



LESSON 4.1: CONSENSUS DECISION-MAKING - THE LAKELSE SOCKEYE CASE STUDY

An exercise in consensus decision-making through role playing that enable students to devise a solution for managing dwindling Lakelse sockeye salmon stocks.

(Adapted from DFO's Stream to Sea Program ("Difficult Decisions: The Sakinaw Sockeye Case Study"))

OVERALL ACTIVITY DESCRIPTION

Overview: This lesson plan introduces students to decision-making on an individual and group level. Then, students will use their critical thinking in a role playing exercise by considering the different perspectives of various interest groups. Students, in their character roles, will try to come to consensus on how to deal with the dwindling Lakelse sockeye species while best meeting the needs of all the stakeholder groups represented.

In the first hour, the lesson first introduces decision-making activities. Then, students take on the roles of different community members and prepare to present their opinion according to the group they represent. In the second hour, students learn through role-playing the value of cooperative decision-making and the human role in sustaining natural populations.

PART ONE

Materials required: goldfish crackers, bowls, cups, one role introduction card per student

1. **Decision-making processes** (*modified from Table Talk (DFO) page 828*)

Many decision-making activities involve ranking items from a list based on personal experiences, values, common sense and knowledge. The following ranking activities will allow students to discover decision-making processes, and will point out the differences and similarities between individual and shared decision-making in small and large groups.

- A. Select a type of trip for the class (e.g., arctic expedition, astronaut on a mission, jungle safari)
- B. Write out the following list for all to see: shovel, rope, water, heat source, candy, tent, paper, radio, telephone, games, clock, compass, map, book, first aid kit, television, axe, oil, extra clothes, medicine, cutlery, boat, canned food, fresh fruit, vitamins, skateboard, insect repellent, matches, weapons, blanket, mattress, chainsaw, hammer, nails, juice, refrigerator, seeds, pen, pencil, truck



- C. Individually have students select the top 10 items from the list of items they deem essential to take along on the selected trip.
- D. Pair students up. Have paired students compare their individual top 10 lists and compromise to create a new top 10 list they can both agree on.
- E. Form groups of 5 or 6 students. Have each group of students collaboratively decide which top 10 items from the provided list they would want on their shared trip.

2. **“Cooperative Fishing and the Tragedy of the Commons”**

Using fish-shaped crackers (e.g., Goldfish Crackers), conduct the “Cooperative Fishing and the Tragedy of the Commons” activity (appended below). This activity will point out benefits of cooperative decision-making, the concept of sustainability, and resource overuse problems. During this activity, students are given the challenge of cooperating with their group to ensure they get the most “fish” in their cup. By trial and error, then by working cooperatively and strategizing, they will strive to get the most fish.

3. **Role-playing**

- A. Assign each student the role of a person from a group that has an interest in Lakelse sockeye or its habitat: commercial fishers, recreational fishers, shoreline land owners, government representatives, conservationists, local business owners, indigenous fishers, etc.
- B. Provide each student the “Role Introduction” page of the handout to complete describing their assumed role/character. The completion of this handout is in preparation for Part Two (below).

Cooperative Fishing and the Tragedy of the Commons

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Learning Objectives:

Familiarity with concepts of the Tragedy of the Commons, free-rider problem, role of government and social rules in protecting the common good, sustainability, over-fishing and other resource overuse problems.

Materials:

One bowl for each group of students and one cup for each student
Several boxes of Goldfish Crackers
Straws and spoons (optional)

How to Perform the Experiment:

First explain that there are 8 fish in each bowl and there will be two turns per round and several rounds per game. For each turn, each student can remove one fish or zero fish and put it in their cup. Once fish are taken from the bowl they cannot be put back. Explain that after the two turns, you will double the fish in the bowl and then there will be more turns where they can withdraw a fish, etc. Explain also that the object is to get the most fish in your cup and that at the end of the game only fish in your cup count. Explain that no fish are to be eaten during the game.

