Modelling Coast Salish fish traps

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Acknowledgements

We thank the Tla'amin Nation for producing media content and generously sharing their knowledge on the longstanding tradition of fish traps within ʔagayqsɛn (Ahgykson Island), formerly Harwood Island, in British Columbia, Canada.

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Activity summary

This is a free resource for teachers and students, and is part of the Callysto project, a federally-funded initiative to bring data science skills into Grade 5-12 classrooms in Canada.

In this activity, students will use an online Callysto notebook to explore:

- An example of Northern First Nations fish traps.
- Parameters involved in the design of Northern Coast Salish fish traps.
- Using a simulation of a fish trap: choosing parameters to harvest fish.

This activity can be done with students in person or online.

Grade level

Grades 9 - 12.

Learning outcomes

- Indigenous knowledge and perspectives.
- Mathematical thinking in relation to First Nations Peoples traditions.
- Engage in problem-solving experiences connected to a place, story, cultural practices and perspectives relevant to the Tla'amin Nation.
- Relationship between the height, and width of a trap, as well as the behaviour of tides and the number of harvested fish.

Before you start

1. This lesson plan allows you to use Callysto notebooks, mathematical modeling, and coding to understand the impact of fish harvesting on pink salmon. You can choose to let students work through the notebook with you. Or, you could introduce this topic separately and use the notebook for the interactive activities.
2. Students should know how to log in to the Callysto Hub as well as run a notebook prior to interacting with it. Teachers, to get started with Callysto notebooks and running material on the Callysto Hub, see our Starter Kit.
3. This notebook will explore the parameters involved in traditional Northern Coast Salish fish traps located in ʔagayqsɛn (Ahgykson Island), formerly Harwood Island, in British Columbia, Canada. Suggested complementary reading: Indian Fishing: Early Methods on the Northwest Coast by Hillary Stewart.

Required materials

1. A charged computer.
2. Access to the internet.
3. An installed internet browser, preferably Google Chrome, Safari or Firefox.
4. A Google or an Outlook email account.

In class activities

1. **Explore the concept of "intertidal zone"**

   This is a zone located on marine coastlines (such as sandy beaches or rocky shores). The intertidal zone experiences two states: a 'low tide' state in which the area is exposed to the air, and a 'high tide' state in which the area is submerged in seawater. The intertidal zone is in a high tide state once or twice daily. To learn more about the intertidal zone ecosystem, read this National Geographic article.

2. **Explore the concept of "intertidal modification"**

   This is an area in the intertidal zone that has been changed by humans to increase harvesting productivity of marine wildlife (like clams or salmon). These changes involve building large structures made of rock or wood in the intertidal zone. Coast Salish Peoples modified the

intertidal zone to facilitate harvesting clams (these modifications are also known as “clam gardens”) and ease the process of catching fish (fish traps).

