LESSON 1.1: THE LIFE & TIMES OF SKEENA SALMON

Lesson 1.1 (The Life & Times of Skeena Salmon) and Lesson 1.2 (Skeena Salmon Species), along with the associated powerpoint presentation, is the basis for "The Life & Times of Skeena Salmon" classroom workshop.

GRADE LEVEL: Grades 1 - 4 *(can be adapted for appropriate grade level)*

CONCEPTS:

- Salmon have a complex life cycle that carries them through both freshwater and ocean environments
- Salmon eggs and juveniles need a high quality habitat to survive
- Salmon use their sense of smell to find the way to their home stream

OBJECTIVES:

Students will be able to:

- Describe the life cycle of Skeena Salmon and habitat requirements for each stage
- Identify characteristics of a healthy salmon spawning stream
- Describe how salmon use their sense of smell to find their home spawning stream

ACTIVITIES:

1. Making a Redd
2. Smell Your Way Home
3. Making a Salmon Print
4. Making a Salmon Life Cycle Plate
5. Salmon Math Problem
6. Salmon in the Food Web Game

OVERVIEW

Skeena Watershed salmon move through several distinct stages in their lives, as do all living things. Each of the five species of Pacific Salmon (Chinook, Chum, Coho, Pink and Sockeye) as well as Steelhead (an important salmonid, although classified as a trout rather than as a salmon) has developed distinct physical characteristics, different habitat needs, and different timetables for spawning and rearing. Each species vary in terms of their life cycles: some spend very little time in their home (or natal) streams, others spend many years. Some mature at two years of age, and some mature at five. Some live for only a couple of years (pink), and others live for ten years (Chinook). And some can even spawn more than once (steelhead). Despite the variation between species, there are some

common elements in their life cycles. Although they undertake long ocean migrations, all adult salmon return to the river, tributary and even the specific stream reach where they started life. Each generation begins a new generation and another set of stages. All five species are a crucial part of the food web that binds together the Skeena Watershed's tributaries and estuary.

BACKGROUND INFORMATION

The Skeena Watershed is home to five Pacific salmon species (Chinook, Chum, Coho, Pink and Sockeye), as well as an important salmonid species, Steelhead Trout. They are part of a larger *Salmonidae* family (generally referred to as salmonids) that include other salmon and trout species. *[For more information on the salmon species, please refer to Lesson 1.2]*

The salmon life cycle is similar for all salmonids. However, the length of time spent in freshwater and saltwater varies to some extent for each species. All Pacific Salmon are **anadromous,** meaning they start in freshwater (streams, rivers, lakes), they then migrate to the ocean, and eventually return home, traveling thousands of miles to their natal stream (the stream they were born in), to spawn, and then die, providing food for wildlife and nutrients for the surrounding environment. Each stock is genetically adapted to the environment in which it resides, and exhibits unique characteristics such as migration route, migration timing, and productivity.

Eggs: Salmon return from the ocean and enter the stream in the summer or fall to **spawn**. When spawning, the female creates depressions in the gravel using her tail – usually 4 to 5 depressions, and lays her **eggs** in these gravel nests (called **redds**), hidden from predators and direct sunlight in streams, creeks and rivers throughout the Skeena Watershed – from close to the ocean to the river's headwaters 570 km upstream. The male fertilizes her eggs with **milt** (sperm). Each female deposits from 2,000 to 10,000 eggs in the gravel (about the size of a pea), although very few of these eggs will develop to maturity (about 1 in 1,000 eggs will make it back to spawn). The number of eggs depends on the size of the female and on the species (pink salmon lay an average of 1,000 to 2,000 eggs, while chinook can lay up to 10,000 eggs and even more). The eggs stay hidden in the gravel for an incubation period that can last for more than 50 days (colder water means a longer incubation period). At the end of the incubation period, the eggs "hatch" into **alevins**. The timing of spawning differs according to the species and geography ranging from early June to December. Salmon select spawning sites in their natal streams that are shaded (to provide the cool water that they require), as well as in riffles with fast moving water, which produces oxygen, moves sediment, and disposes of wastes.

Alevins: Alevins hatch from eggs in late winter or early spring, depending on the ambient water temperature and spawning time. They can't swim and are extremely vulnerable to predators. They must rely on their ability to hide under the gravel in the streambed to avoid the danger of being seen and eaten. Their only food source is the yolk sac attached to them; this yolk must last for several weeks. It is very important during the egg and alevin stages of the salmonids' life cycle to have clean, cold, flowing water and a clean gravel substrate. Clean gravel is imperative; the eggs and alevins will suffocate if there is too much sediment covering the gravel in the stream.