For the first game tell them there is to be no talking or other communication. At least some groups will deplete all their fish after the first round, but go ahead and play three rounds – they are just out of luck, but it is still good to emphasize the long term consequences of their “overfishing”. They may try to put fish back in the bowl, but explain that the fish are already dead and therefore can't reproduce to make more fish.

For the second game, tell them they can talk for 30 seconds and then we will play another game in silence. Usually results improve somewhat. For the third game tell them that they can create rules among themselves about how to play the game (but that the rules of the overall game cannot be changed). To enact the rules a majority must agree and then all must follow the rules.

Explanation of What's Happening:

This is an example of a Tragedy of the Commons where doing what is best individually

does not lead to the best result in the long run. Optimally, students will remove one fish per round (forgo one of their two turns) and then each round their fish are replenished. But if everybody else follows this strategy, it still pays an individual not to. If 3 players take 1 and one player takes 2, then there are 3 left

and they double to 6. Then if all take one, the “defecting” player ends up with 3 total compared to 2 total for the “co-operators”. If the students know how many rounds will be played, then it makes sense to take all the fish on the last round, so leave the number of rounds ambiguous.

References: There are similar exercises on the internet. Search for “Tragedy of the Commons” and “fish crackers”.

PART TWO

Materials required: one “Species of Risk Act” document and “Decision-Making Chart” per student, “Student Questions and Answer Key”, and colour pens.

1. With the teacher, have students read over the pages titled: “Species at Risk Act” and “Skeena Sockeye Backgrounder”. Have students review the map of the Lakelse Watershed.
2. Provide students the “Decision-Making Chart” page. Using the roles that they developed for themselves in the last part of the lesson, have them individually fill out each section with their ideas around making decisions for the management of the Lakelse sockeye species.
3. Using the “Role Introduction” and “Decision-Making Chart” pages, have student present or discuss their characters’ individual views about the management options for Lakelse sockeye (within the context of their interest group (i.e., land owners, business people, etc.)
4. Lead a discussion based on the “Student Questions and Answers Key”
5. Students will now use the decision-making and collaboration skills they learned from the last part of the lesson. Have students (in their character’s roles) try to come to a group consensus on how to deal with the dwindling Lakelse sockeye population. Ensure the interest groups the students represent speculate on the effect that local water concerns, development and pollution will have given current population growth rates.

CONCLUSIONS OF LESSON PLAN

- The decision-making process is not an easy one; decisions agreeable to all parties may or may not be possible
- Differing viewpoints have a large influence on decision-making
- Decisions can have different impacts on a large variety of groups
- Implementing a decision is the most difficult part
- Regulation may or may not be effective in protecting an animal population
- Mistakes may be made in managing animal populations; there is also often not enough data to determine what path to take for the best recovery effort

THE SPECIES AT RISK ACT (SARA) Working Together to Protect Aquatic Species

The **Species at Risk Act (SARA)** was created to protect wildlife species from becoming extinct in two ways:

- By providing for the recovery of species at risk due to human activity; and
- By ensuring through sound management that species of special concern don't become endangered or threatened.

The Act became law in June 2003. It includes prohibitions against killing, harming, harassing, capturing or taking species at risk.

A Collaborative Effort

Three government departments are directly involved in protecting species at risk: Environment Canada, Parks Canada, and Fisheries and Oceans Canada (DFO). DFO is responsible for all aquatic species, freshwater and saltwater alike.

From the beginning, it was recognized that no single government, industry or community could protect Canadian species at risk on its own. Government and stakeholder groups across Canada must all work together. In fact, SARA was designed to encourage such cooperation.

The good news is that everyone can help in some way: by knowing the species at risk and understanding why they're threatened (for example), or by taking steps to care for their habitat.

How Does A Species Get on the List?

