

Will the salmon return?

MATH 9

This learning activity connects land and place to identity. The investigation starts by considering the importance of salmon to some Indigenous people, the forests, and the ecosystem. This learning activity shapes students' thinking and awareness about being stewards of the land and discover what is currently happening with the salmon runs in BC. Students will look at the salmon's life cycle and how they return to the rivers where they were born, what factors impact their population, and why salmon are important to people and the land. Students will make connections to the salmon, community, and Canadian Indigenous culture by looking at story, local contexts, and sense of place, and numerical data collected by different agencies. Students will explore the importance of salmon to self and community, what is happening to the salmon run and water temperatures over time, and the impact of this trend on local Indigenous people.

Videos of this activity's writer and reviewers discussing design considerations and Indigenous math are available on [Focusing on Competencies in Math](#).

Core Competencies

- Collaborating: Determining Common Purposes
 - I recognize the interdependence of our roles and draw on these to move us forward.
- Critical and Reflective Thinking: Questioning and Investigating
 - I can gather, select, evaluate, and synthesize information.
- Positive Personal and Cultural Identity: Understanding Relationships
 - I can identify ways my actions and the actions of others affect my community and the natural environment.

First Peoples Principles of Learning

- Learning requires exploration of one's identity
- Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place)
- Learning recognizes the role of Indigenous knowledge
- Learning is embedded in memory, history, and story

Aboriginal Worldviews and Perspectives

- Connectedness and Relationships
- Local Focus
- Engagement with the Land, Nature, and Outdoors

Big Ideas

- Analyzing the validity, reliability, and representation of data enables us to compare and interpret.

Curricular Competencies

- Represent mathematical ideas in concrete, pictorial, and symbolic forms
- Engage in problem-solving experiences that are connected to place, story, cultural practices, and perspectives relevant to local First Peoples communities, the local community, and other cultures
- Reflect on mathematical thinking
- Connect mathematical concepts to each other and to other areas and personal interests
- Incorporate First Peoples worldviews and perspectives to make connections to mathematical concepts

Content

- two-variable linear relations, using graphing, interpolation, and extrapolation
- statistics in society

Cross-Curricular Connections

Science 9

- Big Idea
 - The biosphere, geosphere, hydrosphere, and atmosphere are interconnected, as matter cycles and energy flows through them.
- Curricular Competencies
 - Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal interest
 - Apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information
 - Express and reflect on a variety of experiences, perspectives, and worldviews through place
- Content
 - sustainability of systems
 - First Peoples knowledge of interconnectedness and sustainability

Social Studies 9

- Big Idea
 - The physical environment influences the nature of political, social, and economic change.
- Curricular Competencies
 - Compare and contrast continuities and changes for different groups at the same time period (continuity and change)
 - Assess how prevailing conditions and the actions of individuals or groups affect events, decisions, or developments (cause and consequence)
 - Make reasoned ethical judgments about actions in the past and present, and determine appropriate ways to remember and respond (ethical judgment)
- Content
 - physiographic features of Canada and geological processes
 - the continuing effects of imperialism and colonialism on Indigenous peoples in Canada and around the world

The Learning Activity Plan

The Hook

Watch CBC: *The Nature of Things*, “The Salmon Forest”
<https://curio.ca/en/video/the-salmon-forest-844/>

This video briefly describes how salmon return back to the rivers from which they are born, situates the salmon in an Indigenous context, and looks at how salmon feeds the people, the animals, and the forest. “The Salmon Forest” will provide some context as to how salmon sustains life but also why it is important for Indigenous peoples to be stewards of the land and support Mother Earth so that culture, traditions, and life can continue in a healthy and sustainable way.

Teacher-Led Discussion and Student Reflection

- Why are salmon important to the land, the people, and some Indigenous communities?
- What factors impact the salmon population?
- Why is it important that the salmon return?

Follow-Up Videos

These videos look at salmon spawning from two points of view. They provide additional context to the salmon life cycle and why it's important for the salmon to return.

