

Hooks and Ladders

Dear Presenter,

This is a 20 to 25 minute presentation and HANDS-ON outside activity for approximately 25 - 30 ten year-old children. You MUST do this activity at home BEFORE you attempt to lead the activity during the Water Festival.

As each new group of students arrive, find the classroom teacher, introduce yourself, and let the teacher know this is a hands-on activity and you will need assistance from him/her. If you do not ask for assistance, the teacher will assume that YOU are the EXPERT and they are the observer! When you “practice” the activity at home, visualize 25 - 30 little bodies doing this with you or as you verbally instruct them. Plan when you will ask the teacher for assistance! DO NOT hesitate to call the teacher by name and politely ask for their assistance with ANY of your needs.

As each session begins, introduce yourself to the students. “Good morning, my name is.... and I work for..., I am a or simply I am happy to be here today.” Then introduce the topic of this presentation. Each step of this presentation is explained in this packet. These are recommended guidelines and do not have to be followed exactly word for word. However, you may present this material just as written. Feel free to personalize the presentation to suit you, if necessary.

Thank you for volunteering to present “Hooks and Ladders.” Have fun, enjoy yourself, and we hope you will consider volunteering again next year.

**Big Sioux Water Festival
Presenter Kit Committee**

Note: This activity was adapted from Aquatic Project WILD

Hooks and Ladders

BACKGROUND information is provided as a basic overview with both general and specific information. Share this information with the students throughout the presentation.

Many fish live part of their lives in one habitat and then migrate to another habitat. Some make their migratory journeys to another habitat. Some make their migratory journeys to mature and reproduce. Pacific salmon are an example of one of the most spectacular of the migrating species.

Pacific salmon are destined to spawn only once in their lifetimes. Within their genetic fiber is an encoded instinct that drives them from the time of hatching along a monumental journey from their freshwater spawning beds downstream into the sea. Once in the sea, they spend several years reaching the maturity needed for the single return journey to their original hatching ground. Once there, the salmon spawn and die.

Salmon must face a myriad of hazards that serve as limiting factors in the completion of their life cycle. Limiting factors are factors that reduce the populations of living organisms. Sometimes the limiting factors are natural and sometimes they result from human intervention with natural systems.

The female Pacific salmon deposits 1,500 to 7,000 eggs in her freshwater spawn. The eggs are deposited in a shallow gravel depression scooped out by the female. Once deposited, the eggs are fertilized by the male and then both fish nudge the gravel back over the eggs to offer as much protection as possible. Within a few days, both the male and female salmon have completed their reproduction and soon die.

The eggs, before and after hatching, are susceptible to many limiting factors. Smothering silt can be washed in suddenly from watersheds damaged by a variety of land-use practices and events - including erosion following some road building, logging, and fires. Predators can eat some of the eggs and damage hatching populations. Dropping water levels can isolate salmon offspring in streamside depressions to remain isolated and die. After hatching, the small fish - called "alevins" - spend their first two weeks hiding in the gravel. Gradually they absorb their yolk sac and become known as "fry." If they survive the first two weeks, they then begin their journeys. Some head directly to the sea.

Depending on the species, young salmon may spend several months to as much as a year or more in the river before migrating to the estuary and then to the open ocean.

The small ocean-bound salmon, now called “smolts,” are at once confronted by hazards on their downstream journey. Examples are dams; low water in streams; and predatory birds, mammals, and larger fish. Up to 90% of the salmon that hatch never reach the sea.

When in the ocean, the salmon grow rapidly by feeding on the ocean’s rich food supply. Predators such as sharks, killer whales, and other marine mammals take their toll. In addition, humans fish for salmon commercially and for personal reasons, including food and recreation.

In two to five years, the Pacific salmon start the journey that will guide them back to the rivers and streams leading to their own hatching site. The upstream migration from the ocean is also a series of hazards. For example, dams hinder their journey and would block it completely if fish ladders were not installed. Fish ladders are water-filled staircases that allow the migrating fish to swim upstream, around the dam. Humans who fish, eagles, bears, and other predatory mammals also reduce the numbers along the way to the spawning ground. Sometimes landslides and logjams provide unexpected new barriers. So, too, do the natural waterfalls and rapids that the now weighty salmon must overcome.

Once back at the spawning ground, the life cycle of the Pacific salmon begins anew. To maintain the Pacific salmon population, some biologists believe that only one pair of fish from each spawn must return to deposit and fertilize eggs.

All possible conditions are not covered by the design of this activity. However, the activity does serve simply and effectively to illustrate three important concepts - life cycle, migration, and limiting factors.

The major purpose of this activity is for students to gain an understanding of some of the complex characteristics of the life cycle of one representative of aquatic species.

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VOCABULARY TERMS: (Hint: Do not assume the students will know the meaning of the following words.)

