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...in the classroom

Science 7:
Fish Monitoring

Indigenous Knowledge Lesson Plan

Local and Traditional Knowledge in Watershed Governance
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Science 7: Fish Monitoring

RATIONAL OF CURRICULUM CONNECTIONS

This lesson meets cross-curricular outcomes for Science 7, Social Studies 7, and English Language Arts 7. Students will learn the significant relationship between humans and the ecosystems in the circumpolar region, including the consequences of human activities on the environment and how to monitor those changes. They will also write a persuasive letter explaining their position on an environmental issue.

SCIENCE 7
Unit A: Interactions and Ecosystems (Social and Environmental Emphasis)

Focusing Questions: How do human activities affect ecosystems? What methods can we use to observe and monitor changes in ecosystems, and assess the impacts of our actions?

- Monitor a local environment, and assess the impacts of environmental factors on the growth, health and reproduction of organisms in that environment
    - Investigate a variety of habitats, and describe and interpret distribution patterns of living things found in those habitats (e.g., describe and compare two areas within the school grounds—a relatively undisturbed site and a site that has been affected by heavy use);
    - Investigate and interpret evidence of interaction and change (e.g., population fluctuations, changes in weather, availability of food or introduction of new species into an ecosystem)

Skills: Initiating and Planning

Students will: Ask questions about the relationships between and among observable variables, and plan investigations to address those questions.

- Identify questions to investigate arising from practical problems and issues (e.g., identify questions, such as: "What effects would an urban or industrial development have on a nearby forest or farming community?")
- State a prediction and a hypothesis based on background information or an observed pattern of events (e.g., predict changes in the population of an organism if factor X were increased, or if a species were introduced or removed from the ecosystem; propose factors that will affect the population of a given animal species)

Attitudes: Mutual Respect

Students will be encouraged to: Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., show awareness of and respect for aboriginal perspectives on the link between humans and the environment).

Cover Photo: Wild caught Rainbow Trout
Photo Credit: Patrick Boucher

SOCIAL STUDIES 7

Communication Skills: Explain circumpolar issues by writing and speaking about them.

Common Learning Experiences: Students should be able to write a letter to express a point of view regarding a circumpolar issue.

ENGLISH LANGUAGE ARTS 7

General Outcomes: Students will listen, speak, read, write, view and represent to clarify and enhance oral, written and visual forms of communication, through a process.

- Use appropriate form and genre to organize ideas and information for a particular audience and purpose.
- Applies understanding of elements of narrative texts when creating oral, print, and other media texts.

PURPOSE

Students will learn the significant relationship between humans and the ecosystems of which they are part, including the consequences of human activities on the environment and how to monitor those changes. This lesson shares several excerpts from the Tracking Change reports that includes quotes from Elders, land users and community members on indicators of fish health.

Teacher Resources

- Mikisew Cree First Nation community-based fish monitoring video [17:07] https://www.youtube.com/watch?time_continue=5&v=ybx5tNbFjXU&feature=emb_title
- Makenzie River Basin (location and introduction): http://www.trackingchange.ca/river-basins/mackenzie/
- This lesson is based on research from Tracking Change: Local and Traditional Knowledge in Watershed Governance: http://www.trackingchange.ca/.

Materials Needed

- Computer and projector to display short film on Mikisew Cree First Nation community-based fish monitoring program.
- Copies of "Mikisew Cree First Nation Community-Based Monitoring Viewing Guide"
- Copies of "Venn Diagram Comparison" handout

- Copies of case studies handouts:
  - Dehcho Area Case Study
  - Akaitcho Area Case Study
  - Deline/Sahtu Area Case Study
- Copies of "Persuasive Letter: A Gold Mine in Your Community" handout
- Copies of "Tracking Change's Indicators of Fish Health Survey" worksheet (for Extension activity)

INTRODUCTION

Human societies are a major part of their local ecosystems, and human activities have both direct and indirect impacts on those ecosystems. One of these impacts is on fish habitat, health, and population - including the fish human beings rely on for food. This lesson introduces students to the concept of fish monitoring through Indigenous knowledge systems, the indicators of fish health used, and how to monitor fish habitat, health, and populations.

Key questions for student inquiry:

- How can I know if the fish in my community are healthy to eat? What are some of the ways changes to fish health is being monitored?