3. Share with the students this video on wuχoθɛn (Fish Traps)

https://youtu.be/JWw9ZduMgb8

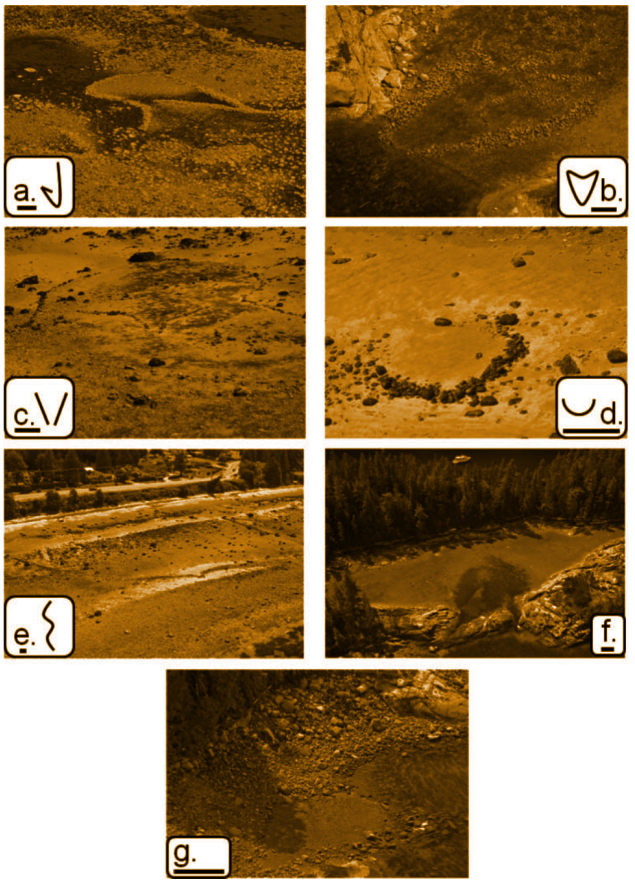
This video was produced by the Tla’amin Nation, a First Nations self-governing nation whose traditional territories reside on the upper Sunshine Coast in British Columbia. In this video, we learn about traditional Coast Salish fish traps found in ʔagayqsɛn.

4. Explore different types of fish traps

Below are aerial images of different kinds of fish traps found in Northern Coast Salish areas. Share this picture with the students, along with the trap type.

a. Hook fish trap.
b. Heart fish trap.
c. V, with associated lead line visible.
d. Crescent, sitting on a naturally sandy beach.
e. Linear.
f. Cleared bedrock depression.
g. Cleared beach.

You’ll see a black bar underneath each letter. This black bar represents how wide each trap is, relative to the crescent element on image d. The following exercises focus on the crescent element.



Source: Megan E. Caldwell , Dana Lepofsky , Georgia Combes , Michelle Washington , John R. Welch & John R. Harper (2012) A Bird's Eye View of Northern Coast Salish Intertidal Resource Management Features, Southern British Columbia, Canada, The Journal of Island and Coastal Archaeology, 7:2, 219-233. Photos by G. Combes.

5. **Student activity: work with the students to identify factors that Coast Salish Peoples needed to consider when modifying an intertidal zone. You can ask the students to share their thoughts with the class. Some of these factors include:**
    - Location where harvesting would occur
    - Location of the trap, relative to the tide
    - Shape and measurements of the trap
    - Time of day to perform harvesting
    - Tide behaviour

6. **Student activity: focusing on the crescent element fish trap.**

    This type of trap consists of either a semi,or completely circular stonewall. Crescent elements are

located in the high to low intertidal zone. Key measurements are radius (or width) of the circle and height of the trap.

Facilitate a discussion that helps students connect the relationship between the radius of a circle and the width of the crescent element.

Here are some questions you could ask them:

- **What measurements are required to design this trap?**
    - Answers include: height of the trap, width of the trap, location of the trap relative to the tide, slope of the beach.
- **How do fish get into the trap?**
    - Answer: when the tide goes above the highest point of the crescent element.
- **How are fish trapped?**
    - Answer: when the tide goes below the highest point of the crescent element, some water remains inside the trap. Any fish that swam into the crescent element, but did not make it back to the ocean, when the tide goes down, then becomes trapped**.**
- **When is the best time to harvest fish?**
    - Answer: after the tide has gone up (let fish into the trap) and down (trap fish).

