Tacoma Salmon in the Classroom Teacher Curriculum 2022-2023

Foss Waterway Seaport & Pierce Conservation District

Lesson #	Title	Suggested Timing	Taught By
	Land Acknowledgement/ Pre-Assessment	Early November (Before eggs arrive)	Teachers
1	Egg Observations	Late November/Early December (Before eggs hatch)	Teachers
P1	Water Quality/Tank Care	January	Partner Organization
2	Alevin Observations	Late December/Early January (after eggs hatch)	Teachers
3	Salmon Life Cycle	Flexible	Teachers
4	Fry Observations	January	Teachers
5	Stewardship	February	Teachers
6	Salmon Art	April	Interns
Appendix A	Predicting Salmon Hatch	Egg arrival - Mid December	Teachers
Extension	Salmon High Five	Flexible	Teachers
P2	Dream Stream	January	Partner Organization
P3	Salmon in the Wild (hooks and ladders)	February	Partner Organization

Minimum Teacher Expectations

Work with Salmon Ambassadors to maintain your salmon tank with your students.

1. Complete the (5) Teacher-taught Lessons using this curriculum AND the Student Journal.
2. Schedule the (3) Partner Lessons.
3. Communicate in a timely manner any tank issues to your Community Partner.
4. Schedule and attend the March field trip.
5. With help, disassemble the tank and complete the Salmon Art project.

Land Acknowledgement

Please begin each salmon lesson with an appropriate land acknowledgement. Even if you already have a practice of daily land acknowledgement in your classroom, please remind students that the salmon you care for have been donated by Puyallup Tribal Salmon Hatcheries, at the beginning of any salmon lesson (after Lesson 1 where this is initially discussed).

If you need to create a land acknowledgement for your classroom, please see the following from the Puyallup Tribe of Indians website:
http://puyallup-tribe.com/ourtribe/Land%20Acknowledgement.php

"***Where to start:***

We encourage you to personalize statements to align with the mission and values of your organization. Be mindful, though, not to stray too far from the core intention and message. It's also important to recognize that some areas may be shared between multiple tribes. At times it's appropriate to acknowledge multiple tribes, or to recognize the "Coast Salish tribes" as a whole. However, before incorporating tribal perspective be sure to contact official representatives from that/those tribe(s).

Here are some examples that can serve as starting points, or final versions, for your organization's land acknowledgement:

- *We acknowledge that we are on the traditional homelands of the Puyallup Tribe. The Puyallup people have lived on and stewarded these lands since the beginning of time, and continue to do so today. We recognize that this land acknowledgement is one small step toward true allyship and we commit to uplifting the voices, experiences, and histories of the Indigenous people of this land and beyond.*
- *ʔukʼʷədiid čəł ʔuhigʷəd txʷəl tiił ʔa čəł ʔal tə swatxʷixʷtxʷəd ʔə tiił puyaləpabš. ʔa ti dxʷʔa ti swatxʷixʷtxʷəd ʔə tiił puyaləpabš ʔəsłałłil tulʼal tudiʔ tuhaʔkʷ. didiʔł ʔa həlgʷəʔ ʔal ti sləx̌il. dxʷəsłałłils həlgʷəʔ gʷəl ƛʼuyayus həlgʷəʔ gʷəl ƛʼuƛʼax̌ʷad həlgʷəʔ tiił bədədəʔs gʷəl tix̌dxʷ həlgʷəʔ tiił ʔiišəds həlgʷəʔ gʷəl ƛʼuʔalalus həlgʷəʔ gʷəl ƛʼutxʷəlšucidəb. x̌ʷəla···b ʔə tiił tuyəlʼyəlabs. We gratefully honor and acknowledge that we rest on the traditional lands of the Puyallup People. The Puyallup people have lived on this land since the beginning of time. They are still here today. They live, work, raise their children, take care of their community, practice their traditional ways and speak the Twulshootseed language – just as their ancestors did."*

Pre-Assessment

Timing: Prior to eggs being picked up or students completing any lessons

Before your school picks up your salmon eggs, please have your students take the following pre-assessment at the link shared . Students will take the same assessment at the end of the program to measure their growth. The questions are below:

Student Survey: Salmon in Schools Pre-Program

Student name:

School:

Grade Level:

1. Fill in the blanks with the 3 C's of water quality.

Salmon need water that is _____, _____, and _____.

