



MATH

Fishing for Treaty Rights and Sustainability

ESSENTIAL UNDERSTANDINGS

- Since time immemorial
- Lifeways
- Genocide, federal policy, and laws

LEARNING OUTCOMES

- Students will determine whether a section of the river has a healthy salmon population by using linear strategies for solving an unknown number.
- Students will understand the impact of federal policies on Native fishing rights and traditional ways of life.

ESSENTIAL QUESTIONS

How do people know when rivers have healthy fish populations?

LOGISTICS

- Where does the activity take place?
Classroom
- How are the students organized?
 - Whole class Teams: 2 – 4
 - Pairs Individually

TIME REQUIRED

50 – 75 minutes

Overview

Many federal policies have had a negative impact on tribal nations in Oregon. This is particularly true in the area of fishing rights. The treaties signed with many different tribes ensured access to traditional Native fishing grounds, but the U.S. government later attempted to limit or eliminate this access. The tribes have fought back in the courts, and there have been several high-profile cases over the past several decades. In this lesson, students will examine these treaty rights violations through the application of linear equations.

Background for teachers

- *Changing the Faces of Mathematics: Perspectives on Indigenous People of North America:* National Council of Teachers of Mathematics (2002)
- *Salmon and the Columbia River: Continuities and Challenges:* <https://www.webpages.uidaho.edu/~rfrey/422salmon.htm>
- *The Fish Wars: What Kinds of Actions Can Lead to Justice? Review the video, Fish Wars: Four Simple Truths* <https://americanindian.si.edu/nk360/pnw-fish-wars#staging>



- **Three Oregon Tribes Are Locked in a Dispute Over Fishing at Willamette Falls.** <https://www.wwweek.com/news/2018/09/12/three-oregon-tribes-are-locked-in-a-dispute-over-fishing-at-willamette-falls-its-about-much-more-than-a-few-salmon/>
- **Fisheries Timeline: Chronology of tribal fishing and fishing rights on the Columbia River** <https://www.critfc.org/about-us/fisheries-timeline/>

Before lesson delivery teachers should

- Review Oregon’s Math in Real Life Initiative at <https://www.oregonednet.org/groups/oregon-mathways-initiative-math-real-life>
- Review the focus outline to promote a rich context and a purposeful connection <https://www.oregon.gov/ode/educator-resources/standards/mathematics/Documents/Math%20in%20Real%20Life.docx>
- Prepare the “fish stock bags.” Count roughly 100 fish-shaped crackers (2 cups) and place them in the bag with a small paper cup.

STANDARDS

Oregon social sciences standards

8.4 – Evaluate the impact of different factors, including gender, age, ethnicity and class on groups and individuals during this time period (1765 to Reconstruction) and the impact these groups and individuals have on events of the time.

Oregon math standards

8.EE.7 – Solve linear equations in one variable.

- a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
- b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

MATERIALS

What materials are needed for students to engage in this activity?

- Slide deck that includes videos
- Sticky notes
- Fish-shaped crackers, fish-shaped pretzel (bowls or baggies for each group)
- Small cup (2 ounces or smaller) or spoon
- Exit ticket



Considerations for teachers

Formative assessment

- Observe and provide feedback during student discussions after videos and math activities.
- Teachers should check the exit ticket for completion and accuracy.

Learning targets

- I can analyze a real-world problem and solve it with mathematical practices.
- I can interpret and justify mathematical thinking.
- I can explain the effects tribal fishing rights have on individuals, tribal nations, and industry.

VOCABULARY

Reservation – A land set aside for exclusive use by federally recognized tribal nations.

Tribal Nation – A nation of people with their own sovereign government, including laws, representation, and managed resources.

Seasonal rounds – The practice of moving from one area to another based on the natural resources that are available in a given season.



