Science
4th grade

Science: | 45 minutes

Activity 1 - Cedar: Observation, Structure, & Stewardship
Activity 2 - Salmon and Lamprey: Structures, Behaviors, and Barriers
Activity 3 - Fish Passage Design Challenge

Summary:

The Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians have developed knowledge of plants, animals, and places through generations of observation and relationship. Cedar trees, salmon, and lamprey each have structures and behaviors that support their survival and continuation over time. Understanding these characteristics helps people recognize the needs of living things and informs decisions about how to care for and support them. Through examining trees, fish, and human-designed solutions such as Fish Passages, students explore how knowledge of the natural world can guide stewardship and help sustain living systems.

Key Discovery: *Generations of observation and relationship to place help people understand how living things survive and how to support their continuation.*

Standards	Primary: • 4.LS1.1, 4.LS1.2, 4.ESS2.1, 4.ETS1.1, 4.ETS1.2
Materials	• Cedar Bark Slides • Bark Identification and Reflection Worksheet • Cedar Characteristics Challenge Cards • Salmon and Lamprey Worksheet • Fish Passage Investigation Recording Sheet • Fish Passage Slides • Fish Passage Design Challenge Worksheet • Fish Passage design Printouts (Slides 10-15)



Vocabulary	
	• **Bark** – The protective outer layer of a tree • **Cambium** – A thin layer of special cells found between the bark and the wood of a tree • **Heartwood** – Dead wood that forms the central supporting pillar of a tree • **Inner bark (or phloem)** – The living layer of a tree that transports nutrients. • **Xylem**- The part of a tree that moves water from roots to the rest of the tree. • **Outer bark (or rhytidome)** – The tough, dead layer of a tree that protects the tree. • **Stewardship** – Caring for and supporting the continuation of living things, places, and natural resources. • **Structure**- A physical part of a living thin or object that helps it do a specific job. • **Behavior**- An action or way of acting that helps a living thing survive and meet its needs. • **Barrier**- Something that blocks, slows, or makes movement difficult. • **Upstream**- In the direction toward the source of the river or stream. • **Diadromous fish**- A fish that spends part of its life in salt water and part of its life in freshwater. • **Fish Passage-** A structure or system that helps fish move past barriers in rivers and streams. • **Weir** 1) A low dam built across a river to raise the level of water upstream or regulate its flow. 2) An enclosure of stakes set in a stream as a trap for fish.

Setup & Logistics:

Activity 1-Cedar:

- Prepare the Cedar Bark Slides for display.
- Copy Bark Identification and Reflection Worksheet.
- Confirm access to a nearby outdoor area with multiple trees.
- Prepare a hard writing surface (clipboards, cardboard, tables) and pencil for recording.
- Print and cut apart the Cedar Characteristics Challenge Cards.
- Create Cedar Use Stations around the room (Basket, Mat, Clothing…).
- Place chart paper at each station and prepare the two-column chart:
  Characteristics | *Why Might It Help?*
- Prepare multiple sets of Cedar Characteristics Cards so students can participate in the challenge simultaneously.



Activity 2-Salmon and Lamprey:

- Prepare the Salmon and Lamprey Slides
- Copy the Salmon and Lamprey Worksheet for each student or student pair.
- Preview and test the salmon and lamprey videos to ensure they play correctly and are accessible.

Activity 3-Fish Passage Design Challenge:

- Prepare the Fish Passage Slides for display.
- Copy the Fish Passage Investigation Recording Sheet.
- Print the fish passage design examples (Slides 10-15) so each investigation team has access to one assigned design.
- Copy the Fish Passage Design Challenge Worksheet for each student.
- Prepare chart paper or whiteboard space to record student ideas for:
    - What Should a Fish Passage Design Do?
    - Design Features and How they Help Fish

Class Flow:

Activity 1— Cedar: Observation, Structure, and Stewardship

Students explore how generations of observation have helped people understand cedar trees and their characteristics. By investigating tree bark and cedar structures, students consider how plant structures support survival and how knowledge of those characteristics informs stewardship and use over time.

