

TTCD Lesson Plan (23): Fish Passage + Culverts

Unit: Fish Passage + Culverts	Grade(s): All	Class Size: 1-30	Lesson Duration: 45 mins	Location(s): Classroom
Topic(s):	Culverts, Fish Passage			
Student Prerequisites:	N/A			
Essential Questions:	What is a culvert? Why is fish passage important? For what kinds of fish is fish passage important? How does expanding fish passage impact the ecosystem beyond fish?			
Student Objectives:	Students will be able to explain why fish passage is crucial for the health of aquatic ecosystems and the sustainability of fish populations. Students will be able to recognize various fish passage barriers, including poorly designed culverts, dams, and natural obstacles. Students will be able to describe how culverts function within a stream or river system and their potential impacts on fish movement and water quality. Students will be able to identify key design elements that promote effective fish passage and design a culvert or fish passage solution that accommodates both aquatic wildlife and human infrastructure needs.			
Standards:	Supports NGS Standards: MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. Relevant NGS Crosscutting Concepts: Cause and Effect: Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2) Interdependence of Science, Engineering, and Technology: Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS4-5) Cultural Standards B.4: Culturally-knowledgeable students are able to build on the knowledge and skills of the local cultural community as a foundation from which to achieve personal and academic success throughout life by: identify[ing] appropriate forms of technology and anticipat[ing] the consequences of their use for			

	improving the quality of life in the community. E.2: Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them by: understand[ing] the ecology and geography of the bioregion they inhabit;
Local Context:	Take a trip to a local culvert or show a side-by-side photograph/time lapse of the Lower Tyonek Creek culvert before and after restoration. Ask students how they think the new culvert impacts the ecosystem. A time lapse video of the Lower Tyonek Creek Culvert can be found here: https://www.youtube.com/watch?v=K3ynxYRq6qc&feature=youtu.be&fbclid=IwY2xjawJJBKdleHRuA2FlbQIxMQABHRmGWtHygxThOKEVsMXtCDRdBI7BJDRrjeFYobTTg2Ouho6Nscg7mYxMRw_aem_Uijx3zbr-X78B3S8VzG7WQ
Vocabulary:	Culvert: A culvert is a short tunnel structure that primarily conveys water beneath an obstruction. Fish Passage: Fish passage refers to the ability to effectively and efficiently allow fish to move through a water system. Anadromous: Relating to fish, such as salmon, that migrate up rivers from the sea to breed in fresh water.
Dena'ina language words:	
Materials:	• PPT Presentation: Fish Passage + Culverts.pptx • (Optional): Print out of one page of each of the “Design Problem” slides in the ppt. • Blank paper • Markers
Instructor Prep:	Decide if you aim to facilitate this activity as a full class exercise or if you plan to break students up into groups. If breaking students up into groups and you have a wide range of students ages, consider distributing older and younger kids evenly among the groups. Print out the “Design Problem” slide for each group to have in front of them.
Introduction:	Play this lesson introduction video: Did you know? Fish migrate too!: https://youtu.be/KzIBtMFc43s Briefly evaluate student’s knowledge of fish passage and barriers to migration. Fish passage refers to the ability to effectively and efficiently allow fish to move through a water system. Ask the class, can you think of any fish that need to move through waterways? Salmon, steelhead trout, Dolly Varden char, hooligan. All of these species are known as anadromous, which are fish that migrate up rivers from the sea to breed in fresh water.

