Salmon Survival

Objectives and Summary: Students learn about salmon life cycle stages and simulate the salmon journey from egg to breeding adult in a high-energy field or barn based activity. The playing "field" includes a "river" (either a trail or an area in the field marked off by cones) and an "ocean" (marked off by cones in the field). Students will learn:

- The importance of salmon ecology in the Pacific Northwest
- Predator-prey relationships
- The human impacts on salmon

Background: An iconic symbol of the Pacific Northwest, salmon are important both ecologically and culturally. Modern salmon have been around for 4 to 6 million years, which is much longer than modern-day humans. The Pacific Northwest salmon species include: Chinook (also called King, Tyee, or Spring), Coho (Silver), Sockeye, Chum (Dog), and Pink.

Salmon are known for their exceptional navigation, strength and determination to return to the place of their birth in order to spawn and then die. Some may travel over 3,000 miles to accomplish this. Along their perilous journey, salmon are an important food source for numerous other species and even provide nutrients for the forests themselves.

Salmon spawn in freshwater streams. Females clear an area of gravel on the stream bottom, called a red, and lay between one and ten thousand eggs. Males swim over the red and fertilize the eggs. After approximately 67 days, the eggs hatch.

Newly hatched salmon are called alevins and have a yolk still attached to them (this is common in species of fish with large brood sizes and low/no parental care). Alevins stay close to the nest for 12 weeks before becoming fry. Fry leave the nest to swim down the river and find food. These juvenile fish live in the river for 6 months to 3 years. As these fry are migrating downstream, environmental cues cause them to undergo physiological and behavioral changes so that they can survive in the ocean. This process is called smoltification, and the salmon themselves are called smolt. The smolt mature in the ocean for another 1 to 8 years before heading back to the stream where they hatched. Some salmon migrate thousands of miles from their ocean feeding grounds and all use a specialized sense of smell to identify the correct home river. If an adult salmon does not die on the journey to spawn, then it will die within 2 weeks of spawning.

Salmon runs in the Pacific Northwest have been reduced from a historical average of 2-6 million salmon per year to just 70,000 per year on the Washington coast. Salmon are in jeopardy. This game helps explain the causes behind this decline as well as gets the students brainstorming solutions.

Materials

- Cones to mark boundaries (found in the field)
- Approx. 10' Rope
- 2-3 Pool noodles

- Salmon Survival Bin with additional materials (food chips (white plastic poker chips), predator cards, etc)

Location and Duration: This activity can be done in the large field and can last 40 - 90 min. A rainy day alternate location is the barn. Additionally, the use of a trail can be incorporated into this activity.

HS Leader Role: During the introduction, leaders will make sure students are quietly paying attention. During the activity they will make sure students are being safe and following rules. In rounds 2 & 3, they can fill the predator/challenge roles that require more maturity.

Procedure

Introduction

In whichever location you choose, a "river" and an "ocean" must be established and marked. The river can be a path marked with cones or a trail with natural side boundaries. The ocean needs to be a larger and wider area that the river leads to and can also be marked out by cones or a natural boundary. There needs to be 2 markers, such as cones, that are placed within the ocean about 100' apart that the salmon will run around as if making laps. ***Food chips should be widely spread around the ocean to symbolize the resources salmon require to live and eventually be able to reproduce.***

This activity is structured in 3 rounds. In all rounds, students mimic the salmon life cycle and experience the dangers they face from egg to spawning adult. Students will start out as baby salmon in the spawning grounds at the most upstream point in the river (designated as the "starting point"). The salmon run down the stream as fry/smolt and (hopefully) make it to the ocean. In the ocean, the juvenile salmon must run around the interior markers 3 times to symbolize the several years it takes to mature. While doing this, each individual must collect 3 food cards, symbolizing the food/resources required to survive and mature. After maturing, the salmon must return to the spawning grounds by "swimming" back up the river until they reach the original starting point (and spawn before dying).