Options/extensions

- Students can review <https://plan.critfc.org/2013/spirit-of-the-salmon-plan/about-spirit-of-the-salmon/we-have-halted-the-salmons-decline/> and predict the current rate of population based on expected growth. They can research to determine if their predictions are true. Students can also create slope-intercept formulas and compare pre-and post- Wy-Kan-Ush-Mi Wak-Kish-Wit. Students can use the graphs and predict when the runs will meet the 4 million Spirit of the Salmon goal.
- Teacher may choose to show Slide 8 in the deck for extended practice.
- Teacher may choose to use the Placemat Protocol during the group practice and discussion.

Reflection/closure

Have students complete the exit ticket to show understanding of the mathematical concepts and the context of tribal fishing rights.

Appendix

Materials included in the electronic folder that support this lesson are:

- Slide deck
- Sample the Rivers Recording Sheet
- Exit ticket
- Placemat Protocol

Activity 1

Launch the Context

Time: 10 – 15 minutes

This activity provides students with a basic understanding of traditional Native hunting and fishing practices, a summary of how Euro-American settlement and colonization impacted these traditional practices, and a look at how tribes have fought to retain or regain the hunting and fishing rights that were guaranteed in treaties they signed with the U.S. government. The activity includes a PowerPoint presentation, three short video clips, and additional supporting materials.

Slide 1

Say:

Who likes to eat salmon? Maybe some of you have fished for salmon? Salmon is an important food for many people in the Pacific Northwest, and it is especially important for Native American tribes.

Slide 2

Many tribes traditionally followed a seasonal cycle of hunting, fishing, and gathering. This is sometimes referred to as seasonal rounds. This means they traveled from place to place based on the time of year and the natural resources that were available. For example, Native people knew exactly when the salmon would be swimming upstream to spawn and where they would be most abundant. It was important to all the tribes to take care of the land, the rivers, and the animals, so that there would be plenty for the next cycle and for other tribes. During the salmon runs, tribal members would catch as many as they needed to support their tribal bands, which were large extended families. Of course, they ate salmon fresh, but they also smoked and dried it, which preserved it for the seasons in which there were no salmon runs. This way of life continued for thousands of years and countless generations.

Activity 1 (Continued)

The photograph on the left shows Celilo Falls, which was one of the most important Indian fishing sites in the entire Pacific Northwest until it was submerged under the lake that formed when the Dalles Dam was built in 1957. In the picture you can see the platforms that Native people built so they could get out over the rushing water and catch salmon using poles and nets.

The two photos on the right are more recent. They were taken by members of the Burns Paiute Tribe in 2016. In the photograph on the upper-right the sign they are holding says “1st Chinook Salmon in Malheur River since 1919.” The Tribe worked with the Oregon Department of Fish and Wildlife to restore salmon runs to the Malheur River, a tributary of the Snake River. Due to a series of dams built on the Snake in the early 20th century, salmon had been unable to return to their spawning grounds on the upper Malheur River, high up in the Blue Mountains in the eastern part of the state.

Despite nearly a century in which they were unable to fish for salmon in the traditional way, Burns Paiute tribal members told stories and taught new generations how to create fish traps and hooks. They never quit believing that salmon would one day return to the Malheur watershed, and they never quit working to make that happen.

Slide 3

This map from 1846 shows that there were many tribal nations living in the area that is now known as Oregon. These tribes had been living here since time immemorial, which means long before written history and long before the arrival of Europeans. Beginning in the 1800s the land was claimed by both Great Britain and the United States. Both countries wanted to colonize the area and take advantage of its rich resources. This desire to own and control the land was driven first by the fur trade and then by the discovery of gold and other precious minerals.

In 1850, in an attempt to encourage settlement in what was being called Oregon Territory, the U.S. government offered 320 acres to any U.S. citizen over the age of 18 who would move to the territory and create a permanent dwelling there. This was known as the Donation Land Act of 1850, and it resulted in thousands

Activity 1 (Continued)

of non-Native settlers pouring into the region, claiming land that Native people had always known as their homeland. The U.S. government backed this settlement with military force that the tribes could not match, although many fought hard to remain on the land.