2. Salmon have 5 stages in their life cycle, can you name any? Y N

If so, which ones:

3. Circle all the items below that make a stream a healthy salmon habitat

Shade **Straight path** **Cloudy water** **Native plants**

Rocky stream bed **Pollution** **Hot water** **Fast moving flow**

4. Name two other organisms affected by salmon in the natural environment.

5. What is one thing you can do to make the world a better place for salmon to live?

Lesson 1: Salmon Egg Observation

Timing: Late November/Early December (before eggs hatch)

Learning Objectives/Goals/Learning Targets: Understand the needs of the first stage of salmon development, especially as provided by their habitat.

Essential Questions/Focus Questions:
What do you **see** when you look at your salmon eggs?
How are the needs of the eggs met in the tank?

Materials:
Use the Salmon Egg Observations pages in their student journals.

Background Information:
Discuss observational skills with students as needed to prepare them.

Engage:
Explain to students that the eggs have been donated from Puyallup Tribal Salmon Hatcheries. Share with them the stated goal of the hatcheries: "The Puyallup Tribe's restoration goal is to rebuild depressed Chinook and steelhead stocks and remove them from ESA [endangered species act] listing by limiting harvest, using acclimation ponds, and making substantial gains in habitat restoration." http://puyallup-tribe.com/fisheries/hatchery.html.

Explore:

1) Allow students plenty of time to draw and label the salmon eggs as well as describe the eggs in the aquarium.
2) Have students spend some time using the sentence starters to be more descriptive.
3) Go over estimating how many eggs are in the aquarium and the fraction that seems to be moving.
4) Go over how many eggs have died (they have turned white) and have students record what fraction of the eggs have died.
5) Back in the classroom, as a class or individually, read Article 1 about salmon eggs, available in Schoology and the student journal.
6) Have students find the 3 needs of salmon eggs shared in the reading. Have students share out and record them on a chart. Have students turn to the Salmon Dependence on Habitat page in their journals. Have them underline the 3 needs just listed on the board in the table for eggs
    - Temperature, Oxygen, Clean Water

Explain/Elaborate:
7) Discuss with students how these needs of the eggs are met in the aquarium and write them in the table and display overhead. Have students record in the table on eggs.
    - Water is cooled by the chiller

- The air pump introduces oxygen; in the aquarium eggs don't get covered with silt like they can in the stream
- Water is filtered to clean it

Evaluate?

8) Remind them that the aquarium is a model of the stream habitat. Ask students to think about how the needs of eggs are met in the stream habitat. Have them record those in the table and share out.
    - Shade from the trees and large woody debris keeps the stream cool
    - Clear (without silt) and cool flowing water has highest oxygen
    - Clean water from a not polluted watershed

Extend (optional):

9) Brainstorm what threats there are to salmon eggs while they are in streams and record them in the table.
    - Deforestation removes shade; Climate change increases temperature
    - Erosion of stream bank increases silt; dumping in the stream prevents the stream from flowing
    - Fertilizer and other pollution will affect the water quality of the stream

NGSS Learning Standards:

Crosscutting Concepts:

- **Patterns**-Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena

Common Core State Standards Connections:

- **RI.5.1**- Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

Source: https://sisseattle.org/wp-content/uploads/Salmon-Logs-1.pdf

Partner Visit 1: Water Quality

Timing: January - This will align with School Visit 2 from your interns and partner organization. The lesson is taught by the **Partner Organization**, not teacher.