LESSON PLAN PROPER

- **Location:** In classroom, with an on-the-land extension
- **Length of activity:** 135 minutes / 3 class periods [1.5 class periods periods for video and introduction, and 1.5 class periods for letter writing] (plus an optional extension)]
- **Activating Strategies:**
  - *Introduction.* Human activities within the local environment, as well as global climate change, are impacting the habitat, health, and population of the fish in the Mackenzie River Basin. These changes have significant impacts on the lives of the people who live in this region. After all, humans are part of their ecosystems - shaping and being shaped by the environment around them.
    - Show the short film about Mikisew Cree First Nation's community-based fish monitoring program. The video gives insight to community approaches to monitoring, including the use of Indigenous knowledge and western science at Fish Camps, and the role of youth in monitoring.
      - While they view the film, have students take notes using the "Misikew Cree First Nation - Viewing Guide" handout (attached).
- **Learning Experiences:**
  - *Individual or Group Activity.* Indigenous knowledge of indicators of fish health

in the Mackenzie River Basin.

- Divide students into groups of three.
- Introduce the handouts, "Dehcho Area Case Study," "Akaitcho Area Case Study," and "Deline/Sahtu Area Case Study," which provide excerpts from Indigenous knowledge holders about fish monitoring in their regions. These excerpts were gathered as part of a research project called Tracking Change to understand local people's knowledge of changes to the fish. As you learned, many changes are due to human impacts on the environment, including climate change, mines, and hydro dams.
- Conduct a jigsaw to assist the students in working through the case studies.
    - Introduce the "Venn Diagram Comparison" hand out. Explain that each small group of three will be working together to complete this handout.
    - Assign a different case study to each student in every group of three. Explain that each individual will be responsible to understand the case study and be able to explain it to the group members to complete the Venn Diagram comparison.
    - Reconfigure the groups so that students who are reading each case study are working together (i.e. all of the students reading the "Dehcho Area Case Study" will read and discuss the case study together). Have the students read the case studies and respond to the six questions in Part One of the "Venn Diagram Comparison" handout as they read.
    - Return students to their original groups of three. The students will now work together to complete the Venn diagram for Part Two of the handout, sharing knowledge with one another from their case studies. When they are finished, have groups consider the questions in Part Three.
    - Discuss the questions in Part Three as a class, sharing specific evidence from the case studies.
- Option: collect group Venn diagrams for assessment.

CONCLUSION/REFLECTION

- *Individual Response:* In this activity, students will apply their learning to an imagined situation in their own community.
    - Distribute the handout, "Persuasive Letter: A Gold Mine in Your Community" and go through the assignment together as a class.
- **Extension:**

- *Land-based fish monitoring.* Take students out on the land, ideally with an Elder and/or fisher, to get firsthand experience assessing the health of fish in a local body of water.
- In advance of the excursion, get students to brainstorm the types of stories or experiences they would like the Elder and/or fisher to share with the group. Questions might include: "why is the water important?", "what is your earliest memory of fishing?", or "what should youth learn about the land?"
- Students will use "Tracking Change's Indicators of Fish Health Survey" to learn about fish health from the knowledge holders and make their own observations. Have students complete the surveys individually or in small groups.
- Once back in the classroom, discuss the land-based activity together as a class. Ask students to speak about their reactions to listening to the knowledge holder, things they were surprised to discover through the survey, and ways they may use what they learned to improve their communities.

INDIGENOUS LANGUAGES - WORD BANK

Indigenous knowledge of the land is interwoven with language. The following are key terms in northern languages that are directly related to this lesson. Following the NWT's whole-school approach to language learning, we recommend bringing these terms into the science classroom, according to the language(s) spoken in your community. In this way, it is possible to provide students with a holistic understanding of the land, language, and culture in ways that support their own identities.

> *To use any of the Northern Indigenous languages fluently means that the speaker observes and interacts with their environment. They are relational languages. The connection between the speaker, their actions and the environment speaks to a worldview where relationships are important – relationships with self, others, the land and one's spirituality* - Our Languages, 2020, p. 5

We encourage collaboration with language teachers where available to support student learning. A few ideas to bring northern languages into science classrooms include:

- Creating classroom displays that highlight terms from this list using diagrams, photographs, artwork, and/or definitions.
- As a teacher, using these words in conjunction with or in place of English words throughout the lesson (and others) where possible.
- Encouraging students to incorporate these terms into written and oral components of this lesson (and others).
- Discussing with students how the precision of some of these words is linked with Indigenous knowledge of the land.
- Incorporating terms into a game/activity/lab assignment to make language learning fun.