1. **Alevin** - a young salmon during the first two weeks after hatching, until the yolk sac has been absorbed
2. **Fish ladder** - water-filled staircase that allows migrating fish to swim upstream around a dam
3. **Fry** - the young fish
4. **Life cycle** - the entire life span of a species
5. **Limiting factors** - factors that reduce the populations of living organisms
6. **Migration** - the periodic movement of animals from one area to another and back again as a natural part of their life
7. **Smolt** - a young, silvery salmon migrating to the sea
8. **Spawn** - reproducing
9. **Spawning grounds** - an area where fish drop their eggs during reproduction

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MATERIALS LIST

(For 6 presentations with approximately 25 - 30 students per session)

CONSUMABLES

- 2 copier paper box lids or 2.1 gallon Rubbermaid Servin' Saver containers (note: if Rubbermaid containers are used, they can be stored in the kit and reused each year)
- Masking tape

NON-CONSUMABLES

- 2 - 1 ½ gallon ice cream buckets
- 2 - 120' nylon rope sections
- 3 - 70' nylon rope sections
- 1 - 90' nylon rope sections
- 2 - 35' nylon rope sections
- 8 - orange PVC flexible sport cones
- 2 - green fishermen vests
- 1 - 10 ½ foot jump rope
- 2 - plastic containers with a lids for jump rope and poker chips storage
- 2 - grizzly bear neck placards (laminated)
- 1 - skein of yarn for neck placards
- Scissors
- 100 poker chips
- Large twist ties
- 8 - 2 gallon ziplock bags marked with the appropriate rope length
- 1 - Large fabric laundry bag
- 1 - Large Rubbermaid container to store kit supplies
- Presenter notebook, cue cards, etc.

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AREA REQUIREMENT

Large, outside grassy area

PRE-PREPARATION

- Check supplies against supply list
- Photo copy HOOKS AND LADDERS handout (180 copies needed)
- Cut yarn and string through holes on Grizzly Bear pictures to make neck placards
- Memorize important information
- PRACTICE ACTIVITY

PREPARATION : Approximately 1 hour to set up

- Set up HOOKS AND LADDERS grid
- Evenly divide poker chips into the two ice cream buckets and set outside the boundaries of the ocean part of the grid
- Lay out jump rope in turbine engine/dam section of grid
- Place fishermen's vests in the boats and the set boats in the ocean part of the grid
- Lay neck placards in the predator section of the grid

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THIS IS A 20-25 MINUTE PRESENTATION
(Procedure note cards for this presentation are included)

This is a high-energy interactive game. To best explain and supervise this activity, **ONE MUST DO THIS ACTIVITY BEFORE** the actual presentation.

INTENDED STUDENT OUTCOMES

By completing this activity students should be able to:

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

PROCEDURE

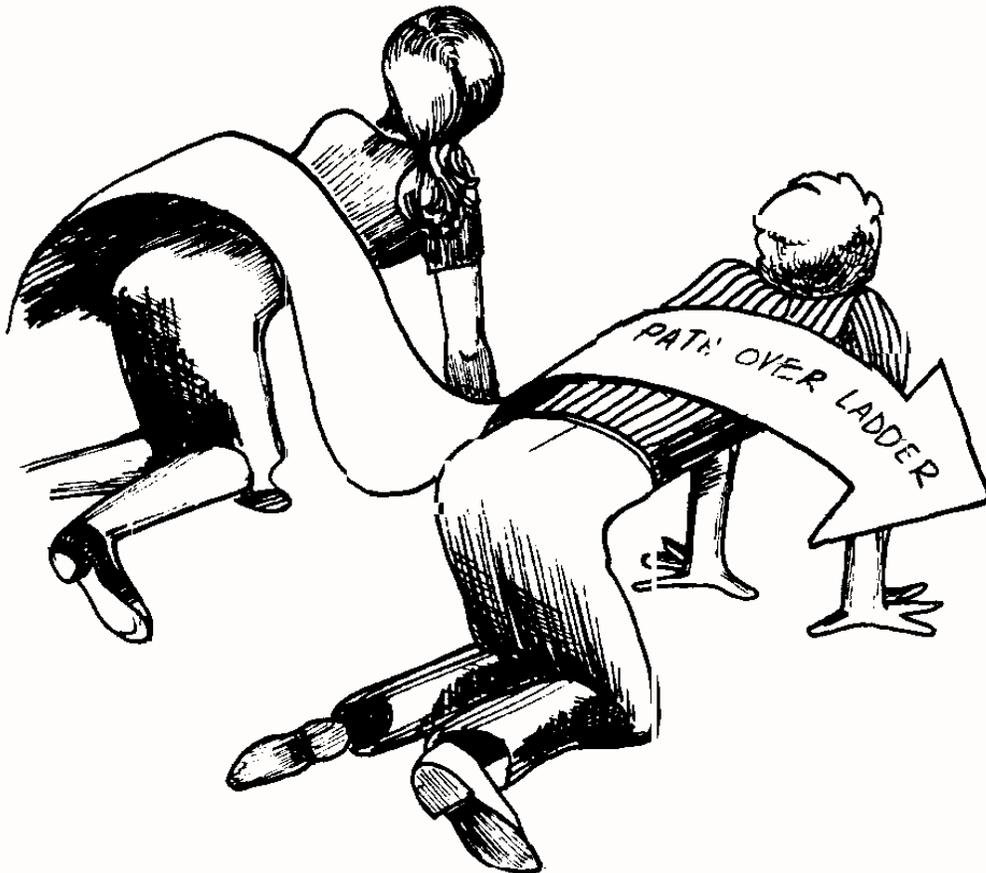
1. Begin by asking the students what they know about the life cycle of fish that live here in South Dakota. Do any local fish migrate to spawn? If yes, which ones (in this state, the American eel, northern pike, chinook salmon, crappies, brown trout, paddlefish are several examples of migrating fish). In this activity, students will learn about some of the characteristics of one species of fish that migrates a part of its life cycle - the Pacific Salmon.
2. This is a high-energy activity. Set up the playing field as a grid shown in the diagram in the packet. The area must be about 150' by 100'. Assign roles to each of the students. Some will be salmon, others will be potential hazards to the salmon. Assign the activity roles as follows:
 - a. Choose two students to be the turbine team. These are the ones who operate the jump rope which represents the turbine engines 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. (*NOTE: A good suggestion for these two people are the teacher and the guide a/o parent chaperone*).
 - b. Choose two students to be predatory wildlife - the grizzly bears. 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 ocean, 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 fishermen, catching salmon in the