Slide 4

This settlement had devastating consequences for Native people. In addition to claiming tribal territory and closing off access to traditional hunting, fishing, and gathering grounds, non-Indians brought diseases for which Native people had no immunity. As a result, many tribes faced devastating illness and starvation and had little choice but to sign treaties with the U.S. government, giving up access to thousands of acres of their ancestral territory. As part of the treaties, tribes were moved onto reservations, which were areas of land set aside for the exclusive use of the tribes. These tribes were designated as “federally recognized,” meaning the U.S. government acknowledged the tribes’ status as sovereign, independent nations and acknowledged that they had legal rights as established in the treaties. Here you can see the nine federally recognized tribes in Oregon. Some of these federally recognized tribes are actually confederations of multiple tribes.

In nearly all of these treaties, tribes managed to retain their right to hunt, fish, and gather in their traditional way and in many of their traditional hunting and fishing grounds. They never gave up these rights. In the following decades, however, the U.S. government repeatedly sought to pass legislation and create policies that negated the original treaties and limited or eliminated Native access to those hunting and fishing grounds.

Slide 5

While seeking to limit Native access, the U.S. government created policies that allowed non-Indians to hunt and fish with little or no limits on their take. At one time, canneries were processing thousands of salmon each year. As a result, the salmon runs were drastically reduced. Other factors also impacted the salmon runs and the health of the watersheds, including mining operations and the building of dams throughout the Pacific Northwest in the 20th century. Many of

Activity 1 (Continued)

these dams created barriers that salmon could not cross. As a result, the salmon runs were completely eliminated in many of the rivers that Native people had fished for thousands of years. In the rivers that did still have salmon runs, Native people were often blocked from fishing.

Slide 6

It wasn't until 1974 that tribal nations won a decision in the U.S. Supreme Court, often called the Boldt Decision, which reaffirmed the treaty-protected rights and established tribes as co-managers of the resources. This court decision allowed Native people to fish in the traditional areas that had been designated in treaties and entitled them to 50 percent of the salmon runs in those areas. In this political cartoon you can see that some people were unhappy about this decision, but the data showed that 1.3 million salmon were caught by larger fishing vessels compared to the 144,000 caught by tribal members. Notice the areas that tribal members fished as compared to the commercial fishing boats.

Now, we're going to do some context building. We're going to think about some questions and problems and try to determine how we might solve them using math skills. Math is about context. It's about applying skills to solve real-life problems. So we're going to explore how we might apply math to the issue of Native American fishing rights. We're going to watch three short video clips that look at the impact of federal policies and legal decisions on both Native people and the environment. Then we're going to look at how math can help us tell this story.

Slide 7

This 1:55 video clip can also be found at <https://vimeo.com/230026513>

As you watch the video, I want you to listen closely to what he is saying, and I want you to think about two questions: How did the changes to the land affect this man? And, if he doesn't have a place that it is "usual and accustomed" for him to fish, then how can he teach others? I also want you to think about additional questions you may have about fishing, tribal rights, and the influence of

Activity 1 (Continued)

government and corporations on the natural environment. After the video, you will share your thoughts with a partner and write any additional questions you might have on a sticky note. We will then post the sticky note questions. We may not answer all of them, but questions are our way to begin thinking about problems we want to answer using math.

After viewing, have students turn and share with a partner about their thoughts on the questions. Allow the pairs to write an additional question they have on a sticky note and to post it in a designated area of the room. You may want to highlight posted questions that are most applicable to the students, context, and content, but all questions are valid.

Slide 8

This 1:01 video clip can also be found at https://youtu.be/4D_kbHksaKQ

Now that you have thought about the impact of fishing for one man, let's explore the considerations for a group of people, in this case the Confederated Tribes of Warm Springs. As you watch, think about this question: Why would people risk their lives in such fishing conditions? After the video you will have a chance to talk about it with a neighbor and to come up with additional questions. You can write these on sticky notes again and post them with the others.