Round 1 of the simulation will simply model the life cycle as described above. In round 2, salmon will repeat the life cycle, but this time with the more realistic model that includes typical non-human predators. Finally, in round 3, human cause challenges will also be introduced. The predators and challenges posed in rounds 2 and 3 can be played by HS leaders, and additional students as needed. Rounds can be played for various lengths of time. We suggest 5-10min per round. ***Collect and re-distribute food chips between each round.***

Lesson/Activity

Round 1: Play as described above. After successfully returning to the starting location, students can stage some dramatic spawning and dying event, if you like. ***After completing the round, debrief and discuss student ideas on what we could add to this simulation to make it more realistic (steer the conversation towards predation).***

Round 2

- River Predators: Bear, eagle, river otter. Each river predator has a name tag to hang around their neck (found in supply box). They stand along the edge of the river, and can only place one foot into the river. Their goal is to try and tag young salmon as they travel up and down the river. If they manage to tag a salmon, they switch roles. The predator becoming a young salmon then starts at the spawning grounds, and the captured salmon becoming the predator.
- Ocean Predators: orca, sea lion, sharks. Each ocean predator has a nametag. These predators can hunt freely in the ocean and try to tag salmon. If they tag a salmon, they will trade roles just like the river predators.

Note: All new salmon need to start as a hatchling at the spawning grounds, not where they were when they tagged a previous salmon. All salmon should hang onto their food chips even if they spend time as predators. You can choose whether challenges with one foot in the river must stay in place or can move along the river. ***At the completion of this round, once again steer the debrief towards the addition of more environmental features (i.e. human impacts in round 3). Did all the salmon in this round have enough time to successfully reproduce?***

Round 3: This round introduces anthropogenic challenges to salmon. The following additional nametags/challenges are available:

- Pollution: The removal of trees due to logging and development raises the temperature of the river and increases erosion. These effects and others can be collective regarded as "pollution". The leader/student playing "pollution" wears the biohazard nametag and can be in the river or along the edge depending on the scenario you describe. This student also trades rolls with tagged salmon, just as the predators do.
- Commercial Fishermen*: These 2-3 students/leaders trawl the ocean looking for their catch, which they tag with pool noodles.
- Dam*: 2 students/leaders stretch a rope across the river (jump rope style) and swing/turn it to represent the turbine of a damn. Salmon must pass through the turbine without touching the rope. The speed of the spinning rope should be slow so as not to hurt students that are hit. Do not rotate this position.

*role that should only be given to responsible students or leaders. Due to the use of noodles/rope, you may wish to send tagged students back to restart their life cycle instead of switching roles.

Conclusion

Final Debrief Questions:

- How did it feel to be a salmon?
- How many salmon survived from egg to spawning adult? (In a natural ecosystem, only 1 in 1,000 baby salmon survive to adulthood and make it back to their spawning grounds.)
- How did this change over the different rounds?
- How was the simulation realistic? How is the real world different?
- What effects did humans have on the ecosystem and on the salmon's journeys?

- What are some things that humans are doing to help salmon, in the real world? (Fish ladders, removing dams, fish hatcheries, fishing regulations, restoring riparian zones to reduce erosion and keep rivers cool, regulating pollution.)

Extension: In-class extension lessons can be done after leaving Waskowitz. If your students were interested in the complexities of human impacts, a class project researching the pros and cons of each would be good to explore.

Notes: Several of the roles, especially in the second round are for mature students, or high school leaders only. Identify these students ahead of time and assign accordingly. Remember, switching is optional for these roles. Also, given that you will likely have only 3-5 HS leaders, the predatory roles they play in round 2 can be passed off to students in round 3, allowing the HS leaders to take the roles of human impacts.

Suggested #s of predators/human impacts per 20 students: Round 2: 2-3, Round 3: 4-6

Per 25 students: Round 2: 4-5, Round 3: 8-10

Per 30 students: Round 2: 5-6, Round 3: 10-12