Lesson 3: Collaborative Research - Case Study on Bears

Overview: Students will learn about the concept of collaborative research. This lesson will highlight the research on bears that is taking place in the Great Bear Sea region.

Subjects: Science, Language Arts, Math

Suggested Time: 2 classes (45-60 minutes)

*** Teacher Note:** The following lesson (Lesson 4) continues to look at this topic using a kelp research project and provides students the opportunity to learn more about kelp, how a plot study works and examine data collected in a different study. If time permits, both of the case studies can be explored. Or, Lesson 3 could be presented to Grades 4-5 and Lesson 4 could be presented to Grades 6-7. If you are only using Lesson 4 with your class, you may also want to use Activity 1 from Lesson 3 to teach your students about collaborative research, which includes viewing the Collaborative Science film clip. Materials with a ***** are available on the Great Bear Sea USB, or at www.greatbearsea.net.

Materials and Resources:

- Computer, projector and screen
- Chart paper and markers
- Lesson 3 Film Clips:
  - Collaborative Science (9 mins)
  - Bear Research (5 mins)
- Teacher Background – Lesson 3
- 3.1: Bear Research Project
- 3.2: Bear Data
- 3.3: Research Questions for Bear Data
- Bear Identification*
- Bear Images*
- Central Coast Map*
- North Coast Map*

Learning Objectives:

Students will:

1. Understand the Great Bear Sea is an ecosystem that is important for its ecology, economy as well as culture and social elements.
2. Be introduced to an example of collaborative research, which includes traditional knowledge, local knowledge and science.
3. Understand the value of traditional knowledge and how it contributes to sustainability and planning for the future.
4. Explore the ideas of stewardship and leadership in planning for the future of marine resources and ecosystems in the Great Bear Sea.

Lesson Context

This lesson will introduce the students to some of the collaborative research that is taking place in the Great Bear Sea region on bears. They will learn that the research that is taking place is partnering with various universities as well as First Nations to learn more about the bear movement across the territories and how much salmon they have been eating. By gathering data and learning more about the animals through these key partnerships planning can move forward with proper decisions to conserve and protect the Great Bear Sea region for the future. Students will learn more about the concept of collaboration, including what collaboration looks like from a science/research perspective. This example of collaborative research pairs traditional and local knowledge with academic research methods and is a key component to marine planning, helping communities make informed decisions while ensuring stewardship and conservation. There are various activities that students will engage in throughout this lesson including examining data collected from the bear research project and doing some analysis with specific target questions.

Learning Activities

Activity 1: Collaborative Research (45-60 minutes)

1. Write the word collaboration on the board. Ask students to explain what they think this word means? Some discussion points may include:
   - Ask the students their thoughts on group work – collaboration within the classroom.
   - What are the advantages and disadvantages to working in a group?
2. Watch the film clip **Collaborative Science**.
3. Write the word **collaborative research** on the board. Ask the students to name the groups collaborating in the research shown in the film clip. Brainstorm together the different research projects that were mentioned in the film clip and why research is important in the Great Bear Sea.
   - Salmon
   - Rockfish
   - Dungeness crab
   - Bears
   - Birds
   - Kelp
4. Review the key information of the bear research using **3.1: Bear Research Project**. Discuss how bears are connected to the Great Bear Sea through their diet of salmon.

5. Watch the film clip **Bear Research**.

6. Use the **Bear Identification*** to review characteristics to identify black and grizzly bears (colour, size, shoulder hump, face shape and ear size). Next, try identifying different pictures of bears that are included.

7. Show the students **Bear Images*** that were collected by the researchers.

8. Have the students list further questions they are wondering about regarding the bear research on **3.1: Bear Research Project**. Discuss the questions the students have about the research project.

Activity 2: The Bear Research Project (45-60 minutes)

1. Provide copies of the **Central Coast Map***. Find and shade on the map the different communities (a-d) that are working together on the Central Coast for this research project. Hartley Bay (e) is on the North Coast and is located at the mouth of Douglas Channel. Find this using the **North Coast Map***.

    a. Klemtu
    b. Bella Bella
    c. Bella Coola
    d. Rivers Inlet
    e. Hartley Bay

    What does this tell you about the bear habitat? Can the students think of advantages of having the different communities working together and sharing the data that they have collected on bear?

2. Divide the class into three groups. (Option: You could divide your class into six or nine groups and have multiple groups working on the same research question noted in step #3) Pass out the data **3.2: Bear Data**. Allow the students time to examine the data. Use chart paper and have the students record any trends noticed, questions about the data, etc. Then in a large group share their observations and questions about the data.

3. Pass out **3.3: Research Questions for Bear Data** and discuss each of the three research questions. Assign each group one of the research questions to investigate using data from the bear research project. Each group will use the same data but will be researching different questions. The data is based on many factors: the seasons of spring and fall; the years of 2012, 2013, 2014; species of grizzly and black bears as well as gender. Ensure the students understand what to do with the numbers in the data and how to calculate the answers. See **Teacher Background – Lesson 3** for information on the calculations.