After viewing the video clip, have students turn and share with a partner, write their additional questions, and post them in the designated area of the room. Again, you may want to highlight the questions that are most applicable to the students, context, and content, but all questions are valid.

Slide 9

This 2:13 video clip can also be found at <https://www.youtube.com/watch?v=F-ADN0oWQkQ>

You have seen what fishing means to a person and to a tribe, but I also want you to see the impact that government and corporate decisions have on fishing and on the ability of Native people to provide for their families. We already discussed that

Activity 1 *(Continued)*

tribes never gave up their right to hunt and fish in their traditional places, but Native people have had to defend this right again and again. While you watch, I want you to think about questions and problems you might be able to solve using math.

After viewing the video clip, have students turn and share with a partner, write their additional questions, and post them in the designated area of the room. Again, you may want to highlight the questions that are most applicable to the students, context, and content, but all questions are valid.

Activity 2

Explore the Mathematics

Time: 30 – 40 minutes

Students will participate in a simulated fish tagging activity in which they will use ratios to determine whether fish population levels in a given area are healthy, unstable, or weak. After setting up the situation, students will use the Sample the Rivers Recording Sheet.

Say:

There are several questions related to a common issue: How can we determine the number of healthy fish in the river?" So, we're going to explore this with math and a simulation. Everyone is going to have a Sample the Rivers Recording Sheet, and we're going to get into teams of four. Each team will get a bowl and a fish-stock bag, which has your fish crackers and what we will use as a "net." First, we're going to look at the political and legal context.

Slide 10

In this slide, you see a graphic from the Columbia River Inter-Tribal Fish Commission, which comprises the four Columbia River treaty tribes: the Yakama Nation, the Umatilla Nation, the Warm Springs Nation, and the Nez Perce Nation. From the website, we are reminded that "All four Columbia River treaty tribes enjoy fishing rights along the Columbia from the Bonneville to McNary dams. This 147-mile stretch of the river is called Zone 6. For fisheries management purposes, the 292-mile stretch of the Columbia River that creates the border between Washington and Oregon is divided into six zones. Zones 1 through 5 cover the area between the mouth of the river east to Bonneville Dam, a distance of 145 miles. Oregon and Washington manage the commercial fisheries that occur in these zones. Zone 6 is an exclusive Native American commercial fishing area, as established by treaty. This exclusion is for commercial fishing only. Non-commercial sports fishers—both Native and non-Native—can also fish in this stretch of the river. Commercial Native American fishers are legally entitled to half the harvestable surplus of fish

Activity 2 (Continued)

in the river. To meet that requirement, Oregon and Washington must set their fisheries in zones 1 through 5 in order to leave enough fish for harvest in Zone 6. Indian fishing is regulated under the ongoing U.S. District Court litigation known as U.S. v. Oregon.

Turn to a partner to share your observations about this graphic. I want you to think about how we can use math to examine the issue of who is able to fish and how we can determine what is fair.

Students may make some or all of the following observations:

- Zone 6 is about the same size as zones 1 through 5.
- There are four dams located in Zone 6 and none in zones 1 through 5.
- The commercial fishermen get first dibs at fishing.
- There are three smaller rivers that enter the Columbia River in Zone 6.

Encourage all student observations and questions in regard to how they might count the salmon to ensure there are enough fish to get to Zone 6.

