Learning Cycle 4

Salmon Survival

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image by Phillip Martin

About this Lesson

In this lesson, students will participate in a simulation/game called “Hooks and Ladders” toto model the impacts of human and natural factors on salmon survival as they traverse different habitats during different parts of their life cycle. They will complete a narrative writing from the perspective of a salmon to communicate how these factors impacted their journey in the game.

Materials, Resources, & Advance Preparation

For the Hooks & Ladders Activity:

Flagging, cones, or other way of marking the boundaries of the activity area (100 ft x50 ft)
Jump Rope (10-15 ft long) to represent a turbine
Cardboard boxes or heavy plastic bins to represent fishing ‘boats ’(2)
Tokens, Poker chips, or other small items like popsicle sticks or cubes to represent years of life (about 4x the number of students)

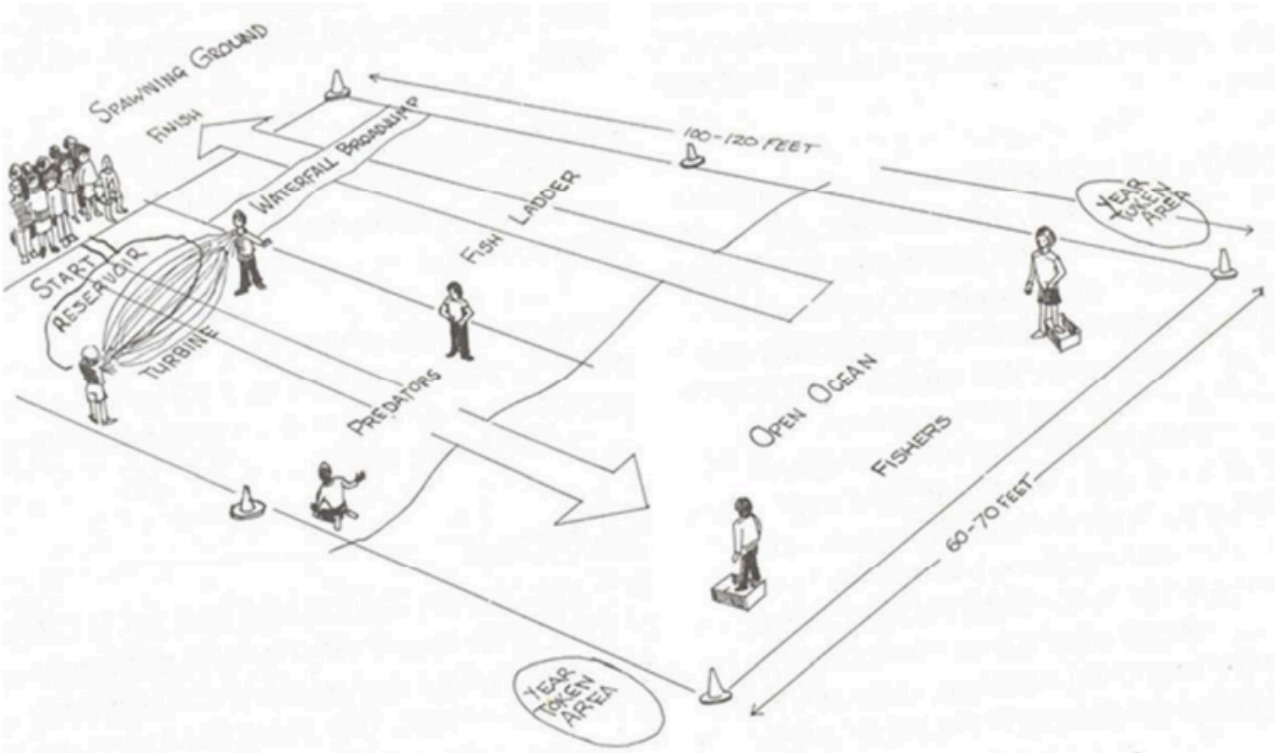

Image from Project Wild Aquatic.