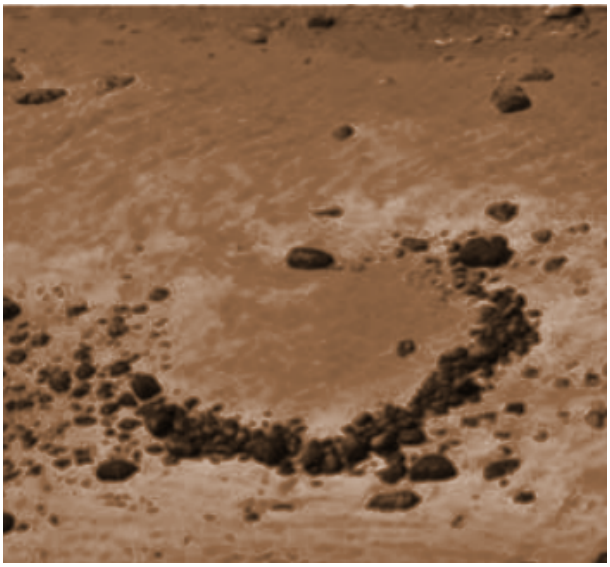
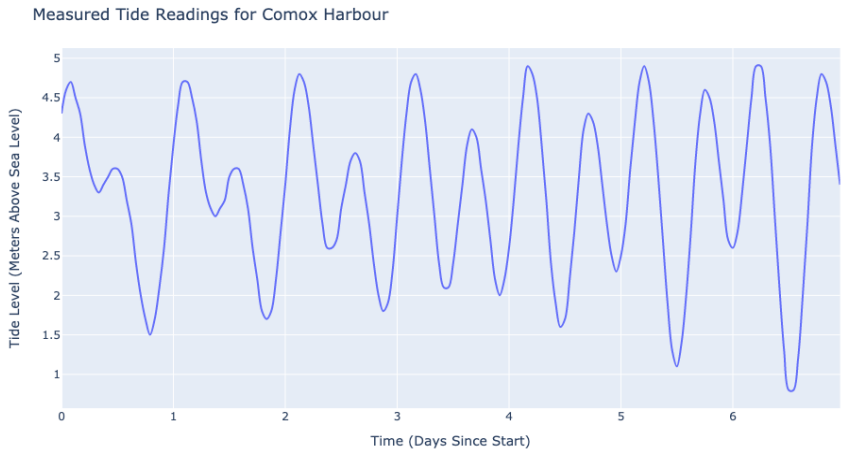


Image from *Combes, G., & Welch, J. R. (2012). A Bird's Eye View of Northern Coast Salish Intertidal Resource Management Features, Southern British Columbia, Canada. The Journal of Island and Coastal Archaeology.*

7. **Student activity: ask students to open the following Callysto notebook https://tinyurl.com/y37hrspp.**
   What students will see after they "run" the notebook. They can "run" a notebook by selecting "Cell" -> "Run All" from the menu.

   This notebook contains a visualization using real data from tide behaviour from ʔagayqsɛn (Ahgykson Island) It also contains a simulation (an approximate imitation of a process, usually using a computer) of the crescent element. It allows students to visualize tide data during one day, for a location in ʔagayqsɛn (Ahgykson Island) (British Columbia, Canada) where fish traps have been located. The tide plot is displayed below.

- The red line indicates the bottom (or low point) of the trap.
- The blue line represents the tide level (in meters above the sea level). When the tide rises, water fills the trap (trap is open). When the tide lowers some water returns to the ocean, but some water remains in the trap along with some fish (trap is closed). This cycle repeats over time.

