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Science Unit: *Pacific Salmon and their Environment*

Lesson 13: *Salmon Eggs and their Habitat*

Summary: Students learn about the role of **gravel size** in the survival of **salmon eggs**. They build **model “redds”** of varying gravel sizes and then compare: how many clay “eggs” are washed away when water is poured over top; the visibility of “eggs” to predators; the flow of water through the “redds”.

School Year: 2014/2015

Developed for: Dr. Annie B. Jamieson Elementary School, Vancouver School District

Developed by: Dominic Tollit (scientist); Beverly Grant and Melanie Dorchester (teachers)

Grade level: Presented to grade K-2; appropriate for grades K-4 with age appropriate modifications

Duration of lesson: 1 hour and 20 minutes

Notes: This experiment is a modification of the Lesson *Making a Redd* which is part of Fisheries and Oceans Canada’s *Salmonids in the Classroom* program. See <http://salmonidsintheclassroom.ca/>

Objectives

1. Learn about salmon migration in the Pacific.
2. Learn about salmon redds and what characteristics are important to ensure egg survival.

Background Information

Salmon migrate 1000s of km to return to the stream they were originally born in. They use the scent of the river to find their way. Female salmon lay their eggs in a nest-like depression in the riverbed gravel known as a redd. Upon arriving at the spawning grounds a female finds an area with the appropriate water flow and gravel characteristics and then uses her tail to scoop out a depression in the gravel. By situating herself upstream of the redd she is able to use her tail to flick the rocks up from the riverbed and utilize the current to move the rocks out of the redd and slightly downstream. The redd is typically twice as large as the fish. There is fierce competition amongst the male salmon for a mate. The successful male courts the female and as she begins to release her eggs he releases his milt into the water and fertilizes the eggs. The fertilized eggs drop into the depression in the gravel and the pair moves slightly upstream and repeats the process. The gravel that is excavated for the next redd will wash downstream and cover the initial redd thus protecting the eggs. The redd must protect the eggs throughout their incubation period. The gravel size used to build the redd is important because it must provide adequate protection for the eggs (from predators, currents and stream disturbances) while still allowing for good water flow over the eggs to ensure adequate oxygen delivery. A female coho salmon lays approximately 2500 eggs. Only two adults may return to lay their own eggs. Both the male and female die shortly afterwards, providing nutrients to the area that in turn sustain the young fry.

Vocabulary

Migration: seasonal movement of animals from one region to another.

Redd: A small depression or nest in the gravel created by a female salmon to incubate her eggs.

Milt: The milky fluid released by a spawning male salmon that contains sperm cells.

Embryo: A young developing salmon still in the egg.



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Materials

- Modelling clay
- 5 Large square washing up bowls
- Pitcher
- Worksheet
- pea gravel
- 30 small 2-3 cm rocks
- 30 large 5-7 cm rocks
- 12 by 3 inch strip of shag carpet
- 1 by 1 inch strips of wood

In the Classroom

Introductory Discussion

1. Short description of 'hook' to capture student's attention.

Students will learn about Salmon eggs and their nest. Why do adults brave killer whales and bears and jump waterfalls and swim hundreds or 1000s of km to get to the special stream of their own birth? Why does the female have to lay 2500 eggs? What is she looking for? What do the eggs need to survive? Explain that today we are going to do an activity to see what features are important in building a salmon nest and making sure we don't lose too many eggs from being washed away by storms or seen and eaten by predators.

2. Short description of other items to discuss or review.

Use a projected map to show BC and Pacific and the various salmon migration routes. Ask the class questions about what predators and human threats salmon face on their migration (Killer whales, eagles, bears, dams, pollution, rising water temperature, lice). Re-introduce the stream where it all ends in the female laying eggs for the new generation and brainstorm about why the salmon come all this way? What makes the stream special?

Discuss where do salmon deposit their eggs? (REDD) What is a redd? (small depression or "nest" that female salmon create in the gravel and rocks)

What does a redd look like? (Is it made of mud, sand, gravel, small rock or large rocks?). Let's think about why a redd looks like it does.

What is a redd for? (Brainstorm on board)

- Protect eggs
- Prevent eggs from being washed away
- Protect eggs from predators

Remind students to act responsibly with the water – no splashing, throwing etc. and to ensure that they clean and dry their desks at the conclusion of the activity.

3. Briefly describe science experiment/activity.

Learn about salmon migration using maps of the Pacific and Pacific Northwest. Students will build redds using different sizes of rocks/gravel to determine how a redd's characteristics can affect egg survival.

4. Briefly describe the processes of science that the students will focus on (prediction/hypothesis, observations, recording results, conclusions.)

We will predict what we think will make the best redd and test that prediction by building 4-5 different structures and observing (by recording the number of washed away eggs), what it takes to best keep them safe from floods, storms and also predators.



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Science Activity/Experiment

Activity Title: Building a rock Redd (that keeps eggs safe)

Purpose of Activity: To learn about salmon redds and determine how gravel size affects the functioning of the redd.