Step 1: Notice and Wonder

- What can careful observation help us learn about a tree?
- How might understanding a tree help people care for it?
- Display Slide 2.
- Invite students to quietly observe.
- Invite curiosity:
    - What do you notice?
    - What is similar?
    - What is different?
    - What do you wonder?
- Invite students to share observations with a partner before a brief whole-group share.



Step 2: Connect Observation to Knowledge

- Share that the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians have developed knowledge of Cedar through generations of observation and relationship.
- Introduce one or two key ideas from the Cedar Narrative.
    - “Generations of observation have helped people understand cedar trees and how they grow as part of a larger system of plants, animals, soil, and water. Knowledge of cedar helps people care for cedar and use it responsibly.”
    - “For generations, the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians have learned about cedar through observation and relationship. They understand that cedar grows as part of a larger system of plants, animals, soil, and water. Knowledge of cedar helps people care for cedar and use it responsibly.”
    - “Cedar trees grow as part of forest ecosystems alongside other plants, animals, soil, and water systems.”
- Suggested Prompts:
    - What kinds of things do you think people notice when they spend time observing a tree?
    - How might understanding a tree help people care for it?
    - What might a tree need in order to continue growing over time?

Step 3: Investigate Tree Structures

- Display Slide 3-the bark anatomy diagram.
- Invite students to spend a moment quietly observing the diagram.
- Invite the students to predict the answers to the following questions: Students may point, hold up fingers, or turn and talk.
    - Which layer do you think helps protect the tree?
    - Which layer do you think helps move things through the tree?
    - Which layer do you think helps the tree grow? What do you notice about the different layers of the tree?
    - Which layers seem like they might be important for protection?

Step 3a: Become Tree Detectives

As you introduce each layer, invite students to think like detectives.

- Outer Bark- “This layer protects the tree.”
    - Engagement:
        - Show me with your hands what protection looks like.
        - Turn and tell a partner one thing bark might protect the tree from.
        - Possible responses may include insects, weather, injury.



- Call and response with protection hands:
  "Outer bark helps PROTECT!" (Protection movement)
- Inner Bark (Phloem)- "This layer helps move food through the tree."
  - Engagement:
    - Invite the students to show how they would move food from the leaves to the rest of the tree.
    - Call and response with a food movement
    - "Phloem moves FOOD!" (Move food movement)
- Cambium- "This is where new growth is made."
  - Engagement:
    - Invite students to show a growing motion.
    - Turn and tell a partner one thing bark might protect the tree from.
    - Possible responses may include insects, weather, injury.
    - Call and response with a growth movement"
    - "Cambium helps trees GROW!" (Growth movement)
- Sapwood/Xylem- "This layer moves water through the tree."
  - Engagement:
  - The water moves from the roots up to the rest of the tree. Can you think of a movement that would indicate water flowing from the roots to the leaves?
  - Call and response with a water movement from the ground up:
    "Xylem moves WATER!" (Water movement)
- Heartwood- "Heartwood provides strength and support."
  - Engagement:
    - Invite students to show strength and support with their bodies.
    - Call and response with strength and support movement:
    - "Heartwood helps trees STAND STRONG!" (Strength and support movement)

Step 3b: Putting it all Together

- Invite students to become a tree.
- Teacher names a structure and the students demonstrate their motion:
  - Outer Bark – Protection motion
  - Phloem – Move food motion
  - Cambium – Growth motion
  - Xylem – Water motion
  - Heartwood – Strength and support motion



Step 3c: Reflect and Connect

- Invite students to discuss with a partner, then share in a large group.
- Suggested prompts:
    - What would happen if a tree lost one of these layers?
    - Why do trees need different structures instead of just one?

Step 4: Look for Evidence Outdoors

Students use their new understanding of tree structures to investigate trees in a nearby outdoor space.

- Distribute the Bark Identification Worksheet.
- Invite the students to be tree detectives and look for evidence of the structures and functions they just explored.
- Invite students to observe multiple trees and record:
    - Similarities
    - Differences
    - Evidence of protection
    - Evidence of growth
    - Questions they have.
- Suggested prompts:
    - Where do you see evidence that this tree is growing or changing?
    - What makes this tree similar to or different from another tree nearby?
- When the students return from the outdoor tree investigation, Display Slide 4: Western Red Cedar to compare and contrast.
    - What characteristics of Cedar do you notice?
    - How is Cedar similar to or different from some of the trees you observed?
    - Record with words and drawings on your worksheet.