Species are designated 'at risk' by the **Committee on the Status of Endangered Wildlife in Canada (COSEWIC)**, an independent body of experts that assesses wildlife according to a broad range of scientific data. The federal Cabinet then decides whether those species should get legal protection under the Act. These decisions are made after consultations with affected stakeholders and other groups.

Species Can Be Listed As:

- **Extinct:** no longer found anywhere on the planet
- **Extirpated:** no longer in the wild in Canada, but existing in the wild elsewhere
- **Endangered:** a wildlife species facing imminent extirpation or extinction
- **Threatened:** likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction
- **Special concern:** a wildlife species that may become a threatened or endangered species because of a combination of biological characteristics and identified threats.

More information about Species at Risk can be found at www.speciesatrisk.gc.ca.

Role –Playing Activity Description:

Begin by showing students the map of the Lakelse Lake Watershed joined with the Skeena River and the Pacific Ocean (powerpoint presentation). The teacher will show students the 13 tributary rivers/streams that are in the Watershed and indicate which ones are salmon bearing. Salmon bearing streams/rivers include Ena, Andalus, Clearwater, Scully/Schulbuckhand, Hatchery/Granite, Furlong, Blackwater, Williams, and Sockeye.

Students need to not only understand the life cycle of the salmon, but they need to understand that salmon who spawn in Lakelse River travel down their own river, then down the Skeena River finally hitting the ocean. A good way for the students to get a clear understanding of this would be to let them go up to the front of the class and trace with their finger the salmon's route of migration back and fourth.

Students should also understand what a stream needs for salmon production to occur. This information will help students make better observations when they go on their field trip to one of the salmon bearing streams.

Stakeholder Roles:

- Large Commercial Fishing Company
- Local Indigenous Fisher
- Local Recreational Fisher
- Local Professional Fish Guide
- Local Wildlife Tour Operator
- Local Small Business: Fish Tackle Shop
- Local Small Business: Fish & Chips Bistro
- Fisheries Scientist
- Regional District of Kitimat-Stikine Representative
- Department of Fisheries & Oceans Representative
- Local Conservation Organization: Lakelse Watershed Society
- Local Resident of Lakelse Lake
- Wildlife: Eagle

A template for role cards is in Appendix A.

LAKELSE SOCKEYE BACKGROUNDER

“Lax Gyels” – Tsimshian translation for fresh water mussels which refers to Lakelse Lake.

Overview of Lakelse Lake: Lakelse Lake is located approximately 10 kilometers south of Terrace on Highway #37 and lies at an elevation of 72 meters. The lake has a maximum depth of 31.7 meters and a mean depth of 8.5 meters. Its surface area is 1460 hectares and the shoreline perimeter is 26.8 kilometer. The flushing rate of Lakelse Lake is estimated to be five to six times per year. The flushing rate is a measure of time that inflow replaces the lake water volume. It is important because the longer the retention time, the less the lake has the ability to assimilate additional nutrients, and therefore avoid unnatural eutrophication. The high flushing rate of Lakelse Lake is caused by its large watershed and the high annual precipitation for the area. A large percentage of the precipitation occurs during the winter as snow, causing maximum water input during the spring and summer months.

Fisheries Values: The Lakelse Watershed possesses very high fisheries values and is one of the premier watersheds of the Skeena drainage system. It provides diverse habitat capable of sustaining sockeye, coho, pink, chum, chinook, and steelhead populations. **Earlier reports on the Lakelse watershed indicated that it supported about 35% of the total Skeena River commercial fishery catch for all species.** Steelhead, coho, and cutthroat trout support major sport fisheries.

Resident fish species present in the system include rainbow trout, cutthroat trout, Dolly Varden, bull trout, mountain whitefish, and the following coarse fish: prickly sculpin, largescale suckers, redbelt shiners, northern pike minnow, peamouth chub, and threespine stickleback. The fish community contributes to the ecology, nutrient regime and structural diversity of the drainage and provides strong cultural, economic and symbolic linkages, as well as supporting aboriginal, recreational, and commercial fisheries.