4. Provide each group with time to create a poster that summarizes their findings to present to the class.
5. Share findings for each research question and discuss how Traditional Knowledge is connected in this research project and why this research project is important to the Great Bear Sea region.

Extension Ideas

- Using the data provided, brainstorm additional research questions to investigate. For example, the students could continue to look at differences between 2012 and 2014.
- Research more about bears. Put together a poster, brochure or fact sheet on bears. Or integrate a technology component to create a class blog on bears.
- Have the students design a research study to learn more about bear movement and the diet of bears. What would they want to investigate and how? Use the scientific method to come up with an investigation of their own.

Assessment Ideas

- Formatively assess students' engagement in individual and group work as well as large group discussion.
- Assess student work from the lesson.
- Have students check each others' data calculations.

Teacher Background – Lesson 3

Collaborative research is very important in the Great Bear Sea region, with several examples of academic institutions and First Nations working together to gather data and knowledge to inform decision making for marine planning. Students could consider all of the potential partners (such as the government and various other organizations) who could all work together to gather information to inform planning.

Collaborative Research

Contributed by Alejandro Frid - Science Coordinator/Ecologist Central Coast Indigenous Resource Alliance (27 April 2016). Do not duplicate without permission from the author.
www.alejandrofridecology.weebly.com/marine-resources-and-first-nations.html

Modern Indigenous people embrace new technologies and do not isolate themselves from contemporary culture and economy, yet maintain a tradition of deep interconnection with our non-human kin. Their gathering of edible and medicinal plants, their hunting and fishing, bring nourishment that not only is physical but also essential to sustaining worldviews that have been rooted in place for many generations. The implication is that habitat destruction and biodiversity loss are inseparable from the demise of cultural diversity, and therefore the rights of many human beings. Not surprisingly, Indigenous people have become conservation leaders in many parts of the world. Their efforts to conserve the ecosystems that sustain their traditional foods — mainly through protected areas that exclude large-scale exploitation — could make ecosystems more resilient to climate change and other stressors.

In the Central Coast of British Columbia, the Heiltsuk, Kitasoo/Xai'xais, Nuxalk, and Wuikinuxv First Nations have joined forces to proactively manage their resource, fostering collaborative research between scientists and holders of traditional knowledge. The elements of this collaboration are complementary.

On the one hand, science tests for explicit mechanisms that might affect ecological communities — such as fisheries and climate change — and uses empirical findings to predict future conditions. Yet science often occurs in short spurts and in few places, suffering from short-term, narrow perspectives that limit understanding.

In contrast, Indigenous Knowledge derives from cumulative and collective observations made by many generations of people who are connected to the resources of vast ecosystems. Oral traditions preserve this knowledge as Indigenous laws and stories that transcend many limitations of science.

In concert, science and traditional knowledge can merge the holistic and long-term perspectives of Indigenous people and the predictive abilities of science. The potential result is a stronger foundation for conservation and resource management policies.

Vocabulary

Collaboration: the action of working with someone to produce or create something.

Background on Bear Identification

This information and data was submitted by Rosie Child – Field Technician, University of Victoria and Spirit Bear Research Foundation.

People often assume that black bears are black and that grizzly bears are brown. Grizzly bears are usually brown but can be very light to very dark in colouring. Black bears are usually black but can also be white, blue, cinnamon, or brown. It is best to use multiple characteristics to ID bears, such as colour, size, shoulder hump, face shape, and ear size.

Colour

- Grizzly bears are usually brown and black bears are usually black, but there is lots of variation so colour is not the best way to identify bears.

Size

- Adult grizzly bears are usually larger than adult black bears but females and young bears are smaller and make size unreliable.

Shoulder Hump

- Grizzly bears have a prominent shoulder hump that is a mass of muscle that helps them dig.

Face Shape

- Black bears have a straight face profile, while grizzly bears have a more dished face profile.

Ear Size

- Black bears have taller ears in proportion to their head than grizzly bears shorter rounded ears.

Claws

- Grizzly bears have longer front claws that are usually lighter than black bear claws.

Answer Key to Research Questions

Below you will find specific research questions and answers. You will find tips to help the students solve the calculations below using the data. If students have not done these kinds of calculations some pre-teaching will be required on how to calculate averages.

Question One: What do you notice about the diet of these bears? What bear eats the most salmon? What bear eats the least salmon?

Answer: There is individual variation. Least is a female black bear (10635) that eats 3% salmon. Most is a male grizzly (10567) that eats 88% salmon.

Calculations Required: The students need to find the bear that eats the most and least amount of salmon by looking at the numbers in the salmon column. Tip: The number can be converted into whole numbers by working with percentages and multiplying the decimal by 100.

Question Two: Which species eats more salmon? Why? Which species do we have more bears for? Why?