To introduce the activity, use this slideshow and explain the turbine, fish ladder, etc.

For the Extend Phase:
Prepare copies of Only the Strong Survive and choose one salmon species for the class to focus on. Make sure there are enough copies so each student can have their own.
Materials needed: The worksheets, calculators, whiteboards, and markers

For Evaluation Phase:
Paper or journals for writing activity
Other writing materials

Engage Phase

Optional: You may wish to kick off this lesson with a video provocation (Salmon Population Depleted or"I Am Salmon"). See the **Connecting to Indigenous Knowledge** section of this lesson for more information.

Invite students to participate in a visualization: *Close your eyes and imagine you are a salmon...*

- Where are the places you go?
- How do you change during your life?
- What do you eat?

Tell students they will be participating in a simulation/ game about SALMON SURVIVAL...What do you think that means? What might the game involve? Think-pair-share.

- *Kids might think about other games they've played like Fortnight, that are based on survival, and mention things that salmon might need to stay alive (food, avoiding getting eaten, competing for resources, etc.)*

Introducing the game and vocabulary to the children using the slideshow:

- Students will be playing a game where they will pretend to be salmon and will face different obstacles/dangers as you travel to the open ocean and then return to spawn.
- Ask students questions: What kinds of things do you predict salmon might encounter that affect their ability to survive?
- Explain that in the game, they will all get different roles, some will be salmon and others will be the factors that affect salmon survival
    - Roles can be assigned randomly or predetermined

Exploration Phase

Teacher Tips:

- Set up the game play area beforehand - Clearly mark the different areas of the game so that students know where each element is.
- Review the rules before going outside! You might also consider doing a practice round once you get outside.
- This game takes about 30 minutes from explanation to wrap up. Students will want to do multiple rounds.
- If you decide to combine your class with another class to play this game, go over instructions with your individual classes and agree on role assignments before getting together.

INSTRUCTIONS

1. This is a physically involving activity! Set up a playing field as shown in the diagram on the following page, including spawning grounds, downstream, upstream, and ocean (if space is limited, the same stretch of playing area can be both the downstream and upstream channels). The area must be about 100 feet by 50 feet. Assign roles to each of the students. Some will be salmon; others will be potential hazards to the salmon. Assign the students roles as follows:
    a. Choose two students to be the turbine team. These students will operate the jump rope, which represents the turbines in hydroelectric dams. Later in the simulation, when all the salmon have passed the turbine going downstream, these students move to the upstream side to become the waterfall-broad jump monitors.
    b. Choose two students to be predatory wildlife. At the start of the simulation the predators will be below the turbines where they catch salmon headed downstream. Later in the activity when all the salmon are in the sea, these same two predators will patrol the area above the "broad jump" waterfalls. There they will feed on salmon just before they enter the spawning ground.
    c. Choose two students to be human fishing boats catching salmon in the open ocean. These students in the fishing boats must keep one foot in a cardboard box to reduce their speed and maneuverability.
    d. All remaining students are salmon.

    NOTE: *these figures are based on a class size of 25 – 30. If the group is larger or smaller, adjust the number of people who are fishing and predatory wild animals accordingly.*

2. Begin the activity with all the salmon in the spawning ground. The salmon then start their journey downstream. The first major hazard is the turbines at the dam. At most dams there are escape weirs to guide migrating salmon past the turbines. The student salmon cannot go around the jump rope swingers, but they can slip under the swingers' arms if they do not get touched while doing so. A salmon dies if the turbine (jump rope) hits it. The turbine operators may change the speed at which they swing the jump rope. **NOTE:** Any salmon that "dies" at any time in this activity must immediately become part of the human-made ladders now used by migrating salmon to get past the barriers such as dams. The students who are the fish ladder kneel on the ground on their hands and knees with a body-wide space between them.

