Salmon Lifecycle Activity

Adapted from a lesson from the Environmental Science Center: https://envsciencecenter.org/

Subject
Life Science

Objectives
The students will be able to:

- Explain the differences between riverine, estuarine and ocean aquatic environments salmon are present in
- List the 7 stages of the salmon lifecycle
- Describe three threats that salmon face, and how that threat affects salmon populations
- Tell how many eggs salmon lay, and how many of those eggs return to their home stream

Materials

- 6 clear containers – can decorate with rocks, sand and resin to look like habitats
    - 3 representing riverine, estuarine and ocean environments
    - 3 representing threats to salmon – human impacts, water quality and predators
- 3,000 orange or red beads
- Small aquarium fish net
- Photos of life cycle stages

Size/Setting/Duration
Entire class/classroom/~20-30 minutes

Background
Lead your students through this hands-on, interactive activity focused on the stages of the salmon lifecycle and the various threats facing salmon, from human-caused pollution to predation.

Procedure

1. Ask the students if they know the first stage of the salmon lifecycle, or how they begin their lives? Show them a picture of salmon **eggs** and mention that a salmon can lay between 2,000 and 5,000 eggs – show the students the eggs (beads).
2. Pour the eggs (beads) into the river bucket. Discuss the importance of the river for providing ideal habitat for laying eggs, and necessary gravel for salmon to dig redds to lay their eggs – can demonstrate by showing scooping motion with hands.

3. After about a month, the eggs start to look different – show a photo of **eyed eggs** and ask the students to list ways they are different than eggs. Ask the students if they think all of the eggs will hatch? (no)
4. Then, ask for reasons why they may not hatch. For each reason listed, ask that student if they would like to come up to scoop some of the salmon eggs out of the habitat and put them into the applicable threats bucket. Some potential threats students may list include:
    a. Pollution affecting water quality (humans)
    b. Humans or dogs disrupting redds (humans)
    c. Natural events like floods washing the eggs out of redds (water quality)
    d. Predators, like birds or fish, eating the eggs (predators)
    e. Warm water, due to climate change, causing eggs not to hatch (water quality)
5. After hatching, the young salmon stay in the gravel and are called **alevin** – show a picture of an alevin and ask the students to list some characteristics they have (yolk sacs – we call them "lunch boxes" for nutrient uptake, lack of mouths, lack of fins).

Containers representing riverine, estuarine and ocean environments, along with rocks and sand encased in epoxy for visual effect

6. Ask the students what threats these alevin may face that could cause them not to survive. For each reason listed, ask that student if they would like to scoop some of the salmon out of the habitat and put them in the applicable threats bucket. Many of the threats are the same as the egg stage, since alevin stay in the gravel. Additional threats may include:
    a. Turbid water reduces oxygen passing through the yolk sac of alevin or makes it hard for them to escape predation (water quality)
    b. Lack of ideal gravel for them to hide in (water quality)
7. The next stage in the lifecycle is **fry** – show a picture of a fry and ask the students how they are different from the alevin (they have mouths and no yolk sac, more fins, parr marks on their sides).

8. Repeat the threats activity where students scoop salmon out of the river container and deposit them in the appropriate threats container. Since fry are out of the gravel, some additional threats may include:
    a. Lack of food – fry eat macroinvertebrates (show a picture of some examples) (water quality)
    b. Lack of hiding spaces (downed trees provide cover) (water quality)
    c. Different predators (raccoons, other fish, birds like kingfishers) (predators)
    d. Being stranded in ephemeral pools due to warmer temperatures drying up sections of the river (water quality)
9. The fry will make their way to the ocean at some point, depending on the species of salmon. As they travel to the ocean, they first stop in the estuary – ask the students if they can define what an estuary is (mixing of fresh and saltwater as the most basic definition). Dump the remaining salmon from the river container to the estuary container.

Containers representing various threat "categories" facing salmon populations, including predators, human impacts and water quality

10. The stage of the salmon lifecycle spent in the estuary is called the **smolt** stage – show a picture of a smolt and ask the students how they are different from the fry (larger size, no parr marks, very shiny/silvery). During this stage, salmon go through a process called smoltification, where they change their bodies so they can tolerate the saltwater of the ocean, but this process takes time, which is why they spend time in the estuary.
11. Repeat the threats activity where students scoop salmon out of the estuary and deposit them in the appropriate threats container. Some threats smolts may face in the estuary include:
    a. Different predators such as seals and larger fish (predators)
    b. Warm or unhealthy water coupled with high energy demand to make it that far and go through smoltification (water quality)
    c. Being caught in nets or litter (humans)
12. Salmon travel many miles and undergo this dramatic change in their bodies to get to the saltwater. Why do you think they do this – why don't they just stay in the rivers? The answer is

food, and space, both of which the ocean provides. Dump the eggs from the estuary container to the ocean container.