Meet a local legend: The salmon

https://www.youtube.com/watch?time_continue=49&v=aRe1ePS_hwg&feature=emb_logo

Sockeye salmon return to BC's Adams River

<https://www.youtube.com/watch?v=LFKQffjMUPk>

Place-Place Based Learning Opportunity

Depending on where you are situated, teachers can bring their class into the forest to imagine what it would be like to be a grizzly bear and immerse oneself into the "Salmon Forest". Situating oneself on the land provides additional context to the content and concepts discussed in the "Salmon Forest" video. The land and place become the teacher. What nutrients do the salmon provide the forest and the animals? What distance do bears travel into the forest with the salmon? What in the forest benefits from the salmon? How do the salmon sustain life?

Have students look at their local watershed: introduce the idea of what a watershed is and have them consider the complexity of those systems that support salmonids.

Another place-based opportunity for this learning activity would be at a river. Teachers and students can imagine salmon spawning and the amount of energy required to swim upstream to return back to their birthplace. Time of year (or season) will influence water flow and water temperatures. This would also be an opportunity to introduce the idea of changing water temperatures, what factors influence the temperature of the water, and where the water flows from river to river or river to ocean.

Depending on where you live, you might be fortunate to witness the salmon run (like in the videos) or invite a local Indigenous Elder, fisher, or knowledge keeper who can tell the story of the salmon and describe the importance of salmon to their community, culture, and way of life. How do we all become stewards of the land?

Go outside. If you do not live near a river, ocean, or forest... go outside. The goal is to connect students to nature and the land. This develops one's sense of place as well as identity with respect to the salmon, its importance, and creates context as to why we should be stewards of the land.

Consider *A Walking Curriculum* for some ideas: <http://www.educationthatinspires.ca/walking-curriculum-imaginative-ecological-learning-activities/>

Introducing Story and Water Temperature

Once context is set with respect to the salmon and the land, consider reading out loud or sharing the contents of the following storybooks and articles. These depict the importance and significance of salmon to Indigenous culture (storybooks) and introduces the problem of increasing water temperatures and their impact on salmon populations and salmon run (articles).

Storybooks

P'esk'a and the First Salmon Ceremony by Scot Ritchie (2015)

<https://houseofanansi.com/products/pska-and-the-first-salmon-ceremony>

Gift of the Salmon by Bill Helin (2016)

https://www.strongnations.com/store/item_display.php?i=6007

The Sockeye Mother by Brett David Hudson (n.d.)

<https://www.portageandmainpress.com/product/the-sockeye-mother/>

The Salmon Run by Clayton Gauthier (1979)

https://www.strongnations.com/store/item_display.php?i=6197

<http://www.theytus.com/Book-List/The-Salmon-Run>

Salmon Boy by Donna Joe (2001)

<http://www.harbourpublishing.com/title/SalmonBoy>

Dipnetting with Dad by Willie Sellars (2014)

<https://caitlin-press.com/our-books/dipnetting-with-dad/>

Articles

BC sockeye salmon return thrills onlookers despite concerns over decline

<https://www.cbc.ca/news/canada/british-columbia/sockeye-salmon-return-2018-adams-river-b-c-1.4862291>

Return to the water: First Nations relations with salmon

<http://www2.laiwanette.net/fountain/return-to-the-water-first-nations-relations-with-salmon/>

Shuswap late-run sockeye drop by 700,000

<https://www.saobserver.net/news/shuswap-sees-drop-in-returning-late-run-sockeye/>

How climate change is impacting the salmon on Canada's west coast

<https://alliance2030.ca/climate-change-impact-salmon/>

'Disastrous': Worst sockeye year on record for BC

<https://www.citynews1130.com/2019/09/09/worst-year-for-salmon/>

Small Group Discussion

Divide the class into groups of 3-4. Each group will consider what they have learned with respect to the sockeye salmon and increasing water temperatures. Students in each group will compose a “guiding question” from what was discussed to guide their thinking and learning. Each group will share their guiding question to the class. The teacher may consider asking the students to vote on a guiding question for the class to consider, compose a class guiding question based on what was shared, or have each group work from their guiding question.

Data Analysis

Students will be given two opportunities to analyze data. The first set of data is looking at water temperature. There are three samples (see links below) for students to analyze trends from different data sets looking at water temperature.

- What trends do you see?
- Are the trends consistent between all three graphs?
- What water temperature is each graph measuring? Does this matter?
- What’s the same and what’s different between each graph?
- How does it relate to the Adams River?
- What impact do you think this makes on the salmon run and salmon population?