	Ask students to provide examples of what might be a barrier to fish movement. Encourage all responses, write examples on whiteboard or flip chart. After a few minutes, review the list, if culvert is included, explain that it is a type of barrier (and when designed correctly a type of passage)! Barriers could include dams, culverts, roads, debris, etc. Ask students what parts of the ecosystem they think are impacted by barriers to waterways other than fish? Water quality, plants, other aquatic species, wildlife, humans. If you haven't done so already, play this time lapse video demonstrating the restoration of the Lower Tyonek Creek Fish Passage Culvert: https://www.youtube.com/watch?v=K3ynxYRq6qc Ask students what they noticed about the changes between the original culvert and the restored culvert. Point to the evidence of planting that occurred around the new culvert. Ask students why they think this might be important? Planting around a culvert after restoration can help with things like erosion control and water quality, filtering runoff, giving the area a better appearance.
Activity	1. This activity can be conducted in two ways, either as a full class or by breaking students up into three small groups. If being led as a full class, the instructor can project the following PowerPoint: Fish Passage + Culverts and go through each design solution one by one as a class. If being led in smaller groups, project the first slide of the PowerPoint to the class (types of culvert shapes) and print out one copy of the "Design Problem" slide for each of the three examples. 2. Assign students groups so there are three groups total. Give each group a print out of one "Design Problem," a sheet of paper for each student, and markers. Ask students to reflect on the design problem being presented. Some questions to ask the class are: "What do you notice about the landscape surrounding the culvert? What does the stream flow look like – heavy or light? How might other animals or humans be using the space in and around the culvert? Does this look like something a fish could swim through? How might you make a design that is better for fish passage?" 3. Instruct students to talk as a group about their design solution and agree on one collective solution. Have each student draw the solution on their piece of paper. Give students 5-10 minutes with the design problem to identify and draw their solution. 4. Project the design problem onto the PowerPoint and have each student group come to the front of the class and present their design solution and explain why they chose that particular solution. Then click on the PowerPoint slide identifying what the real-world design solution was. Ask each group to reflect on how their design solution was similar to or different from the real-world solution.

Wrap-Up:	Ask students: What do you think is a sign that a culvert is not working for the ecosystem in which it is in? - Answers could include: there is a gap between the culvert and the body of water the fish are moving through, there is debris in the way of the culvert, the culvert needs to be passable by humans and animals and it is not, the culvert is too small for fish passage. <i>Evidence of learning:</i> Ask student to respond verbally to the following: Why are culverts important for the ecosystem? - For fish that migrate up rivers from the sea to breed in fresh water, they need a clear path to do so. Culverts also help humans and animals pass bodies of water, can help prevent flooding, and can help manage water flow.
Lesson Adaptations:	Assign each student group the same culvert problem to design a solution to. Have groups present and debate one another on the advantages and disadvantages of each design solution. As the instructor, summarize the key takeaways for the class on the various ways to design a solution to each culvert problem, highlighting that there are multiple ways to approach a problem.
Extensions:	1. Bring in a local project lead who worked on a local culvert project. Have them present to the class on their design problem and the design solution they chose, walking the students through the decision process of landing on the particular design they chose. a. If time allows, visit a local culvert and ask the class what they think this culvert is doing well and how, if at all, it could be improved? 2. Play a game with students in which you time them doing an obstacle course. Time students doing the obstacle course, once just running and once with the added element of having to crawl through a play tube like this one: https://www.amazon.com/Hide-Side-Through-Toddlers-Children/dp/B07G9TKB4W/ref=asc_df_B07G9TKB4W?mcid=73288f48755f3431a6833c13a91d050a&tag=hyprod-20&linkCode=df0&hvadid=693336071271&hvpos=&hvnetw=g&hvrnd=13313147856020945743&hvpone=&hvptwo=&hvgmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9002004&hvtargid=pla-568667987650&th=1 a. At the end, compare the students times between the obstacle course with and without the small tube they had to crawl through. b. Ask students: How is the play tube similar to a culvert? c. Ask students: Why might increased difficulty or time to cross through a stream be bad for a fish like salmon? i. Energy expenditure, increased risk to predation, spawning delays, health stress.
Reflections:	How did it go? What did students understand most/least? What could change about instruction or lesson plan?

Resources Used:

Fish Passage + Culverts PPT: [Fish Passage + Culverts.pptx](#)

US Fish and Wildlife Service: [Building Fish Friendly Culverts and Bridges](#)

Culvert Shapes Handout: <https://www.fws.gov/sites/default/files/documents/Fish-Need-to-Move-Structure-Shapes.pdf>