Source: https://www.ece.gov.nt.ca/sites/ece/files/resources/our_languages_curriculum_2020_low_res.pdf

TRADITIONAL WORDS					
English	**Tsaat'ine tthadeh/ Dene (Beaver or xe'ghont'e)**	**Sahtúǫt'ıne/ Dene (Slavey or Kaguntu)**	**Nēhiyawēwin/ Cree**	**Dinjii Zhu' Ginjik/ Gwich'in**	**Inuvialuktun/ Inuvialuit**
Fish	ługe	łue	Pastew Sîpîsis	Łuk	Iqaluk
Fish that are new to this area (invasive)	ługe edu jǫ wotsin	Echue gotsi łue	môya ohci ôta kinosêw	Łuk k'eejit	Iqaluk
Fish liver	ługe tthhe'	łuethhe'	kinosê-wôskwan	Łuk dhat	Tinguk
Fish heart	ługe dze'	łue dzae	kinosêwohtî	Łuk drìi'	Uumman
Fish head	ługe tthi'	łue tthii	kinosê-wôstikowân	Łuk chì'	Iqaluk
Fish stomach	ługe beh	łue mbe'	kinosêwatay	Ets'igo-ghòo'	Iqaluk
Bad intestine	ługe tlessi edu uujo	łue ts'ié dzo'on'te	mâyâ-cimitakisiya	Its'ik iizuu	No Translation
Healthy	Uujǫ ghedii	Nezu ǫte'	maska-wâtisiwin	Srìi gwandaii	Surraituq
Healthy, in good shape, its not changed	ługe uujo onte uh edu echaonte'	Nezu ont'e uh edu nadeno'ile	miyo-mahcihew	Srìi gwandaii, ejùk t'iinch'uh kwàh	Surraituq
Fish that is conta-minated	ługe mbeta woli atiin	łue beta dzont'e	apiscipô kinosêw	Ejiich'ii iizuu k'iighè' łuk tagwiniin dhat	Iqaluk

Skinny Fish	ługe gonaa	łue ghela'	sihkaciw kinosêw	Łuk ts'ik	Amittuq Iqaluk
Sound of ice breaking up in spring	E'teni ya'itu'ii adii	Te tadetų'	kasekwahk pêhtâwihk maskwamiy epîkopayt	Tan dhatràih	Siquqpa-luktuaq
Rotten fish	ługe ghejį	Ghejide łue	pikiskatew kinosêw	Łuk ahjat	Tibliqtuaq Iqaluk
Fish Liver that looks bad	ługe thhe' edu uujǫ mbe odatii	łue thhe'-nezu'ile	misi-wanâtanah ôskwana kinosêw	Łuk dhàt iizuu vigwid eech'in	Iqaluk
Spots on Fish	ługe k'e denditessi thela	łue k'e goli thela	imisinâsôt kinosêw	Łuk kak gijuudlii	Iqaluk
Cyst	ługe dedihe'	łue dedihii' / eyah	akosi-wpiskayow kinosêw	Chuundał	No Translation
Worms in the Stomach	ługe beh t'a tehtsa woli	łue membe'ta gu'woli	manchosahk ehayawak watayihk	Ets'-igoghoo zhìt gyuu	Qupilruyuak
Bugs in the Fish	ługe tah tehtsa aati	łue met'a tehtsa ati	kinosê-wôtayihk ehayawak manchosahk	Łuk zhìt gwitł'ak	Iqaluk
Fish with large heads but really skinny bodies	ługe tthicho uwh mbe gona	łue gona ih' me thhi cho	mîyay	Łuk vichi' nichii gòo jidìi ts'ik nilih	Iqaluk angiyuk naiquk, amittuq kuyapig
Catching fish for food	ługe tsetthi ghada'e't'se ah'	łue tse'kahi gha mbe'-tsande'	nakwatat kinosêw mîcôn oschi	Etr'ihee'aa eenjit łuk katr'idi'inh	Iqalliyuaq
Fishing place, fishing spot	Da'etse'ahi k'e	Da'etse'ahi k'e	nôciki-nose-wewinohk	Łuk katr'idi'ii k'it	Iqalukmi

Fish nets	ługe mih'	Łue mila	ahyapiyak	Chihvyah	Kubyaq
Ice Fishing	E'ten k'e da etse'ah	Te k'e łue ka'atsetii	mikk-wamihk ka kwâsk-wepicikehk	Łuu t'eh łuk katr'idi'inh	No Translation Available
Old, Large Fish	ługe ti	łue cho	misti-kayâsi-kinosêw	Łuk nichii	Utuqqaq Angiyuq Iqaluk
Young, Small Fish	ługea'	ługea'	apisîsit kinosîs	Ineelu'	Nutaaq mikiyuk Iqaluk
Juvenile Fish (baby fish)	łuh'a	łuha	kinosêwkos	Łuk zhuu	Nutaaq Iqaluk

Keywords: river, fish, community based monitoring

Themes: traditional knowledge, community, livelihood, ecosystem shift

Student Handout: Mikisew Cree First Nation Video Worksheet

NAME _____ **DATE** _____

You are about to watch a video about efforts to include fish health as part of Mikisew Cree First Nation's community-based monitoring program. This began with a "Whitefish Camp" in September 2018 to share knowledge and develop processes for the community monitoring project. As you watch, write notes about the film based on the questions below

Community-based monitoring is when environmental monitoring is driven by community values and directly serves local needs.