Resources to consider

BC sockeye salmon return thrills onlookers despite concerns over decline

<https://www.cbc.ca/news/canada/british-columbia/sockeye-salmon-return-2018-adams-river-b-c-1.4862291>

Ocean Warming: Explained

<https://www.nationalgeographic.com/environment/oceans/critical-issues-sea-temperature-rise/>

Three Data Sets on Water Temperature

Sea Surface Temperatures

<https://www.globalchange.gov/browse/indicators/indicator-sea-surface-temperatures>

Climate Change Indicators: Ocean Heat

<https://www.epa.gov/climate-indicators/climate-change-indicators-ocean-heat>

Climate Change Indicators: Sea Surface Temperature

<https://www.epa.gov/climate-indicators/climate-change-indicators-sea-surface-temperature>

Adam's River Escapement Data

The second set of data for students to consider is data from Fisheries and Oceans Canada for the Adams River. This data looks at the salmon population over time. Students will graph (individually or in groups) this data set (see table below). Students will determine the appropriate scale to graph the data.

Year	Adams River escapement
1998	871,184
1999	314,416
2000	754
2001	16,796
2002	3,738,273
2003	354,534
2004	2,732
2005	34,880
2006	1,459,401
2007	52,713
2008	149
2009	37,861
2010	3,859,983
2011	148,169
2012	0
2013	124,576
2014	707,087
2015	5,485
2016	36
2017	18,239
2018	535,564

Students will compare graphs with other students or groups to see what scale they used to graph the data from the Adams River. What was the best scale? What factors did you have to consider? Is there a noticeable trend in salmon population? What do you notice?

Critical Orientation:

- Can you make a connection between one of the graphs on water temperature to the number of salmon counted in the Adams River?
- What do you have to consider mathematically to make this connection?
- Is there a relationship between the two sets of data?
- What conclusions can you make about water temperature and the salmon run?
- What else needs to be considered?
- What further investigations can you make to verify any relationship?

- Based on your findings, what impact do you think the salmon run and water temperatures have on the environment? How will this affect local communities, Indigenous culture, and you?

Extension

Students will extract some data from one of the water temperature graphs/websites and superimpose this data on the Adams River graph to find if there is any relationship seen graphically between the salmon run population in Adams River and water temperature.

Place-Based Learning Opportunity

Students can take the surface temperature of the river or ocean to verify the data being analyzed. They could also take the temperature of the water over time to see if there are any changes in each season.

Students may also investigate ideal water temperatures for salmon and at what temperature do salmon populations thrive. Students may also visit a local salmon hatchery to learn more about salmon and the ideal living conditions salmon need to grow and survive.

Conclusion

Students go back to the “guiding question” and are asked if they could answer the question with what they have found. Is their answer reasonable? How do they know? What did others find?

Engage students in a class discussion about what they have learned:

- Did they answer the “guiding question”?
- What do they still need to learn? What do they still need to know?
- What would they like to know?
- What impact does water temperature have on salmon runs?
- What impact does this have on First Peoples and communities?
- What other impacts can you think of?

End the learning with these videos, emphasizing the importance of the First People’s worldview and perspectives on the salmon and the teachings of the salmon to influence our worldview.

Salmon Circle (Adams River)

Available on: [Focusing on Competencies in Math.](#)

<https://www.openschool.bc.ca/competenciesmath/index.html>

Lake Babine Nation Sockeye

<https://www.youtube.com/watch?v=5HNScooAWfg>

Journal Reflection (adapt to the learning experiences of your class)

Students are asked to write a journal reflection on their learning experience:

- What role does salmon play for First Peoples? Why is it so important?
- What role does statistical data play when thinking about the environment?
- Without the use of data, graphs, and statistical calculations, what would you need to notice that would indicate to you there was a problem with the salmon run?

Extension

- Discuss with students what they would want to do next (or over time) to make a positive impact on the salmon run, water temperatures, and local Indigenous culture(s).
- Students may want to take action and this would be an excellent opportunity to collaborate with and make cross-curricular connections with Science 9 and/or Social Studies 9.
- Write a letter to local government about what you have learned about the salmon and advocate for action to address the issues of the salmon run and ocean/river temperatures.
- Make a presentation to local government to advocate for action to save the salmon. See BC Salmon conservation websites for further information:

Save Our Wild Salmon

<https://www.wildsalmon.org/>

Pacific Wild

<https://pacificwild.org/>

Rain Coast Conservation Foundation

<https://www.raincoast.org>

Wilderness Committee

<https://www.wildernesscommittee.org/>

Extension

Another environmental factor that impacted the sockeye salmon run in BC is the Fraser River landslide in 2019. There are plenty of news articles about the landslide and the salmon. Students can consider and discuss further about how the landslide impacts the salmon run and make a prediction for the coming year, 5-years, 10-years, etc. and anticipate the fate of the salmon run.

Students may also make connections to what they have learned about water temperature and the salmon to the landslide. This can be a cross-curricular learning opportunity with Science 9 and Social Studies 9 that can be co-developed. Notice the extent and urgency to save the salmon.

Bottleneck blocking salmon on BC's Fraser River

<https://aptnnews.ca/2019/07/16/bottleneck-blocking-salmon-on-b-c-s-fraser-river/>

For salmon stymied by BC's Big Bar landslide, survival depends on help from above

<https://www.theglobeandmail.com/canada/british-columbia/article-for-salmon-stymied-by-bcs-big-bar-landslide-survival-depends-on/>

Fraser River slide poses big engineering challenge for crews working to get fish moving

<https://globalnews.ca/news/5871166/fraser-river-slide-engineering/>

Trapped migrating salmon to be flown over Fraser River rock slide in BC

<https://www.cbc.ca/news/canada/british-columbia/holding-pen-helicopter-big-bar-salmon-1.5219433>

BC to use helicopters to transfer salmon past Fraser River rock slide

<https://globalnews.ca/news/5664463/fraser-river-rock-slide-salmon-helicopter/>

Officials may soon install salmon ladders to help fish blocked by BC landslide

<https://globalnews.ca/news/5709626/bc-big-bar-landslide-salmon-ladder/>

BC confirms sockeye salmon have passed through Fraser River slide naturally

<https://bc.ctvnews.ca/b-c-confirms-sockeye-salmon-have-passed-through-fraser-river-slide-naturally-1.4573538>

Salmon swimming freely through Fraser River landslide site, officials say

<https://www.cbc.ca/news/canada/british-columbia/salmon-swimming-fraser-river-landslide-1.5271121>

Salmon swimming past BC landslide on their own – but is it enough?

<https://aptnnews.ca/2019/09/11/salmon-swimming-past-b-c-landslide-on-their-own-but-is-it-enough/>

Some BC salmon runs face 'meaningful chance of extinction' after landslide, despite rescue mission

<https://www.cbc.ca/news/canada/british-columbia/big-bar-landslide-salmon-extinction-1.5377632>

Remote landslide puts Fraser River salmon on shaky ground

<https://eos.org/articles/remote-landslide-puts-fraser-river-salmon-on-shaky-ground>

Landslide could wipe out some BC salmon species, sparking federal response

<https://www.ctvnews.ca/canada/landslide-could-wipe-out-some-b-c-salmon-species-sparking-federal-response-1.4709872>

Assessment - (Single Point Rubric)

Not meeting expectations	Criteria	Meeting expectations
	<p>Represent mathematical ideas in concrete, pictorial, and symbolic forms:</p> <ul style="list-style-type: none"> • Making a graph • Overlapping graph 	
	<p>Engage in problem-solving experiences that are connected to place, story, cultural practices, and perspectives relevant to local First Peoples communities, the local community, and other cultures:</p> <ul style="list-style-type: none"> • Small group discussion • Class discussion • Journal Reflection 	
	<p>Reflect on mathematical thinking:</p> <ul style="list-style-type: none"> • Comparing graphs • Looking for trends • Finding relationships • Making predictions • Journal reflection • Reflect on inquiry question 	
	<p>Connect mathematical concepts to each other and to other areas and personal interests:</p> <ul style="list-style-type: none"> • Being stewards of the land • Salmon sustainability • Journal reflection 	
	<p>Incorporate First Peoples worldviews and perspectives to make connections to mathematical concepts:</p> <ul style="list-style-type: none"> • Local cultural context • Storybooks and media • An Elder (if possible) 	