Answer: Grizzly bears eat more salmon than black bears. They can calculate averages if time permits. Grizzly bears average 72%; black bears average 23%.

Calculations Required: The students will notice by looking at the data in the salmon column that the amount of salmon consumed for each grizzly bear is significantly more than for black bears. In order to calculate the average students will need to add up all the numbers in the salmon column for grizzly bears and divide by the total number of grizzly bears in the data set. Then repeat with the black bears by adding up the data in the salmon column and divide by the number of grizzly bears.

Question Three: Does the gender of the bear make a difference to salmon consumption? Why or why not?

Answer: Males eat more salmon than females. They can calculate averages if time permits. Males average 52%; females average 35%. Also the class can talk about differences between proportion and amount. What else do bears eat? Why do you think males eat more salmon?

Calculations Required: The students will notice by looking at the data in the salmon column that the amount of salmon consumed for males is generally more than females. In order to calculate the average students will need to add up all the numbers in the salmon column for the male bears and divide by the total number of male bears in the data set. Then repeat with the female bears by adding up the data in the salmon column and divide by the number of female bears.

Name:_____

3.1: Bear Research Project

Purpose:

To monitor the bears using non-invasive methods to see which bears are around, how they are moving across the territory and how much salmon they have been eating.

Methods:

- Remote cameras that show us that bears are around and how they are moving through the territory.
- Collecting hair samples using barbed-wire and hair corrals. The spring is the best time to collect samples as the bears are just waking up and are shedding hair from last fall.

How:

Track the bear movement and use stable isotope analysis to tell the proportion of the bears diet that is salmon, marine mammal or plant based.

Questions: I Want To Know More About…

3.2: Bear Data

Season	Year	Bear	Species	Sex	Salmon
spring	2014	25721	grizzly	female	0.634
spring	2014	23534	grizzly	female	0.594
spring	2014	14642	grizzly	female	0.617
Spring	2014	28132	grizzly	female	0.632
Spring	2014	10911	grizzly	female	0.637
Spring	2014	25852	grizzly	female	0.658
Spring	2014	10466	grizzly	female	0.671
Spring	2013	10680	grizzly	female	0.704
Spring	2013	10466	grizzly	female	0.705
Spring	2012	10911	grizzly	female	0.738
Spring	2014	23860	grizzly	female	0.746
Spring	2012	10667	grizzly	female	0.757
Spring	2012	10992	grizzly	male	0.827
Spring	2012	10567	grizzly	male	0.88
Spring	2012	10663	grizzly	male	0.636
Spring	2012	139903	grizzly	male	0.718
Spring	2012	10853	grizzly	male	0.736
Spring	2012	10981	grizzly	male	0.744
Spring	2012	10640	grizzly	male	0.744
Spring	2012	10303	grizzly	male	0.758
Spring	2012	10665	grizzly	male	0.809
Spring	2012	149691	grizzly	male	0.81
Spring	2012	10786	grizzly	male	0.812
Spring	2013	14256	black	female	0.035
Spring	2012	10936	black	female	0.037
Fall	2014	25723	black	female	0.052
Spring	2014	10646	black	female	0.07
Spring	2013	13723	black	female	0.071
Spring	2013	11706	black	female	0.074
Spring	2013	23452	black	female	0.084
Spring	2012	10646	black	female	0.103
Fall	2014	14837	black	female	0.254
Spring	2014	28476	black	female	0.449
Spring	2012	10635	black	female	0.032

Season	Year	Bear	Species	Sex	Salmon
Spring	2012	10602	black	female	0.036
Spring	2014	28080	black	female	0.039
Spring	2012	10585	black	female	0.046
Spring	2014	26964	black	female	0.167
Spring	2014	26396	black	female	0.172
Spring	2013	11497	black	female	0.309
Spring	2014	26999	black	female	0.471
Spring	2012	10598	black	male	0.195
Spring	2012	10320	black	male	0.225
Spring	2012	10592	black	male	0.342
Spring	2012	10820	black	male	0.344
Spring	2012	10429	black	male	0.406
Spring	2012	10622	black	male	0.422
Spring	2012	10607	black	male	0.043
Spring	2012	10603	black	male	0.079
Spring	2012	10714	black	male	0.266
Spring	2012	10484	black	male	0.351
Spring	2012	10533	black	male	0.517
Spring	2012	10526	black	male	0.586
Spring	2012	10660	black	male	0.834

NOTE: Permission was granted to use the data in the context of this lesson. The data are not available for publication or use outside of the classroom.

Name:_____

3.3: Research Questions for Bear Data

Question One
What do you notice about the diet of these bears? What bear eats the most salmon? What bear eats the least salmon?

Question Two

Which species eats more salmon? Why? Which species do we have more bears for? Why?

Question Three

Does the gender of the bear make a difference to salmon consumption? Why or why not?

My Group is responsible for Research Question: # _____

Hypothesis: Our predictions are...

Results: Our Findings…

Our new questions…