Answer the following on a seperate piece of paper:

1. What are two causes of change that MCFN is observing in the water?

2. One group of monitors set "Index Gill" nets based on the Traditional Knowledge of Elders. How did they measure the mesh size of the net? Why did the group want to test fish of different sizes?

3. What tests/measurements do the scientists/fishers/students do to gather information about the fish? (List at least 5).

4. What is the limitation of doing research only with western scientists?

5. Elder Terry Marten said she was happy that youth attended the camp. What 2 reasons did she give for being glad they were there?

Student Handout: Venn Diagram Comparison

NAME _____ **DATE** _____

Consider the excerpt and quotes regarding fish health in the three case studies provided; the Dehcho Area Case Study, the Akaitcho Area Case Study, and the Deline/Sahtu Area Case Study.

Part One: Read your assigned case study and consider these questions in understanding fish health by responding to the following questions. When you are finished, compare your case study with the other case studies by comparing the responses to these questions (circle one):

1. Is the meat of the fish sometimes softer, especially in the summer? (Yes/No)
2. Do they mention if there is any discoloration in the organs of the fish? (Yes/No)
3. Do they mention if there is less fat or around the organs of the fish? (Yes/No)

4. Was there an issue with the stomach of the fish? If so, what was the issue?

5. Was there an issue with the size of the fish? If so, what was the issue?

6. Did they mention if the fish had an of the following (circle all that apply):

SORES	LUMPS	WHITE SPOTS
SCARS	SCABS	TUMOURS
WEIRD GROWTHS		PARASITES

Part Two: Using the evidence from the case studies and the different fish health indicator questions above, compare all three case studies in a three circle Venn Diagram, and be clear which circle is for which case study.

Part Three: Once you have completed the Venn diagram, on a separate spare piece of paper write down your predictions as to:

Compare your findings with the rest of the class as a group

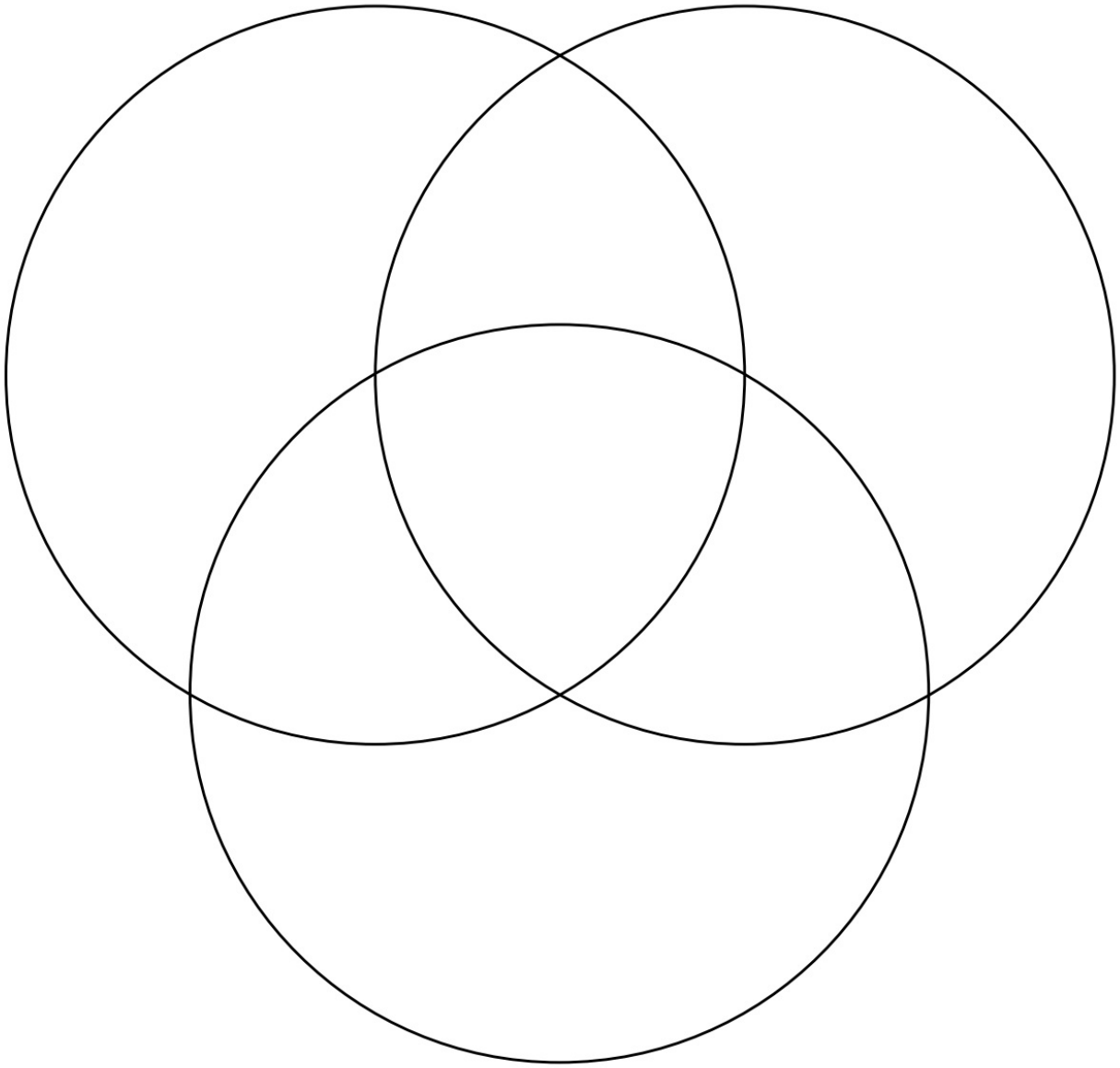
1. Why there are similarities and differences in fish health in different communities?
2. How these changes in fish health impact the people in the communities?