Experimental Observations: Compare the effects different experimental scenarios - using no rocks, large rocks only, mix of large and small rocks and a mix of large and small rocks with gravel – all observed separately. Time permitting, the use of a carpet to act as a protecting river bank is included as a 5th scenario.

Prediction: Students will discuss what they predict will be the best and worst scenarios on their tally sheet worksheets.

Methods and Instructions:

Set-up prior to experiment: Real salmon eggs can be used for this experiment but it is tidier to use modeling clay for the experiment and to observe real salmon eggs separately. Prepare the supplies for each group: a small cup of salmon eggs or a chunk of clay for each student, a large tray, and selection of 6-7 small and large rocks and gravel. If there is no sink in the classroom a large bucket of water will work.

Students will work in small table groups of 4-5.

1. Draw on a white-board a diagram of the how each experiment will be constructed. First eggs with no rocks, then large rocks only, then a mix of large and small rocks and lastly a mix of large and small rocks with gravel observed separately. (Time permitting, the last scenario to include is use of a strip of carpet to act as a protecting river bank.)
2. Describe how we are trying to protect the eggs from storms (which an adult will pretend to be using a large container of water) and predators.
3. Ask which scenario students think will be best and worst and mark on the white board diagrams and on each student worksheet.
4. Instruct students to set up their trays as demonstrated. Prop one end of the tray on the 1 by 1 wood (or a stack of one or two textbooks) so that it is inclined. Use a piece of the clay to stop the tray from sliding if required.
5. Have the students roll their modeling clay into small balls to mimic salmon eggs. They can use the real eggs as a guide to determine how large to make them. The size of a pea is a good size.
6. Guide the students through the worksheet directions: Place a pile of the clay eggs at **one end** of the tray. We are going to pour water on the eggs. Ask again what they predict what will happen. Get the students to each count and record how many eggs are washed away on their worksheet.
7. How will building a redd help the situation? (ask for answers)
8. Use the large rocks to build a redd for your salmon eggs. Which rocks do you think will make a better redd? Why? Ask them if they have protected their eggs from predators? After building the large rock redd, pour water on the eggs and rocks as before and get the students to each count and record how many eggs are washed away on their worksheet.
9. Repeat the experiment with other rock combination scenarios and record observations (number of eggs washed away). Repeat the last rock and gravel scenario with a strip of carpet protecting some of the redd (acting like a protecting river bank).
10. Have students clean up the supplies and wipe their desk and then get each study group to provide their counts for each scenario and record tally for each scenario on the white board.



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Closure Discussion

- What happened? Were the class predictions correct?
- What are some advantages of big rocks? What about disadvantages? Can you still see the eggs? Do you think predators can see them?
- What are some advantages of small rocks? What about disadvantages? How do eggs get oxygen?
- Do you think they get oxygen better if they are covered with larger rocks or small rocks? What if they are covered with dirt?
- What would happen if we destroyed the river bank and river bank vegetation in a stream? Discuss keeping soil and sand from covering the eggs and how plants provide shade and place for insects to live and grow.

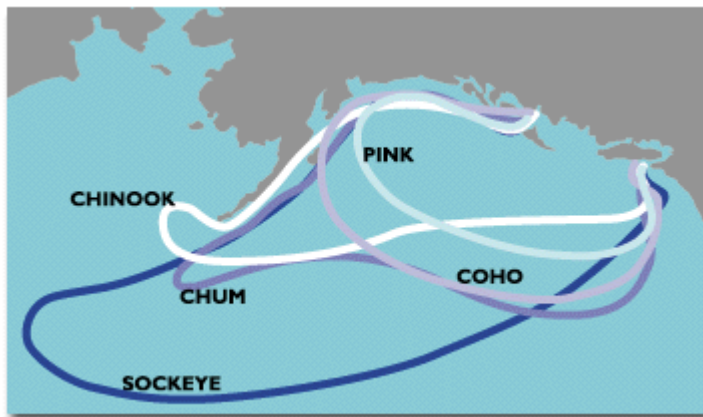
References

Fisheries and Oceans Canada. 2009. Salmonids in the Classroom – Primary. Fisheries and Oceans Canada. Also available online at: <http://www.pac.dfo-mpo.gc.ca/education/primary-primaire/index-eng.html>. Demonstration experiment: protecting the eggs.

Extension of Lesson Plan

Have students make a venn diagram comparing the size, shape colour and parts of a chicken egg and a salmon egg.

Classroom incubation program – Activity from Primary Salmonids in the Classroom Program available at <http://www.pac.dfo-mpo.gc.ca/education/primary-primaire/index-eng.html#ClassroomIncubationProgram>





Redd Nest - Data Collection Sheet

What is the best material to build a redd?

Type of Structure	How many eggs washed away? Write down how many	Rank Structures Best (1st) to worst (4th)
a) No rocks		
b) Large rocks		
c) Large and small rocks		
d) Large and small rocks and Gravel		
e) Large and small rocks and gravel with carpet as a river bank		