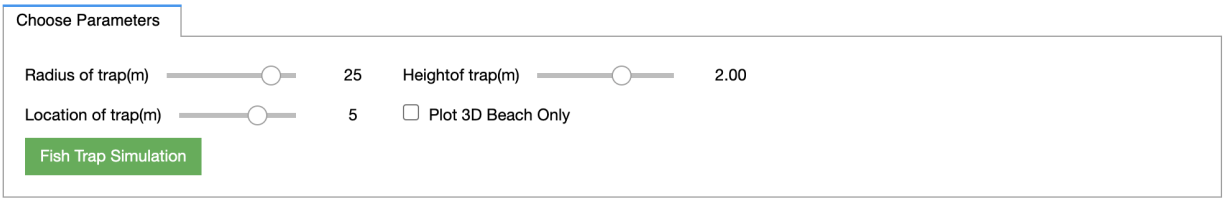


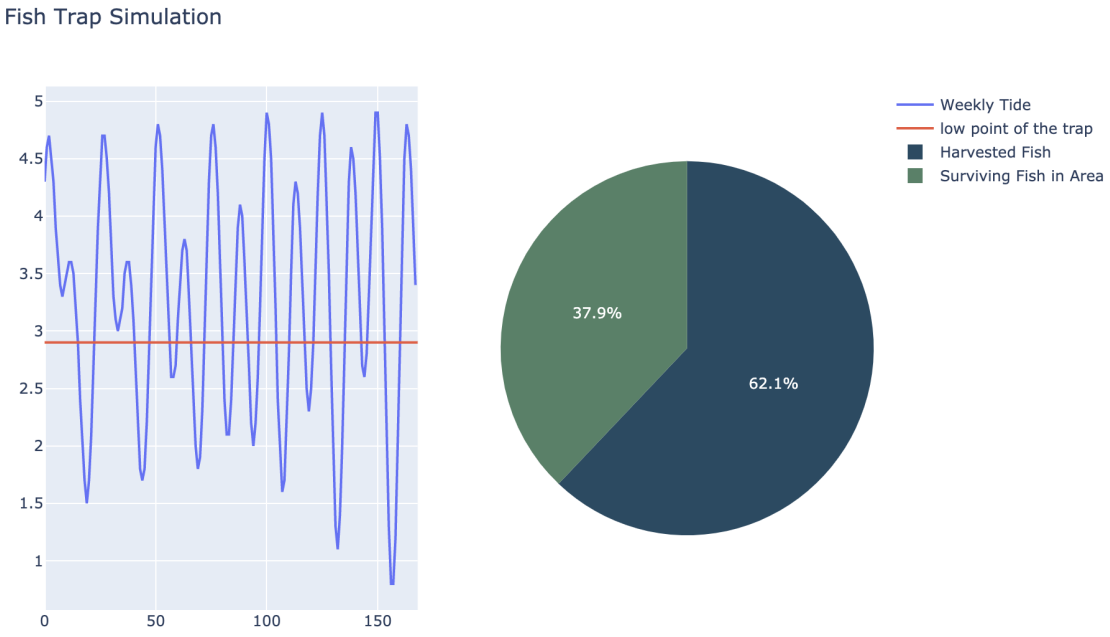
The students can then visualize the tide behaviour for one week.

Next, students can choose the “trap parameters”

Students can adjust the trap parameters, such as the radius, location, and height of the trap. The simulation assumes there are a total of 1000 fish swimming near the shore. It also assumes that whenever a fish is trapped, it is then harvested.

Depending on the parameters the student chooses, the simulation will display the total number of fish harvested along with the total number of fish that survived. Below is a sample of how the student can choose the parameters. To generate a visualization, ask the student to press the “Fish Trap Simulation” button.





When the students adjust the trap parameters, new plots will appear. We’ll use the picture above to explain what these plots mean.

- Line graph (far left): the red line represents the bottom of the trap and the blue line represents the tide. A successful trap should be covered by water when the

tide is high. However, the tide level should be below it as the tide goes down to ensure some fish are trapped. The trap in the simulation above satisfies those conditions.

- Pie chart (far right): the pie chart shows the percentage of fish that survived (light green) vs fish that were harvested (dark green).

Students can then change the trap parameters and see how that impacts the results of the simulation.

8. **Reflection: students can share the following information verbally during class, or in a written report.**

Here are a few suggestions on how you can ask students to reflect:

- Ask students to share their parameters: radius of trap, location of trap, height of trap.
- Ask students to share the percentage of harvested vs surviving fish in the area.
- Ask students to share whether they think traps that harvest as much fish as possible are better and why.

Suggested next activity: modelling the impact of harvesting on salmon.

Further reading

White Elroy, "Heiltsuk stone fish traps: Products of my ancestors' labour", https://summit.sfu.ca/item/4240

Stewart, H. 2008. Indian Fishing: Early Methods on the Northwest Coast.