Fry: Once the alevins have absorbed their yolk sacs, they surface from the gravel sometime between March and June as **fry**. These tiny fish are only about one inch long. At this point, they are able to swim and have to leave the safety of the gravel streambed and forage for food. They nourish themselves by feeding onplankton and small insects (**macroinvertebrates**) in the stream. Atthis stage of life it is important for the fry tohave good streamside cover for protectionfrom predators and to keep water temperatures cool.

Different species spend differing time periods in the freshwater streams. Chum and pink salmon migrate to the ocean immediately and spend up to two years in the Skeena Estuary near Prince Rupert. Coho fry stay in streams, ponds and back channels for at least one year before migrating, and sockeye fry often spend up to three years in their rearing lake before they make their way to the ocean. Chinook fry, which are often territorial, remain the river for three to eighteen months before migrating towards the ocean.

Smolts: After spending time in freshwater, the juvenile salmon head downstream and undergo changes that allow them to live in saltwater. This process is called **smoltification**. Theyoung salmon, called **smolts** at this stage migrate to Skeena Estuary, and are busily adapting to the physiological changes itmust undergo to survive in a saltwater environment. Smolts head for theirhereditary feeding grounds and live in large, loose schools. They stay here for 1 to 5 years, depending on their species. Here, the smolts feed on zooplankton, insects, shrimp and small fish in the estuary.

The Skeena Watershed Invisible Migration: *Each year hundreds of millions of tiny wild salmon smolts begin an incredible journey. These young fish swim as far as 600km's through the brown, swirling waters of the Skeena river to the sanctuary of the Skeena estuary in late spring. Just because you can't see them, doesn't mean they aren't there. Check out this video and join in on the celebration with the Babine Lake First Nation each year in late May:* https://vimeo.com/126748611

How Do Salmon Find Their Way Home? *The most phenomenal characteristic of Pacific salmon is their ability to return totheir natal river, even after spending several years in the Pacific Ocean thousands of kilometres away. This homing ability is so refined that in some circumstances adults return to their natal nest site. How salmon return to the correct shoreline region is not completely understood. It appears they use some form of 'map and compass' navigation based on information about position and direction of travel. This information most likely comes from a suite of environmental cues, including day length, the sun's position and the polarization of light that results from its angle in the sky, the earth's magnetic field, and water salinity and temperature gradients. As spawning time approaches, salmon have a seemingly inherited tendency to orient themselves towards the area of coastline of the ocean where their natal riverdischarges. We know in much more detail how they navigate after they find the river mouth. By the time the salmon reach freshwater, they are guided largely by their sense of smell to the correct tributary.*

Adults: Once the adjustment from fresh water to saltwater is complete the smolts move into the open ocean. Ocean life for salmonids last one to seven years, depending on thespecies. Coho and pink remain close to the West Coast, while sockeye, Chinook and chumspend the majority of their adult lives farther out in the North Pacific. The ocean phase of each species is a different length: 1-5 years for Chinook, 4-5 years for sockeye (sometimes three years for males, also known as jacks), 2 years for pink, 3-5 years for chum, and 2-3 years for coho. The migration routes of adult Skeena salmon overlap and they share ocean habitat and food sources with salmon from Alaska, the northwest US and Asia, as well as their neighbouring populations from both southern and northern BC. During this stage of life,the **sea-run adults** grow large and feed on zooplankton (tiny animals), insects, and small fish such as herring. Once the adult salmon enters freshwater again, they no longer eat, and their stomachs start to disintegrate, leaving more rooms for eggs in the females.

Spawning Adults: When they are fully mature and strong (2-5 years depending on the species), most Skeena salmon return to spawn in the same stream where they were born (natal stream) using their sense of smell, although pink and coho are the most likely to spawn elsewhere. The timing of the return varies by species and tributary, ranging from early June to December. Once they've returned to the freshwater streams, we call them spawning adults, and they swim upstream to reproduce and the cycle starts all over again. After the salmon have spawned, they die. Their bodies decompose and are an integral part of marine and terrestrial food webs, depositing nutrients to riparian (stream side) forests throughout the Skeena Watershed. While all five species of Pacific salmon that are found inthe Skeena die after spawning, Steelhead spawn several times, returning to the ocean and back to freshwater to spawn.

KEY WORDS

Alevin – young salmon shortly after hatching that still have the yolk sac attached

Anadromous – (Greek for "running upward") Fish that are born in freshwater, move to salt water to feed and grow, and return to fresh water to spawn.

Fry – stage of a salmon's life between alevin and smolt; fry are about one and a quarter inches long

Homing – the behavior of returning home to place in the stream where hatching took place

Natal Stream – the stream of a fish's origin (hatching), where spawning takes place

Onchorhynchus – scientific name for salmon and related fish

Parr Marks – dark vertical bars on the sides of salmon fry that serve as camouflage against predators

Redd – the nests dug in the gravel by female salmon

Salmonid – salmon and related fish such as trout and char

Sediment – a collection of dirt and organic matter that settles to the bottom of bodies of water

Smolt – salmon of a certain size (generally 4-7 inches) as they begin seaward migration and smoltification

Smoltification – process of changes that young salmon undergo when they get ready to live in salt water

Spawn (spawning) – to produce, deposit and fertilize eggs

Zooplankton – one-celled aquatic animals that salmon and other fish eat

THE LESSON

This lesson also has a Powerpoint presentation that can be used to supplement the lesson plan.

