LESSON PLAN:

PACIFIC SALMON CASE STUDY

GRADES: 7

SUGGESTED TIME: TBD

OVERVIEW:

Aquatic species in Canada are faced with many factors that impact their ability to survive and reproduce. This lesson focuses on the impacts of bycatch gillnet fishing on Pacific salmon. (Bycatch means that some species are caught unintentionally, and then released.)

In this investigation, students will compare two samples of fish - one group that has been stressed by being trapped in a gillnet, and a control group. Students will look at real telemetry data, and compare the success of these two groups of fish.

Students will then take a deeper look at commercial fishing, including the perspectives of various stakeholders involved in this issue.

OBJECTIVE:

Students will:

- Learn about a data collection method called biotelemetry
- Organize secondary data into relative frequency tables and circle graphs
- Compare two sets of data using mean, median and mode
- Draw conclusions from a sample, and apply their findings to the greater population
- Learn about how human activities impact salmon
- Identify environmental issues associated with commercial fishing
- Optional: Take on perspectives of various stakeholders related to an environmental issue

PRIOR KNOWLEDGE:

Students would benefit from having a basic understanding of:

- Relative frequency tables
- Circle graphs
- Mean, median and mode

MATERIALS:

Part 1: Data Organization

- ☐ Biotelemetry introduction video
- ☐ Pacific salmon species video
- ☐ Handout - Pacific Salmon - Part 1 - Data Organization Package
  - Print a copy of the package for each student
- ☐ Handout - Fish Spawning Map
  - 1 per student
- ☐ String
- ☐ Fish Data Cards (2 sets of 15)
  - Print and cut the cards
  - Each student (or pair of students) should have a fish card from each set
  - Ensure that all 30 fish are used. (It is ok if multiple students get a copy of the same fish card.)
- ☐ Handout - Exit Card: Part 1: Data Organization
  - Print and cut these in half, so that you have 1 per student.

Optional: Part 2: Debate

- ☐ Handouts - Part 2 - Debate
  - Debate organizer
  - Print a copy for each group (Note that if you assign students to the Government Group, they need the more specific organizer.)
- ☐ Debate information
  - Print a copy of the Pacific Salmon Management Debate for each group (3 pages).

INTRODUCTION:

1. Begin by showing students the Biotelemetry Introduction video.
2. Inform students that they will be exploring a case study about a species of Pacific salmon called coho salmon. They will be analysing real telemetry data and learning about the effects of bycatch and commercial gillnet fishing.
3. Show students the Pacific salmon species video.

PART 1: DATA ORGANIZATION

MINDS ON

1. Pose the following question to students: How do you perform differently when you are feeling sick and/or tired? Record responses and discuss.

ACTION

1. Distribute the Data Organization package. Have students read the Case Study Notes on page 1.
2. Give each student two fish cards - one stressed, and one not stressed.
3. Note: Explain to students that when a fish is stressed, it means that it is tired and possibly injured.
4. Discussion: Which fish are most likely to make it to the spawning area and why?
5. Provide students with a copy of the map.
    - Teach the students how to use a string and the scale (at the bottom of the map) to calculate the distance that each fish travelled. Have them lay the string carefully along the river from one location to the next. Then, have them stretch out the string and measure it using the scale at the bottom.
    - Ask each student to measure the distance from the Release point, to each of the locations along the river. Have them jot these distances down on scrap paper. Challenge them to be as accurate as possible.
    - Then, share the actual distances that it takes to get to each location. Have them compare the accuracy of their measurements:

        Mission - 40 km

        Confluence - 60 km

        Vedder - 75 km

        Tahimi - 95 km

        Lower Hatchery - 110 km
    - Once you have given students the accurate distances, have them fill in the distance column on their fish cards.
    - Use an overhead, or communal chart to make a master list as a class, using Table 1: Distance Travelled by Pacific Salmon (Note: To do this, you only need information about the final location where each fish was detected. See the Answer Key for reference.)
    - Have students copy the data into Table 1: How Far Did the Fish Travel? on page 2 of their package. (Accommodation: For students that have difficulty copying down information, you could provide a copy of the completed table found in the Answer Key.)
6. Have students complete the Part 1 - Data Organization handouts. These include:
    - Organizing distance travelled into relative frequency tables
    - Creating circle graphs to compare the relative distances travelled of stressed and not stressed salmon. (Alternative - Have students create the circle graphs using digital software.)
    - Calculating the mean, median and mode distance travelled for stressed and not stressed salmon.

