.
3. Imagine that you are a smolt and try to follow that stream all the way out to the Puget Sound.
4. Along that route, try to identify potential sources of point and nonpoint source pollution along the route. Look for:
    a. Roads
    b. Marinas
    c. Houses
    d. Factories
    e. Forests
    f. Farms
5. Optional extension: Follow the stream on the map back upstream to figure out where it starts.
6. Thinking question to consider: How do you think we can change the way that we live or the way that we build our cities and towns so that less pollution gets into salmon streams?

Video 6: Adult

Activity: Sustainable Fishing

This activity is adapted from California Academy of Sciences Sustainable Fishing: https://www.calacademy.org/educators/lesson-plans/sustainable-fishing

Explore how unregulated fishing can lead to depletion of fish stocks. They will also have an opportunity to discuss the factors that may contribute to the depletion and come up with ways (regulations)to better manage their resources. In this game, play a fisher whose livelihood depends on catching fish. The fish remaining in the ocean after each fishing season represent the reproductive population, and thus one new fish will be added for every fish left in the ocean (plate).

Materials:

1. 40 pieces of popcorn (or similar object) per player. Each piece represents a fish.
2. 1 plate per player. The plate represents the ocean.
3. 1 cup per player. The cup represents the fisher's boat.
4. 1 spoon per player. The spoon represents a fishing rod.
5. 1 Fishing Log per player (https://rb.gy/pzsc1b).
6. 1 writing utensil.

Procedure:

1. Make sure each player has the above materials. Put 40 popcorn pieces on each player's plate. These are the fish that inhabit their fishing area.
2. Give players 30 seconds for the first "season" of fishing. In this time, players must use their spoon (fishing rod) to move as many pieces of popcorn (fish) as they can from the plate (ocean) to the cup (boat).

3. After the first round, have each fisher count their catch (fish in their cup), bycatch (dropped before reaching the cup), and the total fish left in the ocean (plate). Have them record the data in their Fishing Log.
    a) Note: Bycatch is any fish (or other creature) that is unintentionally caught and wasted. In the game, a "fish" that leaves the ocean but is not placed into the "boat" is considered bycatch and cannot be put back into the ocean or counted as catch.
4. To prepare for the next round, add one new fish for every fish left on the plate, explaining that the fish reproduced in between the seasons. (If you have 10 fish left on your plate, add another 10 fish).
5. Play a second round and have students record catches the Fishing Log.
6. Continue playing more rounds until one player runs out of fish.
7. When you run out of fish, think about what you would do in the real world if you caught all the fish who inhabited their surrounding waters. (One option is to switch to a different profession, and another option is to move to another area to fish. What are the benefits and downsides to each?)
8. Why might sustainability be an important goal for a community? Why might it be difficult to achieve that goal? Brainstorm ways that you might have made the fisheries more sustainable. Some possible ways are catch limits (a certain number of popcorn pieces), marine reserves (an area of the plate where fishing is not allowed), bans against overly extractive gear (no use of spoons).
9. Try playing again with the goal of making your fishery sustainable, where the population stays stable or even grows from one round to the next.

Video 7: Spawner

Activity: Ecosystem Connections Drawing

Using their amazing sense of smell, salmon swim back to the stream where they were born, pouring all their energy into producing and fertilizing eggs. They bring nutrients from the ocean back to the freshwater ecosystem. (Researchers have found that trees near salmon streams get 25 to 70 percent of their nutrients from salmon!) Salmon are connected with many, many different organisms from bears to trees to birds to fungi. We invite you to draw an ecosystem web showing all the connections you can think of in a Pacific Northwest forest ecosystem.

Be sure to include in your drawing:

- Plants
- Animals
- Non-living parts (light, air, water, soil)
- Arrows that show how different parts of the ecosystem are connected

Materials:

- Paper
- Something to draw with (markers, crayons, pencils)

Video 8: Conclusion

Activity: Stewardship

At the Greenway Trust, we think it's really important to take care of our Pacific Northwest salmon. We do that by helping people be stewards of this landscape. Stewards are caretakers. Now that you know what makes a healthy salmon stream, we invite you to draw the healthiest salmon stream you can imagine.

Here are some of our ideas. What else do you think you can do?

- Pick up trash in your neighborhood
- Teach others what you know
- Attend a Greenway restoration event
- Plant native plants in your yard
- Remove invasive plant species (like ivy or blackberry)
- Learn more about salmon by visiting the Issaquah hatchery, Salmon Days, or other salmon-related events
- Support legislation that protects endangered species, wetlands, streams, and native habitat, or supports restoration
- Write to your representative asking them to support salmon habitat protection and restoration.
- Take the bus, walk, or carpool
- Compost food scraps
- Use reusable products instead of single-use, and try to reuse single-use items, too

Forests and Fins

Virtual Field Trip

Join a Greenway Educator for a Forests and Fins field study trip along the Tolt River in Carnation, WA. You'll see how we figure out if the river is healthy habitat for salmon by studying four aspects of stream health:

1) the riparian zone, or the area along the stream where the plants grow,
2) the stream channel,
3) macroinvertebrates, or stream bugs, and
4) the water chemistry.

After you watch the investigation, we invite you to use the data to determine whether or not the Tolt River provides healthy habitat for salmon. Print this Virtual Field Trip Worksheet ahead of time so you can follow along with the Greenway Educator and make your own conclusion!

Materials:

- *Forests and Fins Virtual Field Trip* (44 minutes): https://youtu.be/wsch2is3bPU
- Virtual Field Trip Worksheet: https://rb.gy/h3kx3y
- Key vocabulary terms: https://rb.gy/wuhlua

If you would like a free copy of the **Forests and Fins science journal** (https://rb.gy/jezo0e), email our Education Program Manager at education@mtsgreenway.org.

Mountains to Sound Greenway Trust

Forests and Fins

Key Vocabulary

The *Forests and Fins* curriculum focuses on stream/forest ecology and the life cycle of salmon. The terms defined below can also be found in the science journal that accompanies this curriculum. Learn more at **mtsgreenway.org/get-involved/education/curriculums**.

Dissolved oxygen: We breathe oxygen from the air using our lungs. Salmon breathe oxygen dissolved in the water using their gills. Dissolved oxygen levels in stream water increase when the water bubbles over small rapids called riffles. Colder and fast-moving water has more oxygen in it than warmer, slower water.

Erosion: When sediment is carried from the stream bank into the stream, making the water cloudy and burying salmon redds (nests).

Indicator species: Organisms whose presence shows how healthy the stream is. Macroinvertebrates are an indicator species in salmon streams.

Invasive plants: Plants that were introduced to an ecosystem by humans – sometimes purposefully and sometimes accidentally – that have no natural predators, and so can outcompete the native plants for water, nutrients, and sunlight.

Macroinvertebrates: Aquatic bugs that are big enough to see without a microscope (*macro* = big) and that have no backbone (*invertebrate* = no backbone).

Native plants: Plants that have lived in an ecosystem for hundreds of years.

pH: When we measure pH of a liquid, we are measuring how acidic or basic it is. pH is measured on a scale from 0 to 14, where 0 is the most acidic (like lemon juice) and 14 is the most basic (like bleach). Our blood has a pH of about 7, which is neutral. Salmon need to live in water that is neutral with a pH between 6.5 and 8.5.

Phosphate: Phosphate is a nutrient that all plants and animals need to grow. It is added naturally from decomposing plants and animals. Sometimes, though, too much phosphate enters streams from sewage leaks or from fertilizers running into streams from people's lawns or farms. Too much phosphate in stream water can reduce the amount of dissolved oxygen in the water that is available to salmon.

Pools: Deep places in the stream where water moves slowly. Salmon fry live in the pools after they leave their redd (nest) in the gravel bed.

Ppm: This is a unit of measurement that stands for *parts per million*.

Riffles: Small rapids in the stream where water moves quickly and bubbles over big rocks, logs, and sticks. The fast-moving water cleans small particles from the streambed and adds oxygen to the water for salmon and their eggs to breathe.

Riparian zone: The area along the stream where plants grow.

Shade: Trees that hang over the stream provide shade, which helps the water stay cool.

Stream channel: The bottom of the stream.

Temperature: Fish are ectothermic animals. This means they are the same temperature as the water they live in, so if the water temperature of their stream gets colder or warmer, so do they. Salmon need cold water so that they don't get too hot, and because it has lots of oxygen in it.

Transect: A line across a habitat or part of a habitat that is used to inventory the number of organisms in that habitat. Scientists often use simple tools like string or rope to set up the transect.

Turbidity: The turbidity of water is how clear or cloudy it is. The cloudier the water, the more turbid it is. The cloudiness is caused by little particles of soil and plants in the water. The particles make it harder for fish to breathe (imagine trying to breathe in a sandstorm). Particles that settle on the stream bottom can smother fish eggs and macroinvertebrates (stream bugs). Don't confuse water color with turbidity: water can be dark in color and be clear.

Velocity: How fast the water is moving. If the water is flowing too quickly, spawning salmon might not be able to swim upstream, or their eggs could be washed away. If it is too slow, silt and sand could bury the eggs and suffocate them.

Water quality: The measurement of the cleanliness and health of the water. Water quality standards are different for different organisms, although polluted water can be harmful for many living things.

Woody debris: Logs and large branches that fall into the stream. Woody debris provides shade and shelter for young salmon, decomposes and adds nutrients to the stream, and interrupts water flow to form pools and riffles.