Student Handout: Venn Diagram Comparison

NAME _____ **DATE** _____

Venn Diagram for Part 2: Using the evidence from the case studies and the different fish health indicator questions above, compare all three case studies in a three circle Venn Diagram, and be clear which circle is for which case study.

TITLE: _____



Student Handout: Decho Area Case Study

ISSUE DESCRIPTION

People in the Dehcho area are concerned about the changes in the health of the fish populations, as fish seem to be becoming less healthy. People have noticed changes to the consistency (feeling/texture) of fish flesh and organs such as the liver. They have also noticed changes in the size of the fish. These people explain the health of the fish in ways that can be easily understood and that utilizes their traditional knowledge. Paying attention to changes in fish health and communicating these changes clearly is important to a community that relies upon fish as a source of food.

Below are some excerpts from some local reports about the different concerns about the fish health in the Dehcho area collected by a research project called Tracking Change. As you read, keep in mind the different ways in which these people notice changes in fish health. What are some indicators they use to talk about the health of the fish? Could these same indicators be used in your area in order to understand fish health where you live?

CHANGES IN THE HEALTH OF FISH POPULATIONS

Several participants described changes in the consistency of fish's flesh, particularly in the summertime. They said the fish flesh was changing because the water is warmer than it used to be.

Map of Decho Region
Photo Credit: Wikipedia https://en.wikipedia.org/wiki/Dehcho_

"The water is shallower, and warmer and the fish can't go down to deep, cold water" explained one person, *"In the winter the flesh is okay. Cli Lake has good fish—it is deep and cold."*

Another person explained that these unhealthy fish will come in waves or batches. Sometimes fish stomachs are hard like bone. Other times they are so soft you can push your thumb through it.

Biological Indicators are plants or animals that can tell us about the health of an ecosystem. For example, Fish are biological indicators. If we do not see fish in certain areas, that could mean they are unable to migrate due to issues with the water system.

Several people noted incidences of others catching unhealthy fish over the years, including skinnier fish, fish with less fat, fish with a unhealthy colour liver or stomach, or fish not looking healthy enough to eat. Others mentioned sores on the fish.

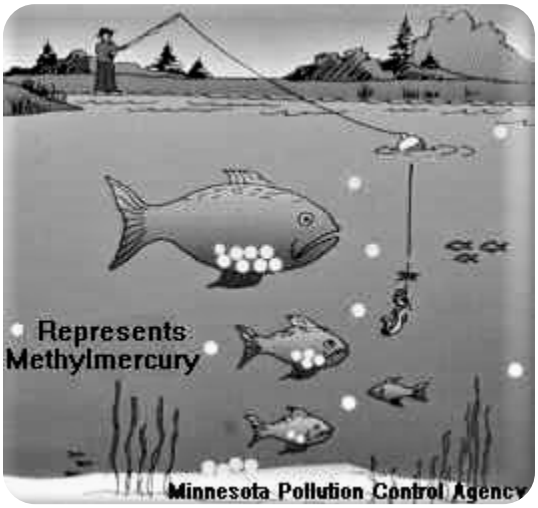
> *[T]here have been instances where people have caught fish where the fish wouldn't even be considered [to be] eaten because of either the way it looked- where it didn't look as healthy as that fish we caught in August. The pickerel, it would have like a skinnier body and not as much meat as a healthy fish would. People see these things.* - Dehcho K'ehodi Program participant

Several participants described using the fish's liver to determine the health of the fish. "If it is red, it is no good" one said. *"White livers are healthy. The fish will tell you what state your water is in."*

One person reported that the community was encouraged not to eat too many of the types of fish from the area known to have high levels of mercury.