3. Once past the turbines, the salmon must get past some predatory wildlife. The predators below the turbine must catch the salmon with both hands – tagging isn't enough. Dead salmon are escorted by the predator to become part of the fish ladder.
    NOTE: Later the salmon that survive life in the open ocean will use the structure of the fish ladder -- by passing through it – to return to the spawning ground. NOTE: Both the predators in the last downstream area and the people fishing in the open ocean must take dead salmon to the fish ladder site. This gets the predators and the fishing boats off the field regularly, helping to provide a more realistic survival ratio.

4. Once in the open ocean, fishing boats can catch the salmon. The salmon must move back and forth across the ocean area to gather four tokens. Once each fish has four tokens (four years' growth), that fish can begin migration upstream. The tokens can only be picked up one token at a time on each crossing. Remember that the salmon must cross the entire open ocean area to get a token. The "four years" these trips take to complete make the

salmon more vulnerable and thus the fishing boats more readily catch them. For purposes of this simulation, the impact of this limiting factor creates a more realistic survival ratio in the population before the salmon begin the return migration upstream.

5. Once four of the year tokens are gathered, the salmon can begin upstream. The salmon must walk through the entire pattern of the fish ladder. This enforced trip through the fish ladder gives the students a hint of how restricting and tedious the upstream journey can be. In the fish ladder, predators may not harm the salmon.

6. Once through the ladder, the salmon faces the broad jump waterfall. The waterfall represents one of the natural barriers the salmon must face going upstream. Be sure the jumping distance is challenging but realistic. The two former turbine students will monitor the jump. The salmon must jump the entire breadth of the waterfall to be able to continue. If the salmon fails to make the jump, then it must return to the bottom of the fish ladder and come through again.

7. Above the falls, the two predators who started the simulation as the predators below the turbines are now the last set of limiting factors faced by the salmon. They represent bears – one example of predatory wildlife. Again, remember that the predators must catch the salmon with both hands. If they do catch a salmon, they must then take the student they caught to become part of the fish ladder.

8. The activity ends when all the salmon are gone before the spawning ground is reached – or when all surviving salmon reach the spawning ground.

Explanation Phase

Debrief the activity with students:

- How many salmon survived? How many died?
- How did different parts of the game help/hinder their survival?
- How were students impacted during the game
    - The role of the barriers
    - The role of the predatory wildlife and the people fishing
    - Where the losses were the greatest/least?
    - Where the losses were least
- What seemed realistic about this simulation and what did not?
    - What would happen if all the eggs deposited made the journey successfully?
    - What would happen if none of the eggs grew into adults?

Teacher note: All models, including role-play simulations like the Hooks and Ladders game, have limitations and ways they differ from the ‘real thing’ they are modeling. For example, this game only focuses on survival of adult salmon, but the math activity that follows will help students consider the bigger picture from the egg stage of the life cycle. Students might suggest that to make the game more realistic that the playing area might need to be larger, etc. but one of the important takeaways should be the high mortality rate of salmon.

Extension Phase

Only the Strong Survive Math Activity

This can be a difficult worksheet for students to go through, which is why we suggest picking one salmon type to work on or going through the worksheet as a class. Calculators may also be used. If working as a class, you might wish to switch from a worksheet to a slide show in which you reveal each new event to students, have them calculate, then check their answers along the way.

Before handing out the worksheet, point out the number of eggs laid by the salmon species you chose– you may even want to prepare a container of items about the same size as salmon eggs in the amount indicated to help students get a sense of that number.

Ask– how many of these do you think will reach adulthood? Why do you think that? (encourage students to draw on prior knowledge and previous lessons in terms of threats salmon may face). You may want students to post their guesses on sticky notes or on a number line to reference afterward.

Based on the approach you chose for your students, they can work in teams/pairs/individually to calculate the number of salmon after each event. Note that some terminology or phrasing may on the handouts may need to be clarified for students.

Discussion questions:

- *What do you notice about the numbers of the salmon before and after?*
- *Which event seemed to impact the salmon population the most? At what stage in the life cycle are salmon numbers decreasing the most?*
- *How is this worksheet similar or different to the "hooks and ladders" game? (the game only considers threats to adult salmon; both show impacts on salmon survival)*
- *How does so many salmon being lost impact the environment? How does it impact us?*

Optional: You may wish to wrap up the activity with a video that explains the impact of salmon population declines on Tribal nations (Salmon Population Depleted or"I Am Salmon"). See the **Connecting to Indigenous Knowledge** section of this lesson for more information.