open ocean. These students in the fishing boats must keep one foot in the 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 students. If the group is larger or smaller, adjust the number of people who are fishing and predatory wild animals accordingly.)

3. Begin the activity with all the salmon in the spawning ground. The salmon then start their journey downstream. Their 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 it is hit by the turbine (jump rope). 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 fish ladder. The student is no longer a fish, but becomes part of the physical structure of the human-made ladders now used by migrating salmon to get past barriers such as dams. The students who are the fish ladder kneel on the ground as shown below, a body-size space between them.**



4. 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 who survive life in the open ocean will use the structure of the fish ladder - by passing through it - to return to the spawning ground.* Both the predatory wildlife 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 fishing boats off the field regularly, helping to provide a more realistic survival ratio.
5. Once in the open ocean, the salmon can be caught by fishing boats. The salmon must move back and forth across the ocean area in order to gather four tokens. Each token represents one year of growth. Once each fish has four tokens (four year's growth), that fish can begin migration upstream. The year tokens can only be picked up one taken at a time on each crossing. Remember, the salmon must cross the entire open ocean area to get a token. The "four years" these trips take make the salmon more vulnerable and thus they are more readily caught by the fishing boats. 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. A suggestion may be to station an adult (teacher, parent, guide) by the ocean to supervise the fish picking up the tokens.
6. 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.
7. Once through the fish 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 operators 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. *NOTE: If activity has to be moved indoors, the waterfall broad jump may be changed into a stepping stone jump defined by masking tape squares for safety on hard floors.*
8. 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 structure of the fish ladder.

9. **The activity ends when all the salmon are gone before the spawning ground is reached or when all surviving salmon reach the spawning ground.**
10. **Next engage the students in a discussion with topics that cover:**
 - a. **The apparent survival-mortality ratio of salmon**
 - b. **The students' feelings throughout the activity**
 - c. **The role of the barriers**
 - d. **The role of the predatory wildlife and the fishermen**
 - e. **Where the losses were greatest**
 - f. **Where the losses were the least**
 - g. **What the consequences would be if all the eggs deposited made the journey successfully**
 - h. **What seemed realistic about the simulation and what did not**
11. **Ask the students to summarize what they have learned about the life cycle of salmon, the salmon's migration, and the limiting factors that affect salmon. Make sure the students have a clear working definition of limiting factors. Encourage the students to make the generalization that all animals - not just Pacific salmon - are affected by limiting factors. Ask the students to give examples. They might mention availability of suitable food, water, shelter, and space; disease; weather; predation; and changes in land use as well as other human activities.**

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SET UP FOR NEXT SESSION

- Place grizzly bear neck placards in the downstream area.
- Have each fisherman return his/her fishing vest to their boat (the box lid)
- Have all salmon return the tokens to the buckets
- Give each student their HOOKS AND LADDERS handout
- Thank everyone for participating, compliment behavior and answer any questions the children may still have.

FINAL CLEAN UP AFTER LAST SESSION (Approximately 30 minutes)

- Rewind each piece of rope. Using large twist ties, secure rope loops and replace each in the appropriate ziplock baggie. Place all ziplock bags into laundry bag for storage
- Replace tokens (poker chips) into the plastic storage container
- Re-stack cones
- Replace jump rope into it's storage container
- Place all items into Rubbermaid storage container and return to the Information Booth