Step 5: Share and Make Meaning

- Gather students and invite them to share one observation that surprised them.
- Create a class chart:

What We Observed	What It Might Help the Tree Do
Ex. Thick bark	Ex. Protect the inside of the tree

- Suggested prompts:
    - What patterns can we notice across different trees?
    - Which structures appear on many trees?
    - How do these structures help trees survive?



Step 6 Connect Characteristics to Uses

- Place the Cedar Use Cards at several stations around the room:
  Basket | Mat | Rope | Clothing | Canoe | Fishing Equipment | House Plank
- Place a piece of chart paper at each station with two columns:

Characteristic	Why might it help?

- Provide several decks of Cedar Characteristics at a central location, face down.
  Cedar Characteristics: Flexible Bark | Strong Wood | Lightweight Wood | Resistant to Rot | Straight Grain | Fragrant Oils.
- Round 1: Individual Thinking
  - Each student selects a characteristic card.
  - Students independently decide which use the characteristic might support.
  - Students place their card at a station and record their characteristic and reasoning on the chart.
    Intention: Individuals are provided an opportunity to make a claim before hearing others' ideas.
- Round 2: Partner Thinking
  - Students join a partner.
  - Partners select a new characteristic card.
  - Together they decide where it belongs and add their reasoning to a station chart.
    Students may begin to notice that more than one characteristic may support the same use.
- Round 3: Notice, Compare, and Revise
  - Partners visit several stations and read classmates' reasoning.
  - Invite students to notice:
    - Patterns
    - Similarities
    - New ideas
    - Multiple possible explanations.
  - Partners may add:
    - Additional reasoning
    - A new connection inspired by another group's thinking.
- Display Slide 5: Traditional Uses of Cedar
  - Invite students to examine the traditional Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians uses shown on the slide
  - Ask the students to compare these examples to the ideas generated during the Cedar Characteristics Challenge.



- Display Slide 6: Cedar Characteristic - Traditional Uses It Supported
    - Flexible bark - Baskets, mats, clothing, rope
    - Strong wood - House planks, structural materials
    - Lightweight wood - Canoes, transportation
    - Resistant to rot - Canoes, houses, storage containers
    - Straight grain - Split boards, weaving materials
    - Fragrant oils - Protection from insects and decay

  Suggested Prompts:
    - Which traditional uses connect to the ideas we explored?
    - Which uses surprised you?

Step 7: Connect Observation to Knowledge

- Through generations of observation, the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians learned which characteristics made cedar useful for different purposes. Careful observation helped people understand both how cedar could be used and how it could be cared for. Cedar bark, branches, cambium, wood, roots, leaves, and other parts all serve different purposes. Nothing is wasted
- Invite students to revisit the chart papers from the Cedar Characteristics Challenge and consider:
    - How might understanding cedar help people make decisions about caring for cedar?
    - Why would it be important to understand a tree before using it?
    - What might happen if people took more Cedar than was needed?
    - How can understanding a tree helps people care for it?
- Note: Please gently introduce the following examples of stewardship if they do not emerge:
    - Taking only what is needed.
    - Reusing materials whenever possible.
    - Avoiding actions that damage trees.
    - Planting and caring for trees.
    - Supporting the protection of forests and natural areas.
    - Sharing knowledge about the value of cedar and other trees.



Step 8: Reflection

- Students complete the final reflection on their Bark Identification Worksheet
- Invite students to consider how observation and understanding can guide decisions about natural resources.

Closing connection: Generations of observation and relationship to place help people understand how living things survive and how to support their continuation.

Activity 2— Salmon and Lamprey Structures, Behaviors, and Barriers

Step 1: From Cedar to Fish

- Share: Through generations of observation, the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians learned about cedar's characteristics, how it grows, and how to care for it. Cedar is not the only living thing people have learned from. People have also carefully observed salmon and lamprey, learning about the structures and behaviors that help them survive and continue their life cycles.
- Invite students to consider this question:
  If understanding cedar can help people care for cedar, how might understanding salmon and lamprey help people care for fish?
- Display slide 2 (“Notice and Wonder”). Invite the students to quietly observe the images.
- Working independently, invite the students to record what they notice using words, pictures, labels, symbols, numbers, or a combination of these on their Salmon and Lamprey Worksheet.
- Partner Thinking: Invite partner teams to create a chart of things they notice and wonder about each fish.
- Invite partner teams to create a chart of things they notice about each fish.

