



Hooks and Ladders

Grades: K-3

Subject, Science

Time required: 30 minutes

Key Concepts:

All life must have enough clean water.

Fish and wildlife need a healthy habitat.

Objectives:

Students will be able to understand that some fish migrate as part of their life cycle; and that a healthy habitat is an important part of that migration.

SQUAMISH RIVERS

Key Words:

Life cycle, migration, habitat

Skills:

Observation, analysis, discussion, psychomotor development, using time and space



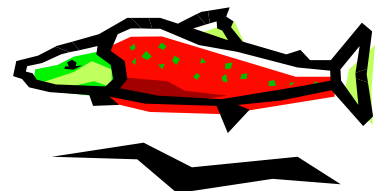
Background:

In this activity, students simulate Pacific salmon and the hazards faced by salmon as they go through their life cycle. Many fish live part of their lives in one habitat and then migrate to another. Some make their migratory journeys to mature and reproduce. Pacific salmon are an example of one of the most spectacular of the migrating species. There are five species of Pacific salmon in North America: chinook, coho, pink, sockeye, and chum.

Pacific salmon are destined to spawn only once in their lifetime. 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 to the sea. Once in the sea, they spend several years reaching the maturity needed for their single return journey to their original hatching ground. Once there, they salmon spawn and die. Salmon face a myriad of hazard that serve as limiting factors in the completion of their life cycle.

Materials

- Jump rope
- Rope for marking boundaries
- Traffic cones
- Cardboard boxes
- 100 tokens or chips
- Large play area



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Background Continued:

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. Spawning habitat contains shallow beds of gravel that are called “redds”.

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 from development, road building, logging, and fires. Floods can wash away eggs and 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 and soon become known as “fry.” If they survive their first two weeks, they then begin their journeys.

Young pink, chum, coho, and the very occasional Chinook all live in our local rivers. They may spend several months to as much as a year in the river habitat before migrating to the estuary and

then to the open ocean. Chum salmon and pinks don’t stay in our rivers at all but go directly into the ocean. Chinook salmon spend a year in the estuary and then go on their migratory journey. Coho salmon fry typically spend 1 – 2 years in the Mamquam and its ground water channels before they head out to sea.

We also have Steelhead, Cutthroat, Dolly Varden, and resident rainbow trout in local rivers and streams.

The small ocean bound salmon, now known as “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 salmon that hatch never reach the ocean.

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. Our salmon have a 4 year life cycle – so for pinks and chums, once hatched, they are in the ocean for 4 years and then return; for coho and chinook they return either 2 or 3 years later. Early returns (3 years) are known as Jacks.

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

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swim upstream around the dam. Humans who fish, eagles, bears and other predatory animals also reduce the numbers along the way to the spawning ground. Sometimes landslides and log-jams provide unexpected new barriers. So too do the natural waterfalls and rapids that the now 10 – 15 lb adult 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 much 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 the importance of healthy habitat as part of that migration.

Procedure:

1. Begin by asking students what they know about the life cycle of fish that live in the Squamish, Mamquam and other rivers and streams in their neighbourhood. Make a list of these fish – which ones migrate?
2. Tell students that they are going to learn about one species of fish that moves from one habitat to another to live out its life – the Pacific salmon.
3. Set up the playing field as shown in the diagram – including spawning grounds, downstream, upstream, and ocean. Assign roles to each of the students. Some will be salmon, others will be potential hazards to the salmon. Assign student roles as follows:
 - Turbine team: two students to operate the jump rope which represents the turbines in hydroelectric plants. When all the

salmon have passed through the turbine, these students move to the upstream side to become the waterfall broad jump monitors.

- Predatory wildlife: two students to be predators should start below the turbines to catch salmon heading downstream. Later, when all the salmon are in the sea, they should move to above the waterfall broadjump to catch salmon just before they enter the spawning grounds.
- Fishing fleet: two students to operate “fishing boats” in the ocean. These students use cardboard boxes as boats and must keep one foot in their “boat” at all times to reduce their speed and maneuverability.
- All remaining students are salmon.

Note: these figures are based on a class size of 25-30. With smaller classes, adjust the numbers of hazards and predators accordingly.

4. 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. The salmon can not go around the turbine (jump rope) but can slip under the swingers’ arms if they do not get touched by doing so. A salmon dies if it is touched by the jump rope or swingers’ arms.

Note: any salmon that “dies” at any time in this activity then goes immediately to become part of the fish ladder. Students who are the fish ladder crouch down (like in leap frog), leaving at least a body space width between them. (Salmon will

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later use the fish ladder when swimming back upstream.)

Once past the turbines, the salmon must get past the predatory wildlife. The predators try to catch the salmon by tagging them with both hands. Dead salmon are escorted to the fish ladder by the predator so that they will become part of the ladder (this helps keep the predators off the field to give a more realistic survival ratio of salmon). Once in the ocean, the salmon can be caught by the fish boats.

The salmon must move back and forth across the ocean to gather four (4) tokens. Each token represents one year of growth. When each fish has four tokens, that fish can begin migration upstream. The tokens can only be picked up one at a time on each crossing. Again, the fishing boats must use a two hand tag and escort dead salmon to the fish ladder.

5. Heading upstream, the salmon must go through the entire fish ladder – but while in the ladder, predators may not harm the salmon.
6. Once through the ladder, salmon face the broad jump waterfall. The waterfall represents one of the natural barriers that salmon face going upstream. The salmon must jump the entire breadth of the waterfall to be able to continue. Thus, be sure the distance is challenging but not impossible! If they fail to make the distance, then they go back to the bottom of the fish ladder and may try again.
7. Above the waterfalls, the predators who started the game below the turbines have one last chance to catch salmon. They represent bears, who are one example of predatory wildlife at this stage of the salmon's life cycle.

8. The game ends when all the salmon are gone before the spawning grounds are reached or when all surviving salmon reach the spawning grounds.
9. Ask students to summarize what they learned about the life cycle of the salmon. Discuss what might happen to salmon if any of their habitats were impacted by pollution. How can we help salmon live their life in all stages of the salmon life cycle?

Extensions:

1. Draw a picture of a salmon life cycle.

Evaluation:

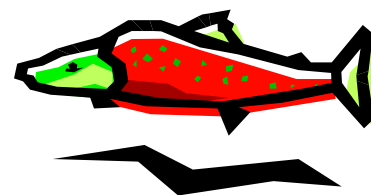
1. Name three habitats that make up part of the Pacific salmon life cycle.
2. Name some hazards that salmon face to grow from an egg to a mature fish.

Community Connections

1. Contact your local fisheries group to get a tour of your local fish hatchery.
2. Participate in a salmon aquarium program and release young fry into local streams nearby the school.

Resource:

This activity has been adapted from "Hooks and Ladders" from Project WILD (1997).



Spawning Ground