Lakelse Sockeye Salmon: Salmon are a large part of this area’s culture and community. High fishery values are based on the outstanding spawning and rearing habitat that is present. Lakelse River is a world renowned angler’s paradise with easy wading, many pools, and stretches of swift water. Lakelse Lake sockeye salmon (*Onchorhynchus nerka*) typically spawn in streams and tributaries close to the outlet of Lakelse Lake. These sockeye return to spawn in late May and early June, and stay an unusually long time in the lake before spawning. Lakelse Sockeye share migration routes and feeding habitat in the North Pacific Ocean with other sockeye salmon populations. The Lakelse Lake sockeye are killed as direct catch in terminal fisheries (where this species is specifically targeted), but more significantly, as incidental catch in fisheries where they are not the target species.

Lakelse Watershed Stewards Society has worked very hard over the last several years to promote and encourage habitat preservation, restoration, and projects related to the Lakelse Sockeye Salmon populations which are now considered by Fisheries and Oceans Canada as a species of concern. Human impacts, linear development, habitat

degradation, loss of riparian areas, and other factors have contributed to a significant decline in this stock population.

Scully Creek Sockeye Salmon Enumeration: On August 6th of 2016 an underwater camera was installed in Scully Creek to monitor the number of adult Sockeye salmon returning to spawn. In an effort to improve the previous year's methods, a fish fence was installed downstream of the camera in order to prevent the double counting of fish who may move upstream and downstream while determining where to spawn. The camera was checked weekly to back-up data and insure visibility. The footage will be viewed this winter to determine the total number of Sockeye that returned to spawn in Scully Creek.

STUDENT QUESTIONS

1. What factors can negatively affect the Lakelse sockeye stocks?

- Habitat degradation:
- Predation:
- Poaching:
- Loss of spawning areas:
- Commercial ocean by-catch:
- Stress from warm water:
- Barriers to migration:
- Competition for food:
- Lack of cooperative management:

2. What could be done to mitigate or lessen the negative effects on Lakelse sockeye stocks?

3. What factors can shift management decisions away from benefiting a biome or species?

4. What effects might unchecked human population growth in the Lakelse Watershed have on the Lakelse sockeye?

5. What effect could the events at Lakelse, human or natural, have on global environments and climate change?

STUDENT QUESTIONS AND ANSWER KEY

6. What factors can negatively affect the Lakelse sockeye stocks?

- Habitat degradation: increased use by power boats, water-skiers, and lakeside developments can cause erosion, disturbance of shorelines, diversion of streams, and fuel and septic tank pollution.
- Predation: natural predators can take fish from the fishway and its approaches
- Poaching: people may poach fish when they are vulnerable in the fishway
- Loss of spawning areas: water levels in Lakelse Lake have dropped due to increased demand for water by local area residents; gravel shoreline spawning areas are being left above water line. Salmon are competing with people for water.
- Commercial ocean by-catch: Lakelse sockeye are caught in commercial fisheries for other salmon species as they migrate with other salmon groups through the North Pacific Ocean.
- Stress from warm water: cold water can hold more dissolved oxygen than warm water; at warmer temperatures, salmon do not get enough oxygen and get stressed
- Barriers to migration: dams at the lake outlet for logging and water storage purposes and lowered water levels in the reek (due to high demand for water by local residents) connecting the lake to the sea hinders salmon's passage.
- Competition for food: from other fish species, food availability, water temperature
- Lack of cooperative management: the public, government, and environmental managers must coordinate their efforts to not further damage this species or its habitat

7. What could be done to mitigate or lessen the negative effects on Lakelse sockeye stocks?

- Policing and regulation
- Habitat enhancement work
- Reduction of water consumption
- Limitation and careful planning of property development in Lakelse Watershed
- Protection of Lakelse sockeye run during ocean migration

8. What factors can shift management decisions away from benefiting a biome or species?

- Economic pressures (e.g., businesses or industries closing)
- Interest groups that are effective at lobbying (i.e., taking a coordinated stance on a position)
- Politically motivated decisions (from various levels of government)
- Ease of keeping things the same (it's hard to begin to see and do things differently)
- Social pressures (e.g., loss of jobs from a community)

9. What effects might unchecked human population growth in the Lakelse Watershed have on the Lakelse sockeye?

- Loss of spawning habitat
- Loss of water
- Increase in water temperature
- Increased predation
- Increased pollution

10. What effect could the events at Lakelse, human or natural, have on global environments and climate change?

- Loss of species due to habitat loss
- Competition for resources
- Continued pollution will destroy habitat, increase disease, degrade quality of life for all living things
- Climate change can be accelerated by people clearing areas of trees and vegetation, using fossil fuels, paving areas, etc.

ADDITIONAL SUGGESTED DISCUSSION POINTS

- Adaptation of organisms to their biome (the Lakelse sockeye and their unique adaptations for survival in Lakelse Lake in the coastal rainforest; possible effects of human interference within the biome)
- Is there value in protecting endangered species?
- The implications of having a species listed as endangered are many. What factors influence management decisions (eg., politics, economics, other)? In the case of the Lakelse sockeye salmon, there are economic, social, biological, and recreational impacts. The Fisheries and Oceans Ministerial decision not to list the species was based on socio-economic factors.
- The effect of the Fisheries and Oceans fishway (a corridor created to enable fish to pass a barrier) and the dam on Lakelse Lake. The dam is now needed more than ever to handle reduced flows going into storage which is compounded by increased water use and global warming.
- Human impacts on the renewable and non-renewable resources of the Lakelse area, i.e., Lake water usage (not enough water passing through fishway for sockeye migrations), other species introduced to ecosystem, development along the shoreline and surrounding forests, etc.
- What happens to a resource if left unmanaged on local and global levels?
- Are there parallels between this local issue and the larger global scene?

Decision-Making Chart

The Issue
Your interests
What are your criteria?
What are some options?
Research each option
Select the best option
Evaluate

<p>Local Fish Guide</p> <p>You are a fishing guide at a local fishing lodge. Europeans and Americans come to the Skeena and rely on fish guides to enhance their fishing experience by teaching them about fishing techniques, providing gear, and showing them where the fish are biting. Lately, business is down because of fishing closures on the Skeena River. You have a</p>	<p>Local Recreational Fisher</p> <p>You do not make any money from fishing but most weekends you go fishing with your family and enjoy catching fish for family and friends. You have noticed that, since a new marine reserve was set up in the next bay, that you are catching some bigger fish again.</p>
<p>Indigenous Fisher</p> <p>You are a member of the local indigenous community (Lakelse Lake is on the traditional territory of the Tsimshian, and specifically, the local Kitselas First Nation), and your salmon fishing rights are described and protected under section 35 of the Constitution Act, 1982. You continue to fish for food and ceremonial purposes, even if there is a closure of the local fishery. Sometimes, local residents are not happy about this, but it is your right.</p>	<p>Local Conservation Group Member</p> <p>You have worked with the local conservation organization, Lakelse Watershed Stewards Society. You select only wild pacific salmon to buy in the grocery store, and ensure that fish products you buy are OceanWise. You are really concerned that Lakelse and Skeena salmon stocks are in danger.</p>
<p>Small Business Owner (Local Fish Tackle Shop)</p> <p>You run a successful business in Terrace that is popular with locals and tourists. You supply fish tackle, sell BC fishing licenses, and provide important local fishing knowledge. Your market includes local recreational fishers as well as local fish guides.</p>	<p>Small Business Owner (Local Fish & Chips Bistro)</p> <p>You run a successful business on the waterfront that is popular with locals and tourists. You used to buy fish from local fisherman but now it is cheaper to buy fish from the large company who catch their fish in the Pacific Ocean.</p>
<p>Dept of Fisheries & Oceans (DFO) Representative</p> <p>You are a DFO manager, but not a scientist. DFO manages Canada's fisheries, oceans and freshwater resources. DFO's mandate is to support economic growth in the marine and fisheries sectors, and innovation in areas such as aquaculture and biotechnology. DFO helps to ensure healthy and sustainable aquatic ecosystems through habitat protection and sound science.</p>	<p>Fisheries Scientist</p> <p>Your job is to research fish stock levels using observation, measurement and computer programs to analyse whether numbers are increasing or decreasing. You work for the federal government (DFO) as a scientific expert, but you are frustrated that your work is not always respected by the non-scientist managers at DFO.</p>

<p>Regional District of Kitimat-Stikine Representative</p> <p>You are the elected representative for the people that live in RDKS Area C (includes Lakelse Lake). The RD is the government for the unincorporated areas outside of the City of Terrace boundaries.</p>	<p>Local Resident</p> <p>You live at Lakelse Lake and enjoy swimming and walking along the beach, and fishing in the nearby rivers every now and then. You have noticed that there isn't as much fish, and the fish that you do catch is much smaller. fed</p>
<p>Local Wildlife Tour Operator</p> <p>Your company runs seasonal daily tours for tourists. You point out grizzly bears, sea lions, eagles and other wildlife that you see along the way. In the past, you also used to run fishing tours but had to stop that because customers were not happy with the amount they were catching.</p>	<p>Large Commercial Fishing Company</p> <p>Your company is responsible for a fleet of 5 large boats and a staff of over 100. You have always caught a lot of fish and have spent a lot of money this year on new equipment to track and catch more fish. Your company is based in Vancouver.</p>
<p>Eagle</p> <p>You are an adult eagle, a large seabird that feeds on fish, squid and krill. You have a chick in a nest so you spend your time out looking for food to bring back to your chick. Each year, you are finding it more difficult to catch enough fish.</p>	

ADDITIONAL RESOURCES

WEBSITES

- **Lesson Plan: Difficult Decisions: The Sakinaw Sockeye Case Study** (Department of Fisheries and Oceans' Stream to Sea Program) – An exercise in consensus decision-making through role playing that enables students to devise a solution for managing dwindling Sakinaw sockeye salmon stocks. <https://www.pac.dfo-mpo.gc.ca/education/lessonplans-lecons/sakinaw-eng.html>
- **Table Talk – A Learning Resource for the Study of Land and Water Allocations in British Columbia.** This learning resource includes a teacher's guide and thirty-three student booklets and is designed to teach decision-making skills especially as they relate to land-use conflict. Students participate in simulations, taking on the roles of people who represent different sectors or interest groups (forestry, settlement, tourism and recreation, fishing, agriculture, mining and conservation). Working together they plan the future land-use and water use in Pangea River Valley, a hypothetical area in British Columbia. All background information is based on accurate BC statistics. The package also includes short units on watersheds, plays and two short videos entitled "Snapshots" and "Connections". Published 1996. 850 pages.
www.pac.dfo-mpo.gc.ca/education/docs/table-talk-menus-propos-eng.pdf
- **Species at Risk Act (SARA).** www.sararegistry.gc.ca
- **Committee on the Status of Endangered Wildlife in Canada (COSEWIC).**
www.cosewic.ca
- **Lakelse Watershed Stewards Society.** The Lakelse Watershed Stewards Society is a volunteer, non-profit organization which was formed in 2002. The Society collaboratively works on issues affecting the Lake and its surrounding watershed with partners such as BC Ministry of Environment, BC Parks, Fisheries and Oceans Canada, and others. www.lakelsewatershedsociety.com.

ADDITIONAL HANDOUTS

- **Lakelse Watershed Map** – Contact the SkeenaWild Office at 250-638-0998