Fish A.	Fish B.
We notice…	We notice…
We wonder…	We wonder…

- Suggested Prompts:
  - What parts of each fish stand out?
  - What similarities do you notice?
  - What differences do you notice?
  - What do you think these structures might help the fish do?

  Note: Encourage students to return to their initial observations and questions as they learn more about salmon and lamprey.



Step 2: Two Fish, Same Goal, Observations

- Share: Both of these fish need to travel upstream to complete their life cycles. Along the way, they encounter rocks, rapids, waterfalls, and other obstacles.
- Display Slide 3 - What do you think this fish uses to help it move upstream?
- Show a video that shows the structure and movement of the Salmon (ex: Pink salmon mom battles an uphill river journey, https://www.youtube.com/watch?v=rkIvaIoF1wg [4:05 minutes]),
  Answers may include fins, muscles, jumping
- Display Slide 4 – What do you think this fish uses to help it move upstream?
- Show a video that shows the structures and movement of the Pacific Lamprey (The Pacific lamprey: your ancient neighbor, https://www.youtube.com/watch?v=ptTqf81SFNY [1:53 minutes])
  Answers may include suction-cup mouth, flexible body, climbing

Step 3: Same Goal, Different Strategies

- Display Slide 5: Structures of Salmon vs Lamprey.
- Share: Salmon and Lamprey both need to travel upstream to complete their life cycles, but they do not rely on the same structures and behaviors.
- Partner Thinking: Invite partners to revisit their charts and discuss:
  - What does the salmon use to help it move upstream?
  - What does the lamprey use to help it move upstream?
  - How are their strategies similar?
  - How are their strategies different?
  - Why might different fish need different strategies?

  Students may record with words, sketches, arrows, symbols, or labels, and any combination.
- Whole Group Discussion:
- Share: For generations, salmon and lamprey have been important to the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians. These fish are connected to food systems, cultural traditions, relationships with rivers, and responsibilities to care for places and living things. Supporting the continuation of salmon and lamprey helps support the continuation of these relationships.
  Suggested Prompts:
  - Which structures help the salmon move through water?
  - Which structures help the lamprey move over obstacles?
  - What can each fish do because of its structures and behaviors?
  - Why might different fish need different strategies?

  Possible points to share:
  - Salmon often uses powerful swimming and jumping to move upstream.



- Lamprey can attach to rocks and other surfaces using their suction-cup mouths.
- Lamprey have been on Earth for hundreds of millions of years—long before dinosaurs—and their unique structures have helped them survive and continue over time.

Step 4: Barriers to Upstream Movement

- Display Slide 6: Barriers to Upstream Movement
- Share:
  Salmon and lamprey have structures and behaviors that help them move upstream and complete their life cycles. Along the way, they encounter natural barriers, such as rapids, waterfalls, and rocks, as well as human barriers, such as dams and culverts.
- Suggested Prompts
  - Which barriers might salmon be able to overcome?
  - Which barriers might lamprey be able to overcome?
  - Which barriers might still be difficult?
  - What clues from the fish structures and behaviors help you think that?
- Whole group discussion- invite students to connect the barriers to the adaptations they observed.
  Possible connections may include:
  - Salmon can use powerful swimming and jumping to move past some obstacles.
  - Lamprey can use their suction-cup mouths and flexible bodies to grip and climb over some obstacles.
  - Some barriers may be challenging for both species.

Step 5: Transition to Fish Passages

- Ask: People have observed salmon and lamprey for generations and learned that some barriers can be difficult for fish to overcome. What could people do to help?
- Invite students to share ideas.
- Display Slide 7: Fish Passage.
- Share: People have developed many different types of fish ladders and fish passage systems to help fish move around obstacles and continue their journey upstream. This is just one example.
- Suggested Prompts:
  - What do you notice about this structure?
  - How do you think it works?
  - How might it help salmon? Lamprey?
  - How does this fish passage design support salmon and lamprey?