Introduction

Ask students how many of them go fishing? Have they caught a fish? A salmon? How many like to eat salmon. What kind of salmon is their favourite? Who knows the five types of Pacific Salmon that is found in the Skeena Watershed? *[Chinook (King, Spring); Coho (Silver); Sockeye (Red), Chum (Dog), and Pink (Humpy).* Each type of salmon is a bit different from the others. They look different, they taste different, and they use different habitats. Which ones get the biggest? *[Chinook, because of their genetics and they live the longest].* Which are the smallest? [*pink*]. Here is an easy way to remember the names of thesalmon. Make a fist. Let's start with the thumb – it rhymes with 'chum'. The next finger is sometimes called the eye finger – so that means 'sockeye', the middle finger is the longest, so that is for Chinook which is the longest fish. The fourth finger is called the ring finger, andsome people wear silver rings, so that is for the silver fish, also known as 'Coho'. And the last finger, the pinkie, is of course for the pink salmon.

Salmon are especially important to our region, not just because we like to eat them but because a lot of other animals and plants rely on them for survival. So it's our job as good keepers of the environment to try and understand what salmon need in their habitat and help ensure that they stay happy and healthy.

Tell students that today we're going to become Skeena Salmon, and we're going to follow their life from start to finish.

Eggs

Where do salmon begin their life? In a freshwater stream, sometimes up in the mountains, other times right near the ocean. And how do they start life – are they born alive or hatched from eggs? [*They hatch from eggs - show picture of egg / eyed egg],* and those eggs develop right down in the bed of the stream. Can you guess how many eggs female salmon lay? [*1,000 to 2,000 for pink, and up to 10,000 for Chinook].* Why do you think that they lay so many eggs? There are so many hazards that they face on their life journey, and out of every 1,000 eggs, only 1 might make it back to spawn. Let's look more closely at that streambed and learn what makes a healthy stream for salmon eggs.

Activity 1 - Making a Salmon Redd (can be done as a demonstration for the whole class or in groups.)

ACTIVITY 1: MAKING A REDD

Grade Level: Grades 1-4 *(this activity can be done either as a demonstration or in groups)*

Materials Required:
- One paint try or container for each group
- Red plasticine balls or beads (to represent salmon eggs)
- Pebbles or gravel
- Pitcher of water

Background:
In this activity, the students will see how the environment in which salmon eggs are placed affects how well they will be protected from predators.

Streams contain two different and distinct types of regions, riffles and pools. A riffle is an area of a stream or river where the water is shallow and fast moving and where gravel or rocks lay on the bottom. A pool is an area of a stream or river where the water is deep, slow moving, and silt or clay lay on the bottom. The female spawner will search around the same area as she was born for a good place to lay her eggs. She will look for a riffle, where the fast-flowing water will provide plenty of oxygen for the eggs, the gravel will give the eggs protection from predators, and the force of the water will remove any sediment that builds up, preventing suffocation. The female spawner digs a nest, known as a redd, with her tail in the stream gravel bed to remove any small sediments. She can lay anywhere from 1,000 to 10,000 eggs in the gravel. If she were to create a redd where there is a lot of soil, sand, clay, or silt, the eggs would suffocate from loss of oxygen.

The male fertilizes the eggs by covering them with milt, a milky substance containing the sperm and seminal fluid. The female then covers the eggs in the redd with gravel using her tail. Gravel hides the eggs from birds and other predators, and prevents them from being washed away and protects them from direct sunlight. This environment within the riffle of the stream is where the eggs will stay until they hatch into alevin. Even as swimming alevin, the salmon will stay in this familiar safe area of the stream, and won't venture far until they start searching for food as fry.

Procedure:

Part One – Without Protection
1. Using the paint tray (or the container with a book under one end to put the tray at a slight angle), take the batch of the eggs and gently place them at the top end.
2. Gently pour water over the eggs from the pitcher.
3. As the eggs are washed away, get the class to count to the number of eggs that escape to the ocean at the bottom of the tray.

Part Two – With Gravel Protection
1. Empty out the tray, and take a batch of eggs and place them at the top end of the tray.
2. This time, cover the eggs with gravel or pebbles.
3. Gently pour water over the eggs from the pitcher.
4. As the eggs are washed away (if any), get the class to count the eggs that end up in the ocean at the bottom of the tray.