> *In the Deh Cho, the land that we live[in] is like the bread and butter for us, because it clothes us and it feeds us and it heats us.... we're really worried about it because when we did studies on the water and the fish we saw a lot of mercury. But even the scientists today say, what is contributing to the mercury in the fish? Is it the climate change, is it the permafrost thawing? They're still figuring it out.* - Dehcho K'ehodi Program participant

Generally, participants were particularly concerned about fish health in the Mackenzie. When asked where to find the healthiest fish, one answered, *"Not the Mackenzie River for sure. Every fish caught in the Mackenzie have sores."*



Mercury is a naturally occurring element that is **toxic** to humans, causing serious health problems. People are mainly exposed to mercury by eating fish that contain mercury. It is released into the ecosystem as permafrost melts due to climate change, by burning coal, and after it has been used in mines to extract metals like gold. Fish are **exposed** to mercury through the water and mercury levels get higher further up the food chain. This is because larger fish eat lots of smaller fish, and end up consuming their mercury. The same thing happens when humans eat the larger fish that have already eaten the smaller ones- **we consume all the mercury in the fish!**

Image: Visual representation of how Methylmercury impacts fish
Photo Credit: Minnesota Pollution Control Agency https://people.uwec.edu/piercech/Hg/mercury_water/fish.htm

Student Handout: Akaitcho Area Case Study

ISSUE DESCRIPTION

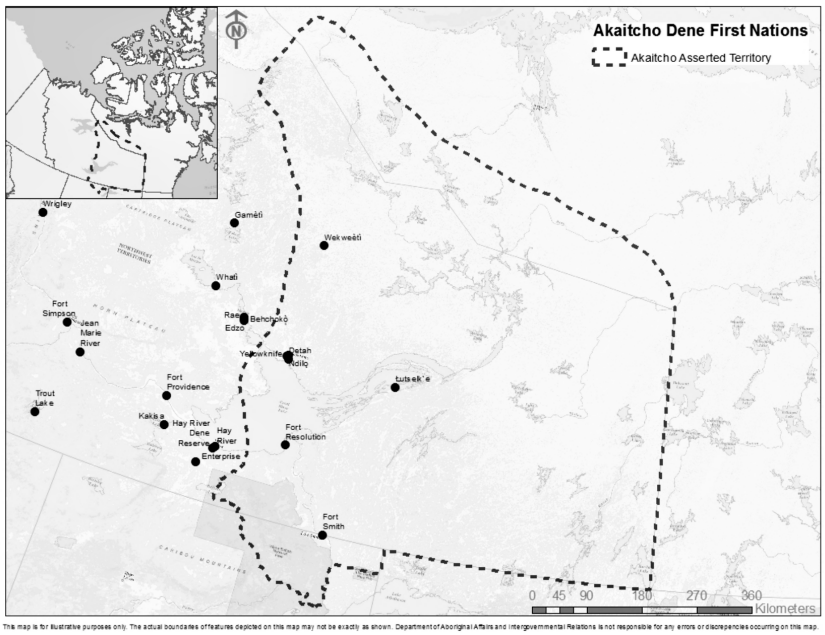
Throughout the Akaitcho area there are many concerns about the health of the fish. Many people in the Akaitcho area have noted changes in the health of fish populations compared to the past. Some of the changes in fish health include changes in the consistency of the liver and flesh, the size of the fish, as well as unusual growths on the fish. In order to explain these changes in fish health to others, the Dene people explain the changes in a simple and easy to understand manner by drawing on their traditional knowledge of the issue.

Below are some excerpts and quotes from some of the Tracking Change Reports about the different concerns about the health of the fish in the Akaitcho area. As you read, keep in mind the different ways in which they notice the change in fish health. What indicators did they use to talk about the health of the fish? Could these same indicators be used in your area in order to understand fish health where you live?

CHANGES IN THE HEALTH OF FISH POPULATIONS

In the Yellowknife area, there are far fewer people fishing today as a result of urban development and significant mining activity (e.g. gold mining at Giant Mine), which have taken place over the last 100 years. Concerns about contamination of the fish with arsenic, mercury, and related toxins from the Giant Mine are a source of anxiety in that region.

The Yellowknives Dene First Nations have been very involved in various research projects and consultations regarding the impacts of the Giant Mine on their health, culture, and livelihood. People are also wary about the impacts of other mines. In general, people believed that where there are mines the fish are unhealthy and *where there are no mines the fish are healthy (*Yellowknives Dene First Nation Elder).



This map is for illustrative purposes only. The actual boundaries of features depicted on this map may not be exactly as shown. Department of Aboriginal Affairs and Intergovernmental Relations is not responsible for any errors or discrepancies occurring on this map.