Say:

One way to count fish is to tag a certain number of them and then use ratios to estimate the amount of salmon in that area. In our case, we will use these fish-stock bags to mimic the amount of salmon at Zone 5. We need to know if there are still enough fish passing through to get to Zone 6 to ensure that at least half of the harvestable salmon are reaching the “usual and accustomed” areas. Each team has a fish-stock bag and will use the small cup to act as a net to capture the salmon, which are represented by the cheese fish. Those captured fish will be exchanged for the fish-shaped pretzels. Then you will mix the cheese fish and the pretzel fish together. Next, you will use your Sample the Rivers Recording Sheet to record the number of pretzel fish, which represent the tagged fish, and the number of total fish. Then you will write the ratio of tagged fish to total fish in your first capture. Remember, there are multiple ways to write a ratio.

Solicit student ideas and write the correct examples for reference.

Activity 2 (Continued)

Say:

OK, return these fish back to the bag and scoop and record again. You and your team should have a total of seven recordings on your sheet. After the seventh tagging and recording, the team will determine the average number tagged and the total number tagged and then create a ratio.

Solicit student ideas and write correct examples for reference in finding the average numbers.

Say:

Use the number of originally tagged salmon to determine your proportion of total fish in your particular area. As I monitor, I suggest you talk with your teammates to figure out how to solve the problem. Once you think you and your team have the correct proportion and have determined the total number of salmon, go ahead and count to see how you did. If it doesn't come up exactly as you and your team thought, have a discussion about what might have gone wrong and where you might change your thinking. If everything goes right, I want you to describe why you and your team were successful in determining the ratio.

Activity 3

Apply the Mathematics

Time: 10 – 20 minutes

Students will discuss what they learned from the previous activity and how they could apply this knowledge to the problem of Native American fishing rights. Students will then apply the mathematical skill set to another linear equation problem.

Say:

OK, we conducted our fish-tagging activity not only to develop our math skills but also to look at how commercial fishing policies affect tribes across Oregon. These policies play out in very real ways, and they impact the ability of tribes to maintain their traditional relationship with the land by fishing in their usual and accustomed places. I want you to think about this activity and discuss with your team: How could government officials and other interested parties use these data to determine whether salmon stock levels are healthy and therefore meet the standards for tribal fishing in Zone 6?

After student groups have discussed the question, have them share their thoughts and understanding with the whole class. Clarify any additional information or provide resources such as <https://americanindian.si.edu/nk360/pnw-fish-wars/pdf/PNWM2-Additional-Resources-for-Teachers-and-Students.pdf>, which students can use to research and add to their understanding of fishing and treaty rights for Native people throughout the Pacific Northwest and the United States. Highlight how mathematical thinking can be used to find and develop linear equations with a single variable.

Say:

So, we're dealing with much smaller numbers here, but let's just say that at the entrance of Zone 1, 270 harvestable salmon came through the river mouth. We know half the amount must reach Zone 6. If that is the amount of fish you have at Zone 5, will the treaty rights be upheld or must stricter bag limits be enforced in zones 1 through 5?

Activity 3 (Continued)

Allow students to answer yes or no and to justify why there must be at least 135 fish leaving Zone 5 or there must be stricter bag limits in the previous zones.

Slide 11

Now we're going to apply those same skills to other contexts. Working in teams of four, I want you to review this problem. First, I want each of you to try solving it on your own. Then, as a team, I want you to review each other's work and decide on a group answer. I'm expecting you to use your listening skills to analyze the thinking of your teammates and to use your speaking skills to explain your own thinking. This isn't about trying to win others over to your way of thinking. It's about four people coming to a consensus based on your collective math skills and understanding of the problem.

After students have completed the task, have each group share their answer and their methodology. If necessary, help students get to the algebraic phrasing $4x+16 = 52$, $x = 9$ and then the meaning "nine pounds of salmon went to each sister."

Slide 12

Have students change groups so there are new members on each team.

Say:

Now I want you to do repeat this process. Read the situation, determine how to solve it individually, then discuss it as a group to analyze and justify your thinking, then prepare to explain it to others.

After students have completed the task, have each group share their answer and their methodology. If necessary, help students get to the algebraic phrasing $3x+2=14$, $x=4$ and then the meaning "each family ate four salmon."