Outline
1) Explain definition of and importance of water quality
2) Demonstrate how to test for nitrate and ammonia, and how to record the data
3) Have students practice the tests and recording data
4) Explain what has to be done if the nitrates etc are too high

Learning Objectives/Goals/Learning Targets: Understand how water quality affects the health of the salmon.

Essential Questions/Focus Questions:
What qualities of water do you think are most important for salmon health?

Which cycles do salmon rely on to maintain their ecosystems?

Engage
Maintaining good water quality is vital in keeping your salmon healthy until release. When it comes to water quality for salmon, remember the 3 C's: Cool, Clean, and Clear water.

COOL: The ideal temperature for salmon is between 45 °F and 50 °F (this is the temperature of the waters they would normally live in if they were in the wild).

CLEAN: Clean water is that which is free from excess nutrients and pollution, things like ammonia, nitrates, phosphates, trash, etc. Dirty water can interfere with a salmon's ability to migrate to their home stream, or even their ability to "breathe" properly in the river or stream.

CLEAR: Clear is just what it sounds like- salmon need to be able to see where they are going, which they can't do if the water is cloudy or murky. Trash and pollution can be one cause of murky water, but another source is erosion- when the soil around the water is disturbed in some way, breaks off, and mixes in with the water as it moves downstream. This causes the water to become cloudy.

Explore,
For this lesson, we will focus on the middle C: Clean. While the salmon are in your tank, you and your students are responsible for keeping their environment clean. One part of this is to test the water for excess levels of certain compounds, such as ammonia and nitrates. Ammonia is a waste product that comes as a result of feeding your fish. It comes from fish waste, leftover food, and any eggs or fish that die and start to decompose. Since we have added and continue to add beneficial nitrifying bacteria to the tank, the bacteria "eat" the ammonia and move it through the nitrogen cycle. Ammonia is then converted into nitrite, which similar bacteria will consume and in turn convert into nitrate. Your Salmon Interns will test for these compounds as well as a few other water quality parameters, such as pH and temperature. Your students will take turns testing for ammonia and nitrates every time your salmon interns visit. We will use the Master Freshwater Test kit to test levels of these compounds.

1) Go over the 3 C's with your students (watch the accompanying video to start off) (maybe)
2) Discuss the compounds/nutrients we are most concerned with in keeping the tank water CLEAN (ammonia, nitrite, nitrate) and how they are introduced into the system (fish waste and leftover food).
3) Show students the data table/chart used to track levels of these compounds over time (and how to use it accurately). Your interns (if present) can do a demonstration later with them.

4) Go to the salmon tank as a class and do one of each test (for ammonia and nitrate). Go through each of the steps together. Call volunteers up to complete each step (putting in the right number of drops from each solution, putting in the correct amount of water, selecting someone to time the reaction, etc.).
5) Put your results on the table/chart together.

Explain

After you complete the tests, discuss with students why it is important to not let certain compounds or chemical levels get too high in the tank (these compounds are toxic at certain levels and will kill your fish).

Elaborate

6) Ask your students if they think this can be an issue in the wild in rivers and oceans, with the compounds you discussed today or with other ones.
    a. Follow-up with a question about how these chemicals and nutrients might end up in bodies of water in the first place (besides the animals and plants that live in them). You may discuss different sources of pollution such as run-off from roads and agricultural areas.

Evaluate

8) Are your levels within safe ranges or are there some that are too high?

Extend (optional unless you find some levels too high)

9) Discuss a water change with your students:
    b. If you find that some of your levels are too high, the first thing you want to do is complete a water change (this will be accompanied with **SIPHONING** once your salmon have buttoned up and can more easily get out of the way of the siphon).
    c. You will need: 1-2 buckets, your siphon, water conditioner, a source of cold water, and beneficial bacteria
    d. You can call volunteers up to complete each of the following steps (your interns may be present for this demonstration as well):
        i. Place the wide end of your siphon in the tank and the hose end in one of your buckets
        ii. Begin the siphon by pumping the bulb. This will start water pumping through the siphon. Once the water begins flowing into the bucket, you shouldn't need to keep pumping (unless the water flow is broken).
        iii. Doing your best to avoid your fish (but it's okay if one or two do get sucked into the bucket) remove 10-15 gallons of water. **IF YOU HAVE STARTED FEEDING YOUR FISH:** siphon the gravel to remove fish and food waste (this is the biggest source of ammonia). Get as much waste and gunk out as possible until you reach the 10-15 gallon mark.
        iv. Once you have removed enough water, take the siphon out of the tank and set it to the side (note that it will drip water, so be sure to clean it up).
        v. Replace the water taken from the tank with cool water from the tap. **REMEMBER:** add the water conditioner BEFORE you put the water in the tank.
            1. You can discuss how chlorine can kill your fish and bacteria at this step.
        vi. Do this until you have reached your fill line. Remember to pour water in gently so as not to potentially harm your salmon.
        vii. Do your tests again the next day (especially for the compound that had high levels).

NGSS Learning Standards met:

- **LS2-1.B: Cycles of Matter and Energy Transfer in Ecosystems**
- **PS1-1.A: Structure and Properties of Matter-**

- **ESS2-1. Earth Materials and Systems** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact The geosphere, hydrosphere, atmosphere, and biosphere are each a system. [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]

Crosscutting Concepts:

- **CAUSE AND EFFECT-** Cause and effect relationships are routinely identified, tested, and used to explain change

Common Core State Standards Connections:

- **Mathematics- 5.G.A.2:** Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation

Lesson 2: Salmon Alevin Observations

Timing: late December/Early January (after eggs hatch)

Learning Objectives/Goals/Learning Targets: Understand the needs of the first stage of salmon development, especially as provided by their habitat.

Essential Questions/Focus Questions:
What do you **see** when you look at your alevin?
How are the needs of the alevin met in the tank?

Materials:
Use the Salmon Alevin Observation pages in their student journals.

Engage:

1) Have students put the day number and date on the Salmon Alevin Observation pages.
2) Allow students plenty of time to draw and label the alevin as well as describe the alevin in the aquarium.
3) Have students spend some time using the sentence starters to be more descriptive.

Explore:

4) Discuss where the alevin get their food (chemical) energy to grow. (It was already in the egg).
5) Have students fill out More Salmon Alevin Observations.
6) Shine the flashlight on the alevin. What happens? Have students record. Discuss what happens when you shine the flashlight. Ask students why they think the alevin respond that way.
7) Have students read the handout Article 2 about alevin, available in Schoology or the student journal
8) Have students look for the needs salmon alevin have for development in the reading. Have students share out and record on a chart or use another book or resource to provide information about salmon alevin.
9) Go to the Salmon Dependence on Habitat page of the journal (Page 5)

Explain/Elaborate:

10) Have students think about how those needs are met in the salmon stream and record those on the table. Discuss with students about the needs of the alevin in the aquarium from the article you just read. Remind them that the aquarium is a model of the stream habitat. Have students share out how salmon alevin needs are met in the tank. On the chart, record how the salmon alevin needs are met in the aquarium and have students record them on their table in the journal.

Extend (optional):

11) Brainstorm what threats there are to salmon alevin while they are in streams and have students record those in the table as well.

NGSS Learning Standards met:

Disciplinary Core Ideas:

- **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems**

Crosscutting Concepts:

- **Patterns**-Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena

Common Core State Standards Connections:

- **RI.5.1**- Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.Source: https://sisseattle.org/wp-content/uploads/Salmon-Logs-1.pdf

Lesson 3: Salmon Lifecycle

Timing: Flexible

NGSS Learning Standards met:

- **5-ESS3-1-** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Science and Engineering Practices:

- **Developing and Using Models**

Disciplinary Core Ideas:

- **LS1.C: Organization for Matter and Energy Flow in Organisms**

Crosscutting Concepts:

- **Influence of Engineering, Technology, and Science on Society and the Natural World**

Common Core State Standards Connections:

- **Energy and Matter**

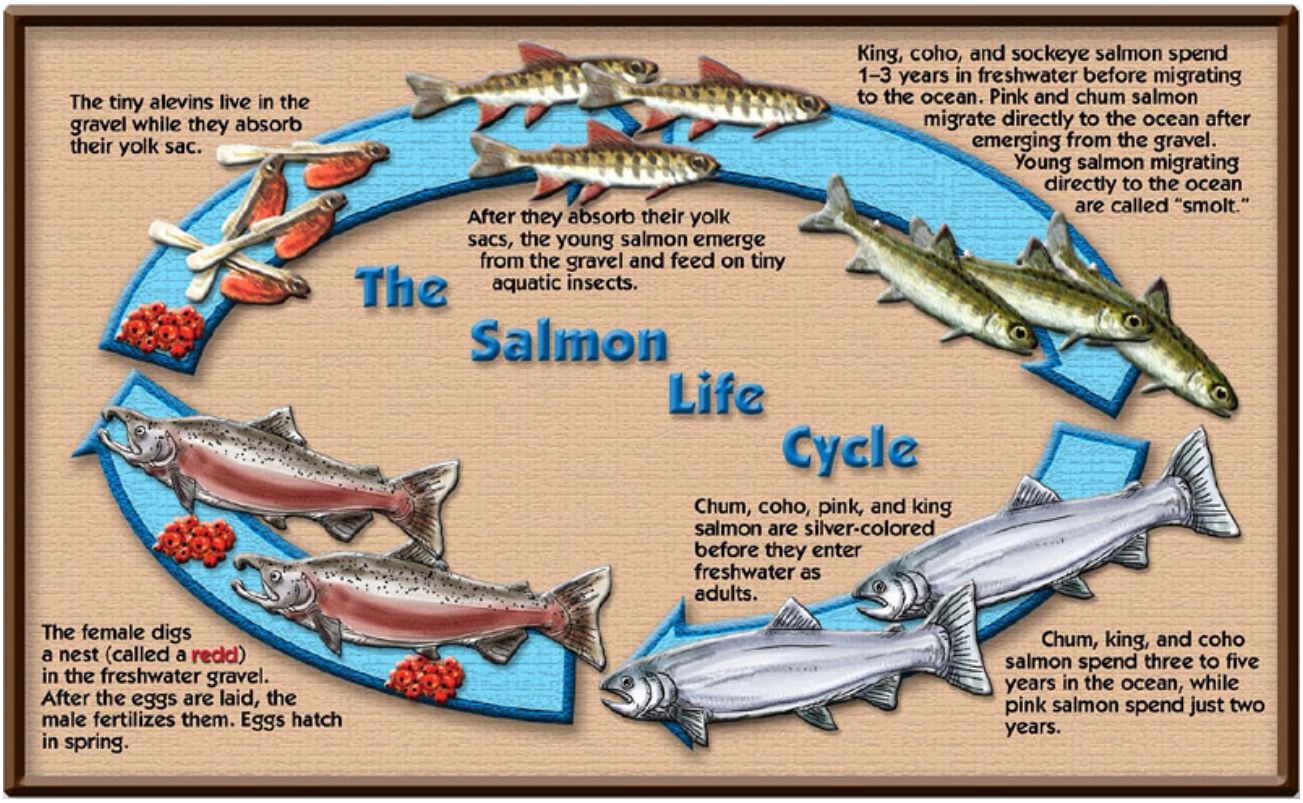

Image: US Forest Service

Engage:

1) Give students a minute to identify the different stages of the salmon life cycle on their page.

Explore

2) Have students identify the stages they are familiar with, and which ones are unfamiliar to them. Make sure they notice the division of stages between stream and ocean.

3) Draw the stages of the life cycle on the overhead projector and have students color along. If the students seem familiar with how the stages look, let them draw first and then have them shout out the characteristics at each stage.

Lesson 4: Salmon Fry Observations

Timing: January, after fish develop and feeding begins
*Use the Salmon Fry Observation pages in their student journals.

NGSS Learning Standards met:

Disciplinary Core Ideas:

- **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems**

Crosscutting Concepts:

- **Patterns**-Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena

Common Core State Standards Connections:

- **RI.5.1**- Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

Engage:

1) Have students put the day number and date on the Salmon Fry Observation pages.

2) Allow students plenty of time to draw and label the fry as well as describe the fry in the aquarium.

Explore:

3) Have students describe fry behavior in the tank.

Explain:

4) Discuss how fry behave when fed. How is their behavior similar to their behavior looking for food in streams?

5) Have students fill out the More Salmon Fry Observations.

6) Discuss what happens when you shine the flashlight. Ask students why they think the fry respond that way. Discuss their ideas of how the fry behavior helps them survive in their stream habitat. Have students record in their log.

Elaborate:

7) Have students read Article 3 about salmon fry available in Schoology and the student journal

8) Go to the Salmon Dependence on Habitat page of the journal

9) Have students think about how those needs are met in the salmon stream and record those on the table. and discuss with students about the needs of the fry in the aquarium from the page you just read. Remind them that the aquarium is a model of the stream habitat. Have students share out how salmon fry needs are met in the aquarium. In the table have students write down how the salmon fry needs are met in the aquarium.

Extend (optional):

10) Brainstorm what threats there are to salmon fry while they are in streams and record.

Evaluate:

11) Answer the questions 1-3 on the next page either individually or as a class.

Source: https://sisseattle.org/wp-content/uploads/Salmon-Logs-1.pdf

Lesson 5: Stewardship

Timing: February

1. Play the video Through Salmon Eyes, slide , by the NW Indian Fisheries Commission, shared in the STI curriculum. This story is shared with permission from the NWIFC. Have students share their reflections on this salmon story and the Billy Frank Jr. quote on the Coast Salish Connection journal page . [After watching Salmon Story and reading the quote above by Billy Frank Jr, write or draw how you might “listen to the world that sustains us and hear the message brought forth by the salmon.”]

Adopted from Explore the Salish Sea - https://www.juniorseadoctors.com/ch-7-migration

Tire Chemicals

1) Have students read Article 4 about tire tread particles. Brainstorm how the chemicals can impact salmon.
2) Look at roads near Swan Creek. Ask students which roads have the highest impact on the release site.
3) Brainstorm solutions for the tire chemical problem. Research current news articles to see if any legislation has started for “Salmon Safe” Tires.
4) Check the Seaport website for the results of our 6PPDQ testing in Swan Creek. Results should be posted by mid-December 2022.

Lesson 6: Reflection Art Project

Timing: April-May, after release field trip

As a way for students to reflect on what they learned, students will create art on templates provided to teachers by interns. More detailed instructions will accompany the templates. Interns will collect student art and bring it to Foss Waterway Seaport
The student art from all the Tacoma Salmon in the Classroom schools will be combined into an art installation at the Seaport that will be publicly available for viewing during the summer 2023. This is students' opportunity to share what they've learned about salmon with the community

Post Assessment

Timing: After all lessons and release are complete

Students will take the same Student Survey that they did as a pre-assessment, now as a post-assessment to measure learning.

Appendix A: Optional Lesson-Predicting Salmon Hatch

Timing: Egg Arrival to ~ mid-December Temperature readings begin at egg arrival. Using those readings begins several days after eggs arrive

Background for Accumulated Thermal Units:

In many species, including birds and fish, the amount of heat that eggs receive is the most important factor in determining when the eggs will hatch. While birds get the heat needed from the parent's bodies, salmon get the heat they need from the water. In salmon and other fish, when eggs hatch is determined by heat accumulated over time and is measured in units called accumulated thermal units (ATUs). Different types of salmon require different amounts of accumulated thermal units. An ATU is the sum of water temperatures over a period of time. For example, if the first day of incubation occurred when the water was 8 °C, the second at 7 °C and the third at 9 °C, then the ATUs at the end of day three is 24, the cumulative total. For this exercise you will assume your chiller is set to a constant temperature of 50°F which is equal to 10°C. **You will need to know how many ATU's the eggs have received on the date they arrived in °C to complete this activity.**

1) Ask students to suggest reasons for birds sitting on their eggs before they hatch. Then explain that a parent bird's body provides heat which eggs need to develop. Explain that in many species, including birds and fish, the amount of heat that eggs receive is the

most important factor in determining when the eggs will hatch. While birds get the heat needed from the parent's bodies, salmon get the heat they need from the water. In salmon and other fish when eggs hatch is determined by heat accumulated over time and is measured in units called accumulated thermal units (ATUs). Different types of salmon require different amounts of accumulated thermal units. An ATU is the sum of water temperatures over a period of time. See Background on ATUs for how this number is calculated.

Accumulated Temperature units (ATU's) required to reach important development stages in 3 types of salmon.		
Species	**Stage**	**ATUs in °C**
Chinook	To hatch	480-540
	To emergence (fry)	900-1000
Chum Salmon	To hatch	475-525
	To emergence (fry)	900-1000
Coho Salmon	To hatch	400-500
	To emergence (fry)	700-800

Explore:

2) Have students record the hatchery ATUs in the space on the journal page and copy the date when the eggs arrived from the front of their journal.
3) Have students compute the number of days to hatching and fry emergence using the formula:

<u>ATUs needed to hatch - ATUs (start) from hatchery</u> = Number of days until hatching
Average daily temperature °C (or °F-32)

a) The ATU's needed to hatch are already filled in on the worksheet and taken from the above table. There is an early and a late calculation to represent the range of dates that you can except to see hatching.
b) The ATU's (start) from hatchery will be given to you when your eggs arrive. Students can fill in the same number 4 times in the equation
c) Average daily temperature in °C we assume is 10°C for all days in the tank. If you have any major fluctuations in temperature you can discuss how this will affect your hatch date. Will an increase in temperature speed up or slow down the hatching.
d) Number of days until hatching is the number that you will find by doing the calculation. Students should use this number to count forward from the days that the eggs arrived to find the range of dates that hatching and fry development are predicted.

Example:

$$\frac{480 \text{ ATUs (for Chinook to hatch)} - 200 \text{ ATUs from Hatchery}}{10\ °C} = 28 \text{ days}$$

$$\frac{540 \text{ ATUs (for Chinook to hatch)} - 200 \text{ ATUs from Hatchery}}{10\ °C} = 34 \text{ days}$$

If eggs came on November 15, 28 days later would be December 13 and 34 days later would be December 19. So you would expect eggs to hatch between Dec 13-19.

4) Now students predict fry emergence in a similar manner and mark on their calendars.

Evaluate

5) After the eggs have hatched, discuss with students how close their predictions were. Explain that these predictions are a best guess using data for what will happen.

Adapted from https://sisseattle.org/wp-content/uploads/Salmon-Logs-1.pdf

Extension Lesson: Know the Salmon High Five!

Timing: Flexible

1) As a class, identify the 5 species of Pacific salmon and 2 anadromous salmonids. Have students look at their hands to relate the types of salmon to their fingers

2) Let students trace their own hands and have them draw a salmon on each finger

Partner Visits 2 & 3

Timing: January and February

Partner organizations will come in and teach the lessons in the student journal.