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...in the classroom

Experiential Science 30: **Freshwater Ecology**

Indigenous Knowledge Lesson Plan

Local and Traditional Knowledge in Watershed Governance
www.trackingchange.ca

Experiential Science 30: Freshwater Ecology

UNIT 3: FRESHWATER ECOLOGY

Purpose

Indigenous peoples in the Mackenzie River basin have been gathering and passing on information about fish populations for generations. This knowledge is key to the livelihoods of communities throughout the Mackenzie River basin. In this lesson, students will conduct fieldwork that is rooted in Indigenous knowledge and on-the-land experience.

Focusing Questions: How can the study of freshwater ecology broaden our understanding of this environment and ensure a sustainable future?

- Students will gain an understanding of aquatic flora and fauna by conducting a series of field studies to investigate and collect data from a study plot for **fish and water birds** to:
 - i. Apply various recognized sampling techniques to document population data and catalogue samples
 - ii. Conduct field and laboratory exercises to identify types of fish and aquatic birds and their distribution (seasonal)
 - iii. Estimate the relative population of species in the study plot
 - iv. Catalogue the diversity and population density of species to acquire baseline/long-term data

Skill Outcomes (focus on scientific inquiry)

Initiating and Planning

- i. Identify questions and investigate
- ii. Evaluate and select appropriate procedures and instruments for collecting evidence and information, using recognized sampling procedures and protocols

Performing and Recording

- iii. Carry out procedures, controlling the major variables, and adapt or extend procedures, if needed
- iv. Organize and integrate data using a format that is appropriate to the task or experiment

Analyzing and Interpreting

- v. Compile and display results by hand or computer, using a variety of formats.

- vi. Interpret patterns and trends in data, and infer and calculate linear and nonlinear relationships among variables.
- vii. Identify and explain sources of error; and evaluate the relevance, reliability and adequacy of data and data collection methods
- viii. State a conclusion, based on experimental data and explain how the evidence gathered supports or refutes a hypothesis, prediction or theory.

Communication and Teamwork

- ix. Select and use appropriate numeric, symbolic, graphical and linguistic modes of representation to communicate findings and conclusions.

Extension Outcome

Students will gain an understanding of careers and occupations related to freshwater ecology by researching and preparing a career and occupational profile related to freshwater ecology for positions available in the NWT and across Canada.

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
- Elders in Schools Handbook (NWT): https://www.ntassembly.ca/sites/assembly/files/13-06-3td_84-174.pdf
- Mackenzie River Basin (location and introduction): <http://www.trackingchange.ca/river-basins/mackenzie/>
- GNWT Environment and Natural Resources website: <https://www.enr.gov.nt.ca/en>
- Programs and services page: <https://www.enr.gov.nt.ca/en/service-categories>
- Report Something page: <https://www.enr.gov.nt.ca/en/report-something>
- Regional offices: <https://www.enr.gov.nt.ca/en/regional-offices>
- This lesson is based on research from Tracking Change: Local and Traditional Knowledge in Watershed Governance: <http://www.trackingchange.ca/>

Materials Needed

- Projector and speakers to display Mikisew Cree First Nation community-based fish monitoring video [17:07] https://www.youtube.com/watch?time_continue=5&v=ybx5tNbFjXU&feature=emb_title
- Copies of "Mikisew Cree First Nation - Viewing Guide"
- Copies of "Indigenous Knowledge and Fish Monitoring"
- Tracking Change: Indicators of Fish Health Survey Worksheet
- Student Handout: Field Studies Instructions (attached)
- Extension: Copies of "Community Based Monitoring - Career Profile"
- Computer(s) to view network data

INTRODUCTION

Fish are an important part of many people's diets. Having reliable access to fish in a nearby waterway is an important part of a community's ability to supply this food resource. While western science provides important information about local fish resources, fishers have accumulated knowledge of fish populations and habitat by spending time on the land and sharing knowledge across generations and can thus provide invaluable information as well. This lesson enables students to investigate local fish resources through fieldwork that is rooted in Indigenous knowledge and on-the-land experience.

Key questions for student inquiry:

- Are the fish in my community safe to eat? Will fish be available as a source of food in the future? How does Indigenous knowledge help me understand the security of fish as a food source in my community?