Source: Science World (www.scienceworld.ca)

Alevins, Fry and Smolts

Ask the students what salmon are called after they hatch from their eggs (alevin). Alevin are little baby salmon that still have a little egg yolk attached to their belly. It's like a portable meal, always giving them food when they need it. So the alevins don't need to eat quite yet. But once their yolk sac is used up, those little salmon need to start eating. Ask the students who knows what the baby salmon are called now, after they've used up their yolk sacs? They're called fry and older fry are sometimes called parr because of the dark spots on their sides, called parr marks. Why do they think they have those markings on their sides? It's for camouflage, to protect them from predators while they're living in the lakes and streams.

The salmon fry may spend up to two years or more in fresh water, or they may swim straight downstream, depending on the species of salmon they are (pink and chum head right to the ocean, but sockeye spend one to two years in fresh water). When the fry And before they reach the ocean, they have to make a change. They become smolts, and they have to adjust to the water in the ocean. Is that water going to be fresh or salty? (salty). Is salt water good to drink? No, not for us, and its not necessarily good for fish either, so they have to wait until their bodies can adjust to that salt. This takes a little time, so the smolts wait in the estuary (the place where a river meets and mixes with the ocean) until they're ready to move on.

Life in the Ocean as Adults

So why do salmon swim to the ocean? They go there because there's food and they can grow big. Who's there? (food – zooplankton, shrimp, small herring, krill). There are also predators (killer whales, sea lions, humans). The small streams where the salmon hatched just can't support nearly as much food as the ocean, so salmon swim there to eat for 1-3 years so they can grow.

Returning Home

Did you know that salmon come back to the very stream where they were born? How do you think they find their way home? When they are in the ocean, they use magnetic and lunar tracking to find the mouth to their appropriate stream, but once they are in themainstem (Skeena River), they use their sense of smell to find their natal stream. When salmon are young, they get to know the smell of their home stream very well. In fact, salmon have a better sense of smell than tracking dogs. Even though salmon breathe through their gills, they have nostrils (called nares) and use them to smell for food, for predators, and to find their way home. Do you think you can smell as well as a salmon can?We are going to play a game called "Smell Your Way Home", and see if you can find your way to your home stream using just your sense of smell.

Activity 2 – Smell Your Way Home (to be done in groups)

ACTIVITY 2: SMELL YOUR WAY HOME GAME

This activity is best done in groups.

Grade Level: Grades 1-4

Objectives:

1. Identify one river via smelling canister and interpret that fish need clean water to find their way home
2. Share that toxins affect the olfactory cells potentially impairing their homing instincts; or prevent them from detecting predators; or may cause pre-spawn mortality
3. Connect their habits at home (be a smart shopper; learn about chemical alternatives in and outside the home; avoid putting chemicals down the drain, etc.)

Supplies Needed:

- 10-16 canisters (depending on number of groups of students)
- 5-8 river signs (e.g., Kalum, Lakelse, Bear, Bulkley, Morice, Kitwanga)
- 5-8 scents (e.g., lemon, cinnamon, vanilla, strawberry, vinegar, lavender)

Lesson/Procedure:

Now its time for our salmon to find their way back home. How will you know which stream is yours? (scent). Ask students how salmon return to their natal stream. (magnetic navigation, passive drift, random searching, temperature and salinity gradients, prior knowledge, etc.). Tell them that salmon don't have noses like we do. They 'breathe' by taking in water through their mouth, and then it goes over and out of the gills. However, they do have nostrils (called 'nares' in fish) through which they can smell.

Have the students in each group smell one of the numbered canisters, remember the number and smell. Then have them visit all rivers in the region and see which river that salmon would return to. Have them return to the table with the letter or river name. If they didn't get it right the first time, ask how similar that might be for salmon? Is that realistic, yes.

Conclude with the facts we know about this 'home stream' hypothesis:

- That every stream has a unique smell
- Salmon can tell the difference between the odors of different streams
- Salmon retain a memory of their home stream odor, this is called imprinting

Ask them if all salmon successfully return every single time. The homing instinct is not perfect and some salmon do stray and are unable to make it back to spawn. However, they can be an important part of mixing the gene pool. Ask students what may cause salmon not to smell or be confused with the odours? What if we had mixed some garlic into their canister (pollution) – would the salmon be able to find their stream then?

Sources: NOAA and Alaska SeaLife Center

Spawning

Once the salmon have found their natal streams, they find the ideal spot to build their nests (called redds). They are looking for a shady spot to provide the cool water temperatures that they require, as well as an area with fast moving water (riffles) that will provide oxygen, and dispose of sediments and other wastes quickly. They also need an area with loose gravel that allows the water to flow through but provides protection for their eggs. Once this spot is selected, the female salmon makes 4 or 5 depressions in the gravel using her tail, and deposits from 1,000 to 10,000 eggs (depending on the species), and covers it up again once the male salmon has fertilized them.

What happens to the salmon once they have finished spawning? Sadly, they die, but they have reached the end of their life cycle, and their decomposed bodies will provide food for wildlife and other aquatic creatures, and the rich nutrients that they have brought back to the ocean will ensure a lush vegetation on the stream side. Research has shown that streams that have lush vegetation are frequent spawning sites, while those streams with bare vegetation are void of spawning salmon.

ADDITIONAL ACTIVITIES

For Younger Students: If there is time, younger students may enjoy making a **Salmon Life Cycle Plate (Activity 3)**. This is a great activity to reinforce the stages of the salmon's life cycle. There are a number of excellent storybooks which also describe the salmon life cycle for the younger students such as "Salmon Stream" (by Carol Reed-Jones), "Sockeye's Journey Home (by Barbara Gaines Winkelman) or "Salmon Forest" (By David Suzuki and Sarah Ellis).

For Older Students: If there is time, a good activity for older students to not only learn about math, but also about why salmon need to lay so many eggs is the **Salmon Math Problem (Activity 5).**

Outdoor Activities: **Making a Salmon Print (Activity 5)** and the **Salmon in the Web of Life (Activity 6)** are great activities that are best done outdoors.

Check for more books, videos and websites in the "Additional Resources" section at the end of this lesson plan.

ACTIVITY 3: MAKING A SALMON LIFE CYCLE PLATE

Grade Level: K-3

Objective: Students will be able to organize the stages of the life cycle in order, and recognize the cyclical nature of the life cycle.

Materials Required:

- Paper plates (one for each student)
- Life cycle drawings (one for each student)
- Crayons, pencil crayons, markers
- Scissors
- Glue stick

Procedure:

- Have each student colour each of the life cycle drawings, and then cut out each life cycle stage
- Glue each stage around the pie plate in the appropriate life cycle order

Handouts:

- Life cycle drawing
- Photo of completed plate

ACTIVITY 4: MAKING A SALMON PRINT (*GYOTAKU*)

Grade Level: Kindergarten to Grade 5

Objectives:

Background: *Gyotaku* (guh-yo-tah-koo) is a traditional form of Japanese art that began over 100 years ago as a way for fishermen to keep a record of the size and species of the fish they caught. They would apply sumi ink to one side of a freshly caught fish, then cover the fish with rice paper and rub to create an exact image of the fish. The ink was non-toxic and allowed for the fish to be washed and prepared for a meal, while preserving records of fish species and sizes. Once the print was completed, the fish could be washed and prepared for a meal. These utilitarian prints were incredibly life like. When done properlythey retained even subtle patterns and textures of the fish. The relatively simple black ink prints later developed into an art form that added rich colors and environmental details. For educators, Gyotaku can also serve as a great way to teach children and adults about basic fish anatomy. You can use either real fish or rubber replicas.

Materials Required:

- Real salmon or rubber salmon model (fish must be cleaned well)
- Water-based inks in a variety of colours
- Newsprint
- Rice paper, kraft wrapping paper, or white construction paper
- Foam paint brushes