- Transition to Fish Passage Design Challenge- If salmon and lamprey use different structures and behaviors to move upstream, what might a Fish Passage need to include to support both species?

Activity 3— Fish Passage Design Challenge

Step 1: Define the Design Problem

- Share:
  Through generations of observation, people have learned that salmon and lamprey need to move upstream to complete their life cycles. They have also learned that some barriers can make that journey difficult. Understanding the needs of living things can help people create solutions that support their continuation.
- Invite the students to consider and answer this question:
  What did we learn about salmon and lamprey that might help us design a solution?
- Capture the answers on the board (Reference for Step 6) titled: What Should a Fish Passage Design Do?. This is the basic Design Criteria moving forward.

Step 2: Investigating Many Solutions

- Display Slide 9: Investigating Many Solutions.
- Ask:
  - What do you notice?
  - How are the two solutions similar?
  - How are they different?
- Share: People have developed many different ways to help fish move around barriers. Some solutions help fish swim through or around a barrier. Other solutions transport fish around the barrier.

Step 3: Investigation Teams

- Assign each team one fish passage design. Teams investigate their design using a printout of their assigned Fish Passage Design. (Slides 10-15)
- Team Investigation Task- Invite the teams to study:
  - The image
  - The description
  - The “Think About” questions
- Hand out the Fish Passage Investigation Recording Sheet. Students may record their thinking using words, sketches, arrows, labels, symbols, numbers, or a combination of these using the Fish Passage Investigation Recording Sheet.
- Encourage teams to use evidence from the image and description to explain their thinking.



Step 4: Share and Compare Solutions

- Invite investigation teams to briefly share their fish passage design with the class. Encourage students to present and listen for the design features that:
  - Help fish move upstream,
  - Support salmon and lamprey,
  - Help fish overcome barriers.
- Create a class chart:

Design Feature	How It Helps Fish

Suggested Prompts:

- Which ideas appeared in more than one design?
- Which designs seemed especially helpful for salmon?
- Which designs seemed especially helpful for lamprey?
- Which design features might support both species?

Step 5: Apply What We Learned

- Display Slide 16
- Share:
  We've investigated several ways people help fish move around barriers. Now let's look at a new fish passage design and see what we notice.
  Suggested Prompts:
  - What do you notice about this design?
  - How do you think it works?
  - Which design features from our investigations do you recognize?
  - How might salmon use this design?
  - How might lamprey use this design?
  - What features seem especially helpful for fish moving upstream?
- Whole Group Discussion. Invite students to use evidence from:
  - salmon and lamprey adaptations,
  - upstream barriers,
  - fish passage investigations,
  - to explain their thinking.
    Encourage students to reference ideas from the designs they investigated rather than looking for a single correct answer.



Step 6: Introduce the Design Challenge
Engineers and communities continue to develop new ways to help fish move barriers. Using what we learned about salmon, lamprey, and fish passage systems, you will create a design that helps both species continue their journey upstream.

- Review the What Should a Design Do? from Step 1. Invite the students to refer to this chart as they are working on the Fish Passage Design Challenge

Step 7: Launch the Design Challenge

- Organize students into groups of 3 to 5.
- Distribute and review the "Fish Passage Design Challenge Worksheet" to students.
- Invite the students to complete their worksheet using drawings, labels, symbols, arrows, words, numbers, or a combination of these.
- Support student thinking.
  Suggested Prompts:
  - How does your design help salmon?
  - How does your design help lamprey?
  - What features help move barriers?
  - What are we missing?
    Encourage students to revise and improve their designs as new ideas emerge.

Step 8: Share and Reflect

- Reconvene as a whole group.
- Invite teams to briefly share their designs and explain:
  - How their designs work,
  - How it supports salmon,
  - How it supports lamprey,
  - And which design criteria it addresses.
- Closing Connection:

Through generations of observation, people have learned about the structures, behaviors, and needs of living things; understanding those needs can help people create solutions that support the continuation of salmon, lamprey, and other living things.