LESSON PLAN PROPER

- **Location:** In classroom and in the community/on the water
- **Length of activity:** 225 minutes
- **Activating Strategies:**
 - 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). After the film, discuss as a class.
- Distribute copies of "Indigenous Knowledge and Fish Monitoring." Introduce how this lesson will engage both Indigenous knowledge and western science in understanding fish populations. Read the section on "Indigenous Knowledge" as a class, and elaborate with the students as needed. Then, assign the case studies and associated questions to small groups.
- Once the students have completed the handout, hold a group discussion to create comprehensive lists of indicators of (a) fish health and (b) fish populations. Emphasize that this lesson will not focus on all indicators. These harvesters and land users know the indicators so well because their livelihoods depend on this knowledge! Emphasize that this lesson will focus on a few key indicators in order to understand fish populations in our community.
- **Learning Experiences:**
 - *Class Activity.* Next, students will conduct a survey within their home community and on the land.

Part 1: Survey

Distribute copies of "Tracking Change's Indicators of Fish Health Survey." [Option: Based on students' reading of "Indigenous Knowledge and Fish Monitoring," have them develop a survey to understand fish health in their community.]

- Discuss with students whether it would be best to gather survey responses in person or online (according to your community context). If students are distributing the survey in person, ensure they have enough copies.
- Discuss strategies for finding survey participants, generate a list of potential people to survey.
- Reinforce professional and ethical survey behaviors, especially if the students are surveying in person.
- Provide time for students to complete the survey, in-class and/or outside of class.
- As a class, aggregate survey responses. This could be done using poster paper and displayed around the classroom. Or, students could type their survey responses into a Google doc or Google sheet.
- Once responses are aggregated, walk through the responses as a class. Tally responses to quantitative questions, and identify patterns and interesting outliers in qualitative questions. Identify any further questions that survey responses raise.

Part 2: Field Work

Connect with an Elder or land user who can share knowledge of fish and fish health on a local body of water. Practice fish monitoring with a land user who is encouraged to share additional knowledge.

- Preparation (Elder): Ensure any district and school protocols are followed regarding working with Elders and compensating them. Share and confirm that they understand the purpose of the field trip with the Elder by providing them with information about this lesson, including what students have already learned. Perhaps share the survey with the Elder, and encourage them to speak to some of the questions in the survey. Let the Elder know that students may be asking them these questions as well as others that may arise. Encourage them to conduct fish monitoring with the students and discuss the importance of fish health - whether by taking the students fishing, bringing a catch, showing photos of fish, or sharing a sample of dry fish. Ask the Elder whether they are comfortable with photographs. Let them know that students will be taking photos of the fish, water, and land, but they will not take photos of the Elder unless permission is granted.
- Utilize Student Handout: Field Study Instructions (attached)
- Preparation (students): Ensure all school safety protocols are made clear to students. Also, take time to discuss protocols for learning from Elders. Students should dress appropriately for being out on the land. They should also bring paper or notebook and a pen, as well as a copy of the survey to discuss with the Elder.
- Provide instructions for documenting their experiences in the following ways (Note: they will be using their notes, photos, and sketches for the next part of the lesson!).

Part 3: Networked Data

(This section may be updated in the future to include the use of an app)

Our community is part of a larger river system: the Mackenzie River Basin. In order to understand fish health and populations in our community, we need to understand our interconnectedness to other parts of this river system. In this part of the lesson, we will (a) contribute to basin-wide knowledge about fish health and populations, and (b) learn from research done by other students to identify similarities and differences across communities in the Mackenzie River Basin.

- Share your knowledge! Share photos that you have taken. Be sure to label your photos and sketches with the following:
 - Location tag
 - Date and time the photo was taken
 - Brief description that includes key information, as applicable. This information may be evident in the photo, or it may have been shared by the Elder or evident in the survey results. Examples: species of fish (if known), evident indicators of fish health or unhealthiness, evident indicators of the health or unhealthiness of the water and/or changes to the water, quantities or predicted quantities of a fish species within a specific study plot.
- Compare with other communities! [This may be conducted individually, in small groups, or as a class]. Navigate the map to explore fish health and populations in other communities throughout the Mackenzie River Basin. As with the survey, tally quantitative indicators if possible, and identify patterns in qualitative indicators.
- Draw conclusions about the river as an entire system and the various factors that may be impacting fish populations system-side.

CONCLUSION/REFLECTION

- *Individual or Group Reflection.* Write and/or discuss:
 - In this lesson, we gathered information about fish health and populations via three different methods focused on Indigenous knowledge: through surveys of land users, by learning from an Elder on the land, and by studying networked samples across a larger river system of which our local bodies of freshwater are a part. In a 1-2 page reflection, discuss what kinds of data/knowledge of fish health and populations you were able to access using each of the three methods. Provide examples of the types of data/knowledge that you learned in each case. What are the strengths and limitations of each method? What can you learn by combining multiple methods? What other methods would help you learn more about fish and fish populations in your region?

Extension

See "Community Based Monitoring - Career Profile" (attached). This assignment enables students to gain an understanding of careers and occupations related to freshwater

ecology through online and in-person research.

Extensions

Invite someone from local Environment and Natural Resources (ENR) office to speak to students about what they do in their job. What role does ENR play in monitoring and managing fish? What methods and sources of information (Indigenous Knowledge and Western Science, etc.) does ENR use in their work? Consider going onto the land with the ENR employee to see what they do first hand.

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	<u>Tsaat'ine</u> <u>tthadeh/</u> Dene (Beaver or xe'ghont'e)	<u>Sahtúot'ine/</u> Dene (Slavey or Kaguntu)	<u>Nēhiyawēwin/</u> Cree	<u>Dinjii Zhu'</u> <u>Ginjik/</u> Gwich'in	<u>Inuvialuktun/</u> Inuvialuit
Fishing Place/Spot	Da'etse'ahi k'e	Da'etse'ahi k'e	nōciki- 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 tuk katr'idi'inh	No Trans- lation Available
Fish	Ługe	Łue	Pastew Sipîsis	Łuk	Iqaluk
Fish that are new to this area (invasive)	Ługe edu jô wotsin	Echue gotsi Łue	môya ohci ôta kinosêw	Łuk k'eejit	Iqaluk
Old, Large Fish	Ługe ti	Łue cho	misti- kayâsi- kinosêw	Łuk nichii	Utuqqaq Angiyuq Iqaluk
Young, Small Fish	Ługea'	Łuha	apisisit kinosis	Ineelu'	Nutaaq mikiyuk Iqaluk
Juvenile Fish (baby fish)	Łuh'a	Łuha	kinosêwkos	Łuk zhuu	Nutaaq Iqaluk
Fish liver	Ługe tthhe'	Łuethhe'	kinosê- wôskwan	Łuk dhat	Tinguk
Fish heart	Ługe dze'	Łue dzae	kinosêwohtî	Łuk drii'	Uumman

Fish head	ługe tthi'	tue tthii	kinosê- wôstikowân	Łuk chi'	Iqaluk
Fish stomach	ługe beh	tue mbe'	kinosêwatay	Ets'igo- ghòò'	Iqaluk
Bad intestine	ługe tlessi edu uujo	tue ts'ié dzo'on'te	mâyâ- cimitakisiya	Its'ik iizuu	Iqaluk
Healthy	Uujọ ghedii	Nezu ọte'	maska- wâtisiwin	Srii gwandaii	Surraituq
Healthy, in good shape, its not changed	ługe uujo onte uh edu echaonte'	Nezu ont'e uh edu nadenó'ile	miyo- mahcihew	Srii gwandaii, ejúk t'iinch'uh kwàh	Surraituq
Fish that is	ługe mbeta woli atiin	tue beta dzont'e	apiscipô kinosêw	Ejiich'ii iizuu k'iighè' łuk tagwiniin dhat	Iqaluk
Skinny Fish	ługe gonaa	tue ghela'	sihkaciw kinosêw	Łuk ts'ik	Amittuq Iqaluk
Rotten fish	ługe ghejj	Ghejide tue	pikiskatew kinosêw	Łuk ahjat	Tibliqtuaq Iqaluk
Fish Liver that looks bad	ługe thhe' edu uujọ mbe odatii	tue thhe'- nezu'ile	misi- wanâtanah ôskwana kinosêw	Łuk dhât 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	Chuundat	No Translation Available
Worms in the Stomach	ługe beh t'a tehtsa woli	łue membe'ta gu'woli	manchosahk ehayawak watayihk	Ets'-igoghoo zhit gyuu	Qupil-ruyuak
Bugs in the Fish	ługe tah tehtsa aati	łue met'a tehtsa ati	kinosê-wôtayihk ehayawak manchosahk	łuk zhit gwitt'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 jidii 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'	nakwataat kinosêw micôn oschi	Etr'ihee'aa eenjit łuk katr'idi'inh	Iqalliyuaq

Keywords: fish monitoring; survey; interview

Themes: freshwater ecology; traditional knowledge; research methods

Student Handout: Field Study Instructions

Our community is part of a larger river system: the Mackenzie River Basin. In order to understand fish health and populations in our community, we need to understand our interconnectedness to other parts of this river system. Today, you will be discussing and learning about fish and fish health with an Elder(s).

During your field study:

Take notes during the visit, if possible.

Take photos (with cell phones or cameras) or sketches of things you notice. This might be different species of fish, indicators of fish health, components of the local freshwater ecosystem, etc. (Only take photos with permission from the Elders).

Ask the Elder the survey questions and any further questions of their own. Document the responses.

Journal immediately following the visit, responding to the following:

1. What did you