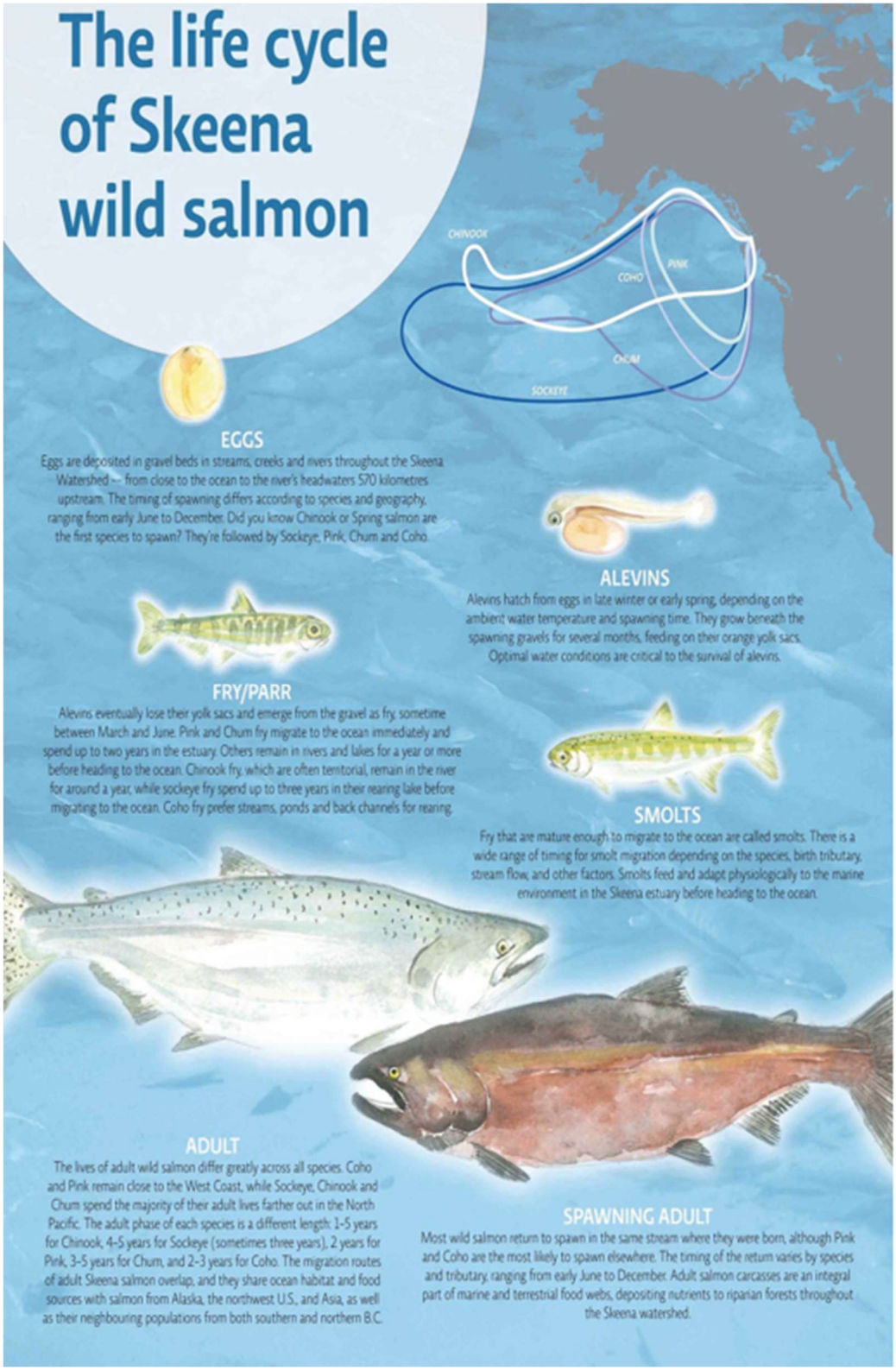
Procedure:

- Discuss the history of Gyotaku with the students.
- Discuss the anatomy of the salmon: students will learn about the different parts of the salmon: gills, scales, fins, eyes, nares, lateral line, etc.
- Students will create their own fish prints. Place fish on top of newsprint.
- Paint the fish, making sure to cover the entire surface of the fish – include the eyes, fins, and all the scales. Spread the ink evenly over the fish. Make designs, use different colours.
- Place the paper over top of the fish; press firmly, covering the entire fish's surface. Do not let the paper move!
- Carefully remove the paper and set aside to dry.

Resources:

Smithsonian Institute: Oceans
https://ocean.si.edu/conservation/get-involved/educational-uses-gyotaku-or-fish-printing

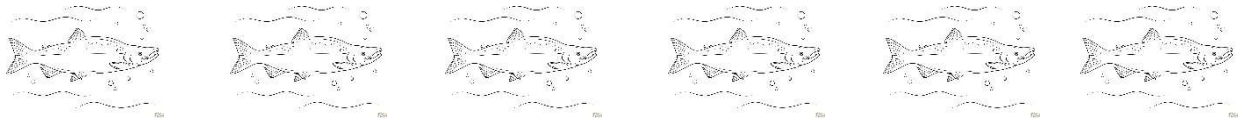
https://www.youtube.com/watch?v=InpLfs4rasw


The life cycle of Skeena wild salmon
CHINOOK
PINK
COHO
CHUM
SOCKEYE
EGGS
Eggs are deposited in gravel beds in streams, creeks and rivers throughout the Skeena Watershed — from close to the ocean to the river's headwaters 570 kilometres upstream. The timing of spawning differs according to species and geography, ranging from early June to December. Did you know Chinook or Spring salmon are the first species to spawn? They're followed by Sockeye, Pink, Chum and Coho.
ALEVINS
Alevins hatch from eggs in late winter or early spring, depending on the ambient water temperature and spawning time. They grow beneath the spawning gravels for several months, feeding on their orange yolk sacs. Optimal water conditions are critical to the survival of alevins.
FRY/PARR
Alevins eventually lose their yolk sacs and emerge from the gravel as fry, sometime between March and June. Pink and Chum fry migrate to the ocean immediately and spend up to two years in the estuary. Others remain in rivers and lakes for a year or more before heading to the ocean. Chinook fry, which are often territorial, remain in the river for around a year, while sockeye fry spend up to three years in their rearing lake before migrating to the ocean. Coho fry prefer streams, ponds and back channels for rearing.
SMOLTS
Fry that are mature enough to migrate to the ocean are called smolts. There is a wide range of timing for smolt migration depending on the species, birth tributary, stream flow, and other factors. Smolts feed and adapt physiologically to the marine environment in the Skeena estuary before heading to the ocean.
ADULT
The lives of adult wild salmon differ greatly across all species. Coho and Pink remain close to the West Coast, while Sockeye, Chinook and Chum spend the majority of their adult lives farther out in the North Pacific. The adult phase of each species is a different length: 1-5 years for Chinook, 4-5 years for Sockeye (sometimes three years), 2 years for Pink, 3-5 years for Chum, and 2-3 years for Coho. The migration routes of adult Skeena salmon overlap, and they share ocean habitat and food sources with salmon from Alaska, the northwest U.S., and Asia, as well as their neighbouring populations from both southern and northern B.C.
SPAWNING ADULT
Most wild salmon return to spawn in the same stream where they were born, although Pink and Coho are the most likely to spawn elsewhere. The timing of the return varies by species and tributary, ranging from early June to December. Adult salmon carcasses are an integral part of marine and terrestrial food webs, depositing nutrients to riparian forests throughout the Skeena watershed.

ACTIVITY 5: SALMON MATH PROBLEM

Grade Level: Grade 3-5

Objectives: To understand why salmon need to lay so many eggs, as so many salmon at all stages of the life cycle do not make it to return to their natal stream to spawn.



If 10 salmon lay 5,000 eggs each in a stream, there are_____eggs.

One-half of these eggs do not get fertilized. This leaves_____developing eggs.

A new road is built alongside the stream leaving lots of loose soil. A rain storm carries some of the soil into the stream. It falls on and kills 2,000 of the eggs. Now there are _____eggs.

These eggs hatch into small salmon and begin their journey to the ocean. People spray lawn and garden chemicals in their yards. These are carried into the stream and kill 5,000 salmon. Now there are_____fish.

Predators such as larger fish, sea gulls and seals catch 10,000 more salmon. There are now_____fish.

Another 5,000 are caught by people fishing. This leaves_____fish.

Some of the remaining salmon swim close to an oil spill in the ocean and 2,000 die. There are now_____fish.

Some hungry bears catch 500 fish as they return to spawn. Now there are_____.

A careless person pours old anti-freeze from his car into this stream. It kills a 3-mile stretch of the stream and 450 fish die. This leaves_____salmon to spawn again.

(Source: Discovering Salmon, a learning and activity book; Dog -Eared Publicatio

ACTIVITY 6: SALMON IN THE FOOD WEB GAME

Grade Level: All Grades

Objectives:
- Identify factors (natural and human-made) that affect salmon survival

Background:

Salmon are considered keystone species on the BC Coast, meaning there are many species that rely on salmon. Because so many organisms rely on salmon as an essential food source, the salmon population is very important in maintaining biodiversity on the BC Coast. Salmon gain a lot of their mass while in the ocean. When they come back to their spawning grounds, they bring many nutrients from the ocean to the river ecosystem. The salmon migration during spawning season helps replenish the entire ecosystem, from the animals that eat the salmon, to the decomposers who break down their dead bodies, to the trees thatgrow from their broken down nutrients. With a decline in salmon, many other coastal organisms suffer as well. This activity is a simple introduction to a deeper discussion about how salmon are important for the entire ecosystem.

Materials Required:
- Ball of yarn
- Creature Index Cards (one for each student; can be adapted to any number of students but just make sure there are both prey and predators of the salmon)

  - The Sun
  - Algae
  - Plankton
  - Herring
  - Shrimp
  - Krill
  - Zooplankton
  - Caddisfly
  - Mayfly
  - Damselfly
  - Salmon
  - Other fish
  - Eagle
  - Killer Whale
  - Grizzly Bear
  - Black Bear
  - River Otter
  - Kingfisher
  - Harbour Seal
  - Human

Key Questions:

1. If salmon are removed from this food web, how are the other organisms affected?
2. How do salmon help the trees in the forest?
3. What are the impacts to the food web when:
   - There is no rain fall for months
   - A storm blows down all the mature trees
   - There is too much rain fall
   - Part of the area is cleared for construction
   - Invasive species are introduced into the area

ADDITIONAL RESOURCES

WEBSITES

- **Salmonids in the Classroom Primary and Intermediate Handbooks (Department of Fisheries and Oceans Canada) –** Primary and Intermediate Lesson Plans and resources for studying the biology, habitat and stewardship of pacific salmon. Used in conjunction with DFO's Salmonids in the Classroom Program in BC elementary schools. http://www.pac.dfo-mpo.gc.ca/education/resources-ressources-eng.html
- **Alaska Wild Salmon Teacher's Guide** – A great resource for Pacific Salmon information.http://www.adfg.alaska.gov/staticsf/statewide/aquatic_ed/adfgTeacherGuide/chapter2.html
- **Alaska SeaLife Center Educational Resources** – The Alaska SeaLife Center is the only facility in Alaska that combines a public aquarium with marine research, education and wildlife response. www.alaskasealife.org
- **Exploring The Great Bear Sea Elementary, Secondary and Post-Secondary Curriculum Resources** – Excellent resources for teachers to engage students in an inquiry-based, educational journey through the Great Bear Sea exploring a variety of themes such as Indigenous Knowledge, Collaborative Science, Marine Planning, Biodiversity, Sustainable Resource Management and Marine Stewardship. These resources are based on the film *The Great Bear Sea: Reflecting on the Past, Planning for the Future* by Green Fire Productions. http://oceanliteracy.ca/exploring-the-great-bear-sea-new-free-curriculum-resources/
- **Science World –** Salmon unit with lesson plans and many activities for Students in Grades 1-4 (salmon lifecycle and salmon survival). - https://www.scienceworld.ca/resources/units/life-salmon
- **Vancouver Aquarium AquaFacts** – Questions and Answers and Facts about Salmon, as well as many other aquatic species. http:www.vanaqua.org/education/aquafacts/salmon.htm
- **Canadian Geographic Kids** – Salmon Facts http://www.canadiangeographic.ca/kids/animal-facts/salmon.asp

VIDEOS

- **The Great Salmon Run** (documentary: 59:17 minutes). A great nature documentary by BBC Earth looking at the annual return of hundreds and salmon from the Pacific Ocean to the mountain streams where they were born. **https://www.youtube.com/watch?v=-ueH3rAzRZY**
- **Wild Kratts: Hero's Journey** (animated video: 45 minutes). This is an excellent and enjoyable animated video that illustrates the lifecycle of Pacific Salmon and the challenges that they face. https://www.youtube.com/watch?v=OqTyisDQ5yQ

- **Magic School Bus Goes Upstream** (animated video: 22 minutes). A great animated video that illustrates the lifecycle of salmon and their challenges. http://www.dailymotion.com/video/x5viuzx
- **Invisible Migration: Skeena Watershed** (animated video: 1:13 min). Enjoyable short video that illustrates the journey of salmon fry from their home streams to the Skeena Estuary. Produced by Skeena Watershed Conservation Coalition. vhttps://vimeo.com/126748611.
- **Life Cycle of Salmon** (Oregon Sea Grant) – 5 minute video that depicts the salmon's life cycle, with images that reveal the salmon's world, often from their underwater point of view. https://www.youtube.com/watch?v=nlSoUXfJEeQ
- **Kids, Creeks and Nature** (3:34 min). A short video about the importance of engaging children with nature. Students at a BC elementary school visit a local stream to release the salmon fry that they have been raising in their classroom. https://www.youtube.com/watch?v=FpXCkM4NdFs&feature=youtu.be
- Salmon Life Cycle Song (xx).

BOOKS

Story Books:

- "*Sockeye's Journey Home: The Story of a Pacific Salmon*" (by Barbara Gaines Winkelman)
- *"Salmon Forest"* (by David Suzuki and Sarah Ellis)
- *"Salmon Creek"* (by Annette LeBox and Karen Reczuch)
- *"Swimmer"* (by Shelley Gill)
- *"A Salmon for Simon"* (by Betty Waterton and Ann Blades)
- *"Magic School Bus Goes Upstream: A Book about Salmon Migration"* (by Joanna Cole)
- *"Salmon Stream"* (by Carol Reed-Jones) – good for younger students
- *"The Salmon Twins"* (Carol Simpson)
- *"The Life Cycle of a Salmon"* (by Lisa Trumbauer)
- *"The Life Cycle of a Salmon"* (by Bobbie Kalman)
- *"The Pacific Salmon and Steelhead Coloring Book".* (US Fish and Wildlife Service). http://www.fws.gov/pacific/publications/salmnbk.pdf

Non-Fiction Books:

- *"Skeena River: Fish and their Habitat"* (by Allen S. Gottesfeld and Ken A. Rabnett – Good resource book on salmon specific to the Skeena Watershed (for educators, not for younger students)

ONLINE GAMES

- **Salmon Challenges** (**Smithsonian National Museum of the American Indian**). What is it like for salmon to swim to their spawning grounds? Play this educational

online game to find out!. https://americanindian.si.edu/nk360/pnw-history-culture/pnw1-salmon/index.html

HANDOUTS

- **Poster of Salmon Life Cycle** - contact SkeenaWild Conservation Trust at 250-638-0998
- **Poster of Salmon Species in the Skeena Watershed** – contact SkeenaWild Conservation Trust at 250-638-0998.
- **Salmon Colouring and Activity Sheets** – contact SkeenaWild Conservation Trust at 250-638-0998

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