Evaluation Phase

Students will pull their learning from the lesson together by writing a narrative of a salmon moving throughout their life. First, ask students to close their eyes and imagine themselves as a salmon. Tell the students that they are going to be authors of their own salmon story! Remind students of the video they watched in Lesson 3 in which the coho salmon narrated their own story.

Teacher Tip: If time is a constraint, move this activity to the Writer's Workshop part of your daily schedule.

Writing Prompt:
The prompt below is for a narrative story writing; Alternatively, you can have students create a comic strip story board, write a letter, etc.

You have been learning about the salmon who live with us in our local watershed, and the things that affect their survival. Suppose you wanted to tell people about the challenges salmon face throughout their life cycle. Write a first-person story about your experience as a salmon, including where you went and what happened to you along the way. Use examples from the Hooks and Ladders game and other learning experiences in this unit to help the reader understand the human and natural factors that affect salmon survival.

Note: Depending on your students' writing experience, you may find it helpful to provide scaffolds (e.g., graphic organizers, storyboards, etc.) or to break up the writing into parts.

References & Related Resources

"Hooks and Ladders" is adapted from Project WILD Aquatic; For an alternative, see Trout Unlimited's *Salmon Survival Game* or the *Salmon Survival Board Game from NOAA*

Only the Strong Survive was developed as part of the Salmon in the Schools Seattle program.

Connecting to Indigenous Knowledge and Since Time Immemorial (STI) Curriculum

The Native Knowledge 360 project has a lesson to help students learn more about why salmon are important to the Native people and Nations of the Pacific Northwest, including the Lummi Nation.

This PBS video, Salmon Population Depleted, features a Lummi elder discussing the decline in salmon and how it impacts her people. Suggested discussion questions include:

- Besides overfishing, what other factors do you think are endangering salmon populations today?
- In what ways have the plants and animals mentioned by the speakers sustained the lives of the Lummi people? In what ways are you dependent upon the natural world?
- Who makes decisions on which resources and how much of those resources are used in your society? Who do you think makes those decisions in the Lummi society?
- What can people do to ensure that resources are available for the next generation?

This award-winning video "I Am Salmon" highlights the salmon lifecycle and touches on threats salmon face, culminating in a tribal member sharing about salmon in their native Southern Wakishan language.

This video, "The Boldt Decision Explained" by Northwest Treaty Tribes, provides an age-appropriate explanation of the Boldt decision and rights for Tribes to fish, hunt, and gather.

The activities in this lesson can be complementary to those in the Since Time Immemorial Units: STI Elementary Unit 2: Living in Washington: Celilo Falls and STI Elementary Unit 3

Washington State History: Salmon Recovery & the Boldt Decision. Specifically, this lesson connects to the storypath of Celilo Falls and the impact on salmon and Indigenous People. Additionally, this lesson connects to the impact of the Boldt Decision on local Tribes, how that and the Centennial Accord affects Tribal Sovereignty today.

Connecting to the Next Generation Science Standards

Performance Expectation(s):

4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

**This learning cycle is one step towards meeting this performance expectation but does not help students fully meet the standard.*

3 Dimensions of Learning	Activity Connections
Science and Engineering Practices	
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Develop a model using an example to describe a scientific principle.	Students participate in a simulation to model salmon survival.
Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). • Construct an argument with evidence, data, and/or a model.	Students use evidence from their simulation and mathematical activities to explain the survival rates of salmon.
Disciplinary Core Ideas	
LS1.A: Structure and Function Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.	Students consider what enables salmon to survive as they traverse different environments during their life cycle.
Crosscutting Concepts	
Cause and Effect Cause and effect relationships are routinely identified, tested, and used to explain change.	Students identify human and natural hazards to salmon survival.