Map of Akaitcho Region

Check it out! The map to the left should the Akaitcho Region in relaton to the rest of Canada!

Photo Credit: Government of the Northwest Territories https://www.eia.gov.nt.ca/en/priorities/concluding-and-implementing-land-claim-and-self-government-agreements/akaitcho-dene-first

Arsenic is commonly used in industrial processes, including mining. It is highly toxic to humans, causing cancer, skin lesions, and other health problems. Humans are exposed to arsenic through water systems, mostly through drinking water, food preparation, and irrigation of food crops.

Fish with big heads and skinny bodies are of particular concern in the east arm of Great Slave Lake. Some fishers of Lutsel K'e Dene First Nation have observed: *"The fish is different, skinny fish, the way they are growing is not the same, big head small tail, crooked fish, not straight, that's what [we've] seen."*

Great Slave Lake fish are comparatively better than the fish in some other lakes, such as Stark Lake and Nonacho Lake. In Nonacho Lake, there are *"lots of sick fish, the colours are different, they're blacker,"* according to elders from the Lutsel K'e Dene First Nation. These are problems attributed to the Talston River Hydro project, which was built to power the nearby Pine Point mine back in 1965. The dam flooded many areas and caused mercury poisoning of Nonacho Lake. As one person described:

> *Fish with flesh sores are being observed in the south of the lake and from the river, while fish with skinny bodies and big heads, small tails, or crooked fish have been observed in the east arm. Mercury is a serious concern in the larger fish from certain areas around the lake.*

People near Yellowknife notice that the fish are becoming soft. Some attribute this to warming water temperatures, while others link changes in the fish to mining in the area. In order to address this problem, people from Yellowknives Dene First Nations have to travel further away to fish in deep, cold water where healthy fish live.

Loche are among the fish that provide people with knowledge about changes in the health of the water. Changes in climate or water temperature may be leading loche to spawn (lay eggs) at different times than in previous years. Some fishers from Deninu Kue have observed that the loche eggs are not ready *("they are still white")* when they should be ready. In the Deninu Kue area and around Yellowknife people report catching more loche with sores and with odd coloured livers.

Giant Mine Remidiation Project
Photo Credit: Kevin O'Reilly

Student Handout: Délınę / Sahtu Area Case Study

ISSUE DESCRIPTION

Délınę is a Dene community with a population of roughly six hundred. It is a part of the Sahtú region. It is the only community on the shores of the Great Bear Lake which straddles the Arctic Circle. Many of the households in the community rely on fishing in some way for their livelihood. Fishing is critical for the community's subsistence, culture, and well-being. People not only eat the fish and share it throughout the community, but many daily activities involve fishing. For instance, people spend time fishing using hook and line methods, setting nets, preparing fish, and smoking fish to make dry fish. There are several concerns regarding the health of the fish, due to changes in fish that community members have noticed over the years.

Below are some excerpts about the different fish health concerns in the Délınę area collected by a research project called Tracking Change. As you read, keep in mind the different ways in which these people notice changes in fish health. What are some indicators they use to note changes in the health of the fish? Could these same indicators be used in your area in order to understand fish health where you live?

CHANGES IN THE HEALTH OF FISH POPULATIONS

Youth, Elders, and other community members from the Sahtú region met together with university researchers in a cross-cultural camp to discuss fishing livelihoods, changing water and climate, impacts on fish, subsistence harvesting, and community well-being. Following the camp, researchers interviewed many of the camp members to hear more about these topics. The people interviewed shared a wealth of knowledge regarding the different fishing practices and their harvesting travels over time.

Many people in the region still actively harvest fish, particularly lake trout, whitefish, and herring or cisco. The fishing practices and preferred fish for eating vary between families in the community. Seasons also impact which fish are eaten and how many.

Délınę Fish Camp
Photo Credit: Chelsea Martin

Some people have noted that herring numbers have decreased. One person believes this decline in herring is due to a new winter road, which goes right over the fishing grounds. Another person noted that despite an abundance of fish, there are some areas where the fish are considered unsafe to eat.

> *"There are pickerel and whitefish and jackfish and trout [in Lac Saint Therese]. But they told us not to eat too much from there. Why? Well, its got lots of minerals in there. Yeah, and mercury."*

Unusual species have also been noted in the area. For instance, people have caught both salmon and char in recent years, though they were never seen in this region in the past.

People have noticed that the fish in the area are getting skinnier, and that there are tumors or growths in the stomachs of fish. The fish with the tumours were from the Russell Bay area where mining has contaminated the water. Others have noticed changes on the outside of the fish. For example, one person observed that the jaw of trout seemed to change:

> *"One year - trout they changed – their jaw changed... Probably it's got something to do with lots of radiation, lots of uranium, lead from Port Radium."*

Port Radium is a mine on the south eastern shores of Great Bear Lake that produced uranium from 1933 to 1960. The site was again active from 1964 to 1982, producing silver.