13. When salmon reach the ocean, they are called **sea-run adults** – show a picture of sea-run adults and ask the students how they are different from the smolt (much larger, developed spots or coloration instead of silver/shiny throughout). In the ocean, salmon can spread out and find more abundant food than in the river. They travel sometimes thousands of miles, and spend anywhere from 2-8 years in the ocean, growing to sometimes very large size.
14. Repeat the threats activity where students scoop salmon out of the estuary and deposit them in the appropriate threats container. Some threats sea-run adults may face include:
    a. Different predators such as orcas and sea lions (predators)
    b. Climate change leading to ocean acidification, which reduces their food source (water quality)
    c. Humans catching them from boats in the ocean (humans)
    d. Oil spills from boats leading to toxic conditions (humans)
    e. Eating or getting tangled in plastic trash in the ocean (humans)
15. After 2-8 years spent in the ocean, an "alert" goes off, indicating it is time for the salmon to return to the same stream they were hatched, so they can spawn. They enter that stream as a **spawning adult** – show a picture of a spawning adult and ask the students how they are different from the sea-run adults (coloration, teeth, hooked jaw (kype), hump). While they do take some time to acclimate back to freshwater in the estuary, when they are spawning adults, they stop eating and are solely focused on making it to spawning grounds to spawn. Dump the eggs (there should only be a handful left at this stage) from the ocean container to the estuary container, and then into the river container.
16. Repeat the threats activity where the students scoop salmon out of the estuary and deposit them in the appropriate threats container. For the final threats, the facilitator should take the eggs out so the correct number is left at the end of the threats activity (2 eggs). Some threats spawning adults may face include:
    a. Different predators such as bears and eagles (predators)
    b. Climate change causing warmer water – leading to creeks drying up, or lower oxygen contents (water quality)
    c. Exhaustion from the journey coupled with water quality issues (lack of water, polluted water (water quality)
    d. Anglers catching them, especially at mouths of rivers (humans)
    e. Fish passage barriers such as dams preventing passage, or leading to exhaustion (humans)
17. At the end of this threats activity, there should be a total of 2 eggs left – show this to the students and ask them what they think of that? Mention this is an average taken from one nest, so some may have more survive, and others may have none.

18. After the salmon lay their eggs in a redd, they will defend that location until they die, which ends their lifecycle. The dead salmon then provides food for a variety of animals, such as the macroinvertebrates the fry feed on, and nutrients to the trees in the forest, which will in turn provide shade to future generations of salmon.
19. Wrap up the activity by generating a cause and effect discussion about some of the threats salmon face in various stages of their lifecycle. Questions to ask can include:
    a. Which threat played the largest role on our salmon population (can use the threats containers as reference)?
    b. How do lower salmon populations effect the predators that rely on salmon as a food source?
    c. What stages of a salmon's life cycle can be affected by threats due to climate change?
20. End by asking what actions students can take to make a positive difference for salmon in their watersheds? Some examples may include habitat restoration such as planting trees to shade waterways, cleanup efforts focused on pollution, reducing energy use to lower fossil fuel consumption, and even introducing their family and friends about the importance of salmon! The actions students take can make a difference in the population of salmon, and there are simple actions they can take in their lives to benefit salmon.

Next Generation Science Standards

Performance Expectations		
3-LS1-1: Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. **3-LS4-3**: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.		
Scientific and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
▪ Engaging in Argument from Evidence ▪ Developing and Using Models ▪ Asking Questions and Defining Problems ▪ Constructing Explanations and Designing Solutions	▪ LS1.A: Structure and Function ▪ LS1.B: Growth and Development of Organisms ▪ LS2.A: Interdependent Relationships in Ecosystems ▪ LS2.C: Ecosystem Dynamics, Functioning, and Resilience ▪ LS4.C: Adaptation ▪ ESS3.C: Human Impacts on Earth Systems	▪ Cause and Effect: Mechanisms and Explanation ▪ Systems and System Models ▪ Stability and Change

Appendix

Photos of Life Cycles Stages