CONSOLIDATION

7. Use the following questions to facilitate a discussion about the implications of these results.

    A. What observations can we make when we compare the circle graphs of stressed and not stressed salmon?

    Possible responses:

    More of the not stressed salmon made it farther distances.

    It seems difficult for both groups of salmon to make it to the spawning grounds. This surprised me. I wonder what other factors affected the success of the salmon.

B. How can we use the mode, median and mean of each set to make conclusions about the data?

Possible responses:

The mode, mean and median scores allow us to compare the data using one score. For example, the data set with a higher mean distance, would have generally made it farther than the other set.

The median shows us the center of the data. It means that half of the fish in that group made it further than the median, and half didn't make it as far.

The mode tells us the distance that was most common among a set of fish. The mode distance is represented in the circle graph by the largest wedge.

All three measures of central tendency show us that not stressed fish travelled further than stressed fish. This helps us to make a clear conclusion.

C. Which of the measures of central tendency would be most affected by an outlier? For example, if the biologists discovered a fish that died at the release point, and therefore travelled 0 km?

Possible responses:

The mode wouldn't be affected at all, since only one fish would have a score of 0.

The median will shift to the left by one number, but in both cases, will remain unchanged.

The mean will drop for both stressed and not stressed fish, because a score of 0 will affect the overall average. When extreme outliers are present, mean is often not as useful.

D. What inferences can we make about the effects of gillnet fishing?

Possible responses:

Stressed fish in the sample did not travel as far as not stressed fish, and fewer made it to the spawning ground.

If we compare this sample to the greater population, we can conclude that more stressed fish fail to make it to the spawning grounds.

If fewer stressed fish make it to spawn, then that species of fish is going to decline in numbers.

E. The overall goal of this management strategy is to conserve the coho salmon population, by throwing them back, after being caught in nets meant for other types of salmon. Do you think this strategy is effective in conserving coho salmon?

Possible responses:

The majority of coho salmon are not making it to spawn, which means that they won't produce offspring.

If most coho salmon don't get to reproduce, then this is not a very effective management strategy.

Maybe they could consider other management strategies?

F. What other management strategies could they use to protect the coho salmon?

Possible responses:

Ex. Ban all fishing during coho migration

Ex. Reduce the amount of overall captures

Ex. Protect certain areas from fishing

Ex. Use other fishing techniques

8. Provide students with the 'exit card' to assess their overall understanding.

PART 2: DEBATE | OPTIONAL EXTENSION (RECOMMENDED FOR HIGHER GRADES)

MINDS ON

1. Pose the following question to the students: Which groups of people might care about commercial fishing methods?

ACTION

2. Read the 'Debate Scenario' aloud to students.
3. Ask students to reflect on their current opinion about this situation, through discussion or journal response.
4. Assign each student to a stakeholder group, and introduce the mock debate. Decide whether to assign the role of Fisheries and Oceans Canada (the government decision makers) to students, or whether to take on this role yourself, as the teacher. If you assign this role to students, you can task them with listening to the debate, and trying to come up with a solution that meets the needs of most stakeholders.
5. Provide each group with a copy of the *Debate Organizer* and the *Pacific Salmon Fact Sheets*. Give them ample opportunity to prepare for the debate. Optional: Allow students to gather further information online.
6. Facilitate the debate. Begin by giving each stakeholder group the opportunity to explain their position. Then, have them continue the discussion, while maintaining their position. After the debate, the Fisheries and Oceans Canada group can decide on a solution, and then present it to the class. (Alternatively - the teacher can take on this role and can propose a possible solution.)

CONSOLIDATION

7. Allow students to abandon their stakeholder group, when you debrief the debate. Have students reflect on the following, through discussion or journal reflection:
    - Which group or groups had the most convincing arguments, and why?
    - Did your opinion change, after hearing the debate? Why or why not?
    - How should the community solve this problem?
    - What did you learn, from taking on a different perspective?

ASSESSMENT

- Assess student understanding of mean, median, mode and circle graphs by reviewing these completed handouts.
- Review the exit ticket to assess student understanding of the implications of the results.
- Observe student responses during whole group discussion.
- Optional: Assess student participation and understanding by observing the debates.