Délınę Fish Harvest at a Camp in the Sahtu Region
Photo Credit: Chelsea Martin

Student Handout: Tracking Change's Indicators of Fish Health Survey

NAME _____ **DATE** _____

Surveys are a useful way to gain information about a topic of interest. Today, many surveys are completed online, although it is still common to complete surveys in person. It is best to consider which format is most accessible for the respondents.

This survey was created using indicators of fish health that were identified through several projects in communities across the Mackenzie River Basin. These indicators are based on Elder's knowledge and fishers' observations about the health of fish and water, as well as changes that have happened overtime.

Use this survey to learn from Elders and land users about the health of fish in your community. Start by asking an Elder or land user if they have time to speak with you about fish health. Ideally this survey is completed while on-the-land so you can take photos and make observations about fish health yourself. Alternatively, you can complete the survey in your community.

See what you can discover about the aquatic ecosystems in your region.

Part A: General Information

Name	
Date	
Interviewee/ Knowledge Holder	
Community	
Province/ Territory	
Fish Type(s)	
Location of Fish	

Student Handout: Tracking Change's Indicators of Fish Health Survey

Part B: Indicator Questions

1. What type of fish species is found in your area?

2. Which of these fish species do you eat for food? How do you eat it (dried fish, fried fish, etc.)?

3. Have you noticed if the meat of the fish is sometimes softer during the summer (circle one)?

YES NO

4. Why might the meat of the fish be softer in the summer? What is softer flesh a sign of?

5. Is there any discolour on the organs of the fish?

YES NO

If “Yes” please explain. What was the colour? Which organ was discoloured? What might this be a sign of?

6. Is the stomach very hard to the touch?

YES NO

7. What does it mean if the stomach is hard to the touch and you cannot push your finger through it?

8. Have you noticed one or more of the following things on the body of the fish (circle all that apply)?

SORES	LUMPS	WHITE SPOTS
SCARS	SCABS	TUMOURS
WEIRD GROWTHS		PARASITES

Other (Please specify below):

9, Is the fish skinnier than you would expect?

YES NO

Explain. How would you describe the size of the fish? Does the size of the fish seem healthy and normal or unhealthy and weird? Etc.

10. Have you noticed an increase in one or more of the following species in your area (circle all that apply)?

CHAR CHUM SALMON SALMON

Other (Please specify below):

11. Explain. Is this species unusual to have in your area? Has this type of fish been caught in your area before? How often was it caught in the past? How often is it caught now? Etc.

12. Is there any mining or development in your area that is a cause for concern?

YES NO

If 'Yes' then please explain why and the name of the cause for concern.

13. Any additional notes that should be noted about the fish that may be important?

Student Handout: Persuasive Letter A Gold-Mine in Your Community

Imagine a company came to your community to propose that a new gold mine be built. This mine will bring jobs and money to your community. The community leaders are considering the mine, but you are worried there are things they have not thought about. Based on the case studies you read about the Dehcho, Délınę/Sahtu, and Akaitcho, write a speech or letter for your community leaders that includes the following:

What concerns do you have for the health of your community if this gold mine is built nearby? Why do you have these concerns (give reasons/evidence)?

Who should the leaders talk to (in your community and/or in other places) in order to find out more about how the mine might impact community health, water, and food sources?

Writing a Persuasive Letter:

A persuasive letter expresses an opinion about a particular subject. It is written to convince the audience to think a particular way and/or take action.

- engages the reader in the first paragraph (has a good lead)
- expresses the situation clearly
- shows thorough knowledge of the situation and evidence
- responds to the reader's anticipated point of view
- provides specific details to support the writer's opinion
- develops ideas through a logical sequencing of information
- states clearly the outcome the writer desires with suggestions for implementation
- leaves the reader with a vision of why the action desired would be beneficial
- follows business or friendly letter format, depending on the audience

[Adapted from Ms. D's Language Arts https://sites.google.com/site/msdslanguagearts/grade-7-standards-by-quarter/persuasive-writing-grade-7]

Student Handout: Outline
Planning a Persuasive Letter

Try your best to follow this format when writing your letter:

Topic:

_____

_____

Recipient's Address:

_____

_____

_____

_____

Author's Address:

_____

_____

_____

_____

Greeting and Opinion:

_____

_____

Argument/Concern #1:

_____

_____

Student Handout: Outline
Planning a Persuasive Letter

Supporting Evidence for Argument/Concern #1:

Argument/Concern #2:

Supporting Evidence for Argument/Concern #2:

Recommendation for Action (including who the leaders should talk to):

Closing Statement:

Signature: