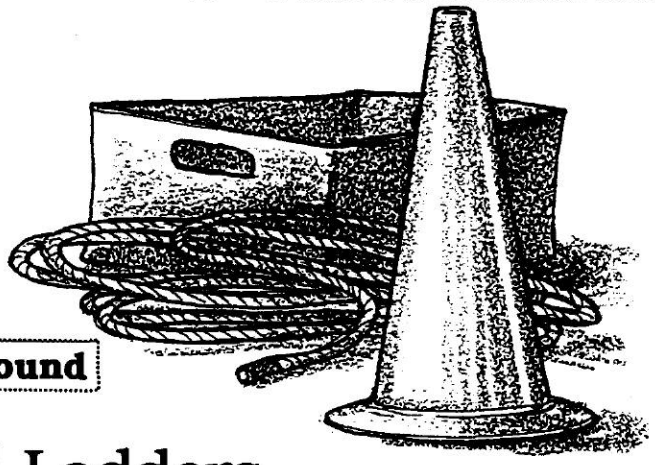


Teacher Background

Hooks and Ladders

(Adapted, with permission, from Project Wet and Wild)

See the previous lesson, THE CYCLE CONTINUES, for Teacher Background.

Lesson Plan

Student Objectives:

Students will role play the life cycle of the Pacific salmon in a game which graphically represents the hazards salmon face during their complex life cycle. Through this experience, students will:

- Recognize that Pacific salmon migrate as part of their life cycle
- Identify the stages of the life cycle of Pacific salmon
- Describe limiting factors affecting Pacific salmon as they complete their life cycle
- Generalize that limiting factors affect all populations of animals.

Materials:

- Large playing area (100 x 50 feet)
- Wooden stakes or traffic cones, and about 500 feet of rope or string for marking the course (helpful, but optional)
- A jump rope (10-15 feet long)
- 2 Cardboard boxes
- 100 tokens, 3x5 cards, poker chips, etc.

Procedure:

1. Ask the students to help you diagram the life cycle of Pacific salmon on the board, as outlined in the preceding section. You may find the diagram at the end of this

section useful as a transparency in presenting this information. You can also introduce the following vocabulary at this time:

Anadromous: Any fish which is born in fresh water but lives most of its life in salt water.

Alevin: A newly hatched salmon with its yolk sac still attached to its body. In the wild alevin stay buried beneath a layer of gravel.

Fry: Young salmon that have used up their yolk sac and have emerged from the gravel ready to feed.

Smolt: A young salmon making the adjustment to sea water and ready to go to sea.

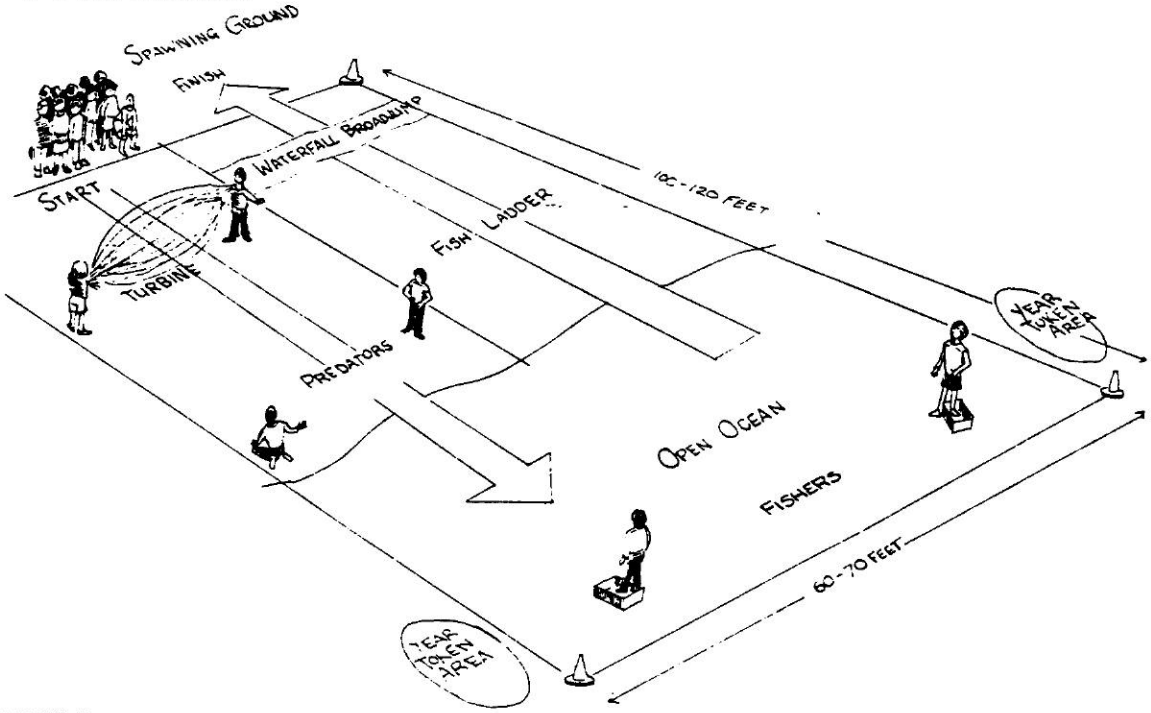
Spawner: A mature salmon which has returned to fresh water to spawn. The body of a spawner undergoes major changes in shape and color.

Redd: The depression dug by a female salmon where she lays and buries her eggs. The eggs stay in a redd about 8 weeks before hatching.

2. With the students, brainstorm all the potential hazards which a salmon faces during its life cycle. These may include predators of many kinds, fishing, obstacles to migration such as dams, pollution, damage to rivers and streams, and others.

3. Explain to the students that they are about to be participants in a game played outdoors to help them experience more directly the life cycle of salmon and the various hazards salmon face. The game is an obstacle course representing the perilous journey salmon make in their lifetime. As in real life, not all players of the game will survive. Explain the game to them, and diagram the game course so that they can be of help in setting it up.

4. Set up the playing field as shown in the diagram below. The area should be about 100 x 50 feet, laid out with spawning grounds, the downstream river, the ocean, and the upstream river. Strings and stakes to mark the salmon's route are helpful, but not essential.



Assign roles to each of the students. Some will be salmon, others will be potential hazards to the salmon. Some of the students will have more than one role, including students playing salmon who "die" in the game.

Choose two students to be the turbine team. These are the ones who 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.

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.

Choose two students to be humans in 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.

All remaining students are salmon.

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

5. Begin the activity with all the salmon in the spawning ground. The salmon then start their journey downstream. The first major hazard is the turbine at the dam, played by twirlers of the jump rope. At most dams there are escape weirs to guide migrating salmon past the turbines. The student salmon cannot go around the rope swingers, but they can slip under the swinger's arms if they do not get touched while doing so. A salmon dies if it is hit by the turbine (jump rope). The turbine operators may change the speed at which they swing the rope.

Any salmon which "dies" at this or any other stage in the game becomes part of the physical structure of the fish ladder later in the course. A fish ladder is a human-made ladder now used by migrating salmon to get past many dams and other obstacles. Later in the game, the salmon who survive life in the open ocean will use the fish ladder to return to the spawning ground. Students who have "died" can move to the fish ladder and prepare to become part of it.

6. Once past the turbine, the salmon must get past some predatory wildlife. The predators below the turbine must catch the salmon <u>with both hands</u>--tagging isn't enough. Dead salmon are escorted by the predator to the fish ladder.

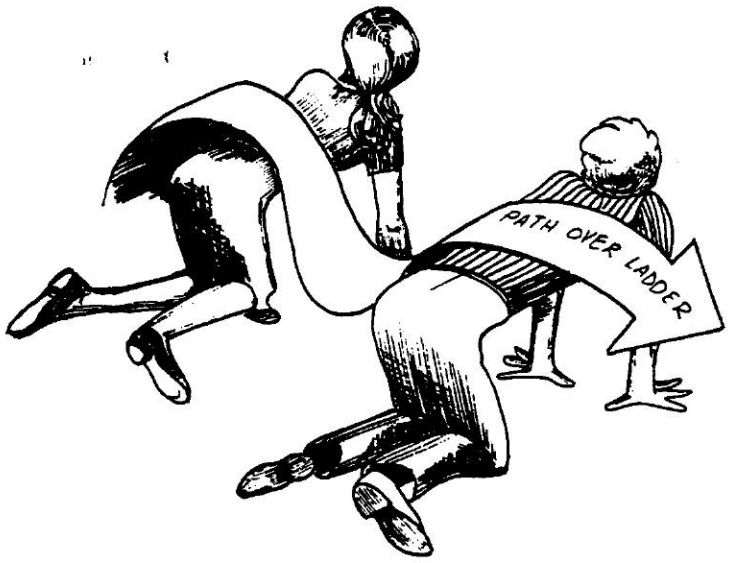
This gets the predators off the field regularly to provide a more realistic survival ratio.

7. Salmon which escape the predators are in the open ocean. The salmon must move back and forth across the ocean area four times in order to collect four tokens, which represent four years at sea. You, an assistant, or a student can stand at the edge of the "ocean" handing tokens to students as they complete these trips. Make sure the students cross the entire ocean before collecting a token.

Meanwhile, the salmon can be caught by fishing boats in the ocean. Remember, people fishing must keep one foot in their cardboard box! When a salmon is

caught by a fishing boat, he or she is again escorted to the fish ladder by the person fishing.

8. As soon as four of the "year" tokens are gathered, the salmon can begin upstream. They will now need to pass up the fish ladder. The fish ladder is formed by students kneeling on the ground in a row, with a body-wide space between them, as pictured:



Salmon must step carefully over the backs of each of them to advance. In the fish ladder, predators may not harm the salmon.

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

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

11. The game ends when all surviving salmon reach the spawning ground, or when all salmon are gone in the event that none survive.

12. Feel free to experiment with other configurations of the game course to include different sets of hazards.

13. After playing the game, explore these questions with your students:

- What was the survival ratio of your population?
  (This is simply: $\frac{\text{survivors}}{\text{total population}}$ *)*
- How does this compare with the actual survival ratio in salmon?
  (A typical survival ratio would be two survivors out of 3000 eggs, or 2/3000)

- Where were the losses the greatest?
- Where were the losses the least?
- What seemed realistic about this simulation and what did not?
- What would be the consequences if all the eggs deposited made the journey successfully?

  (extreme overpopulation)
- Introduce the term "limiting factors" as those environmental factors which limit population size. What are some limiting factors for salmon?

  (predation, limitations of habitat, barriers to migration, fishing, food shortage, etc.)
- Are limiting factors important for other species?

  (Yes. Have the students come up with examples in other species.)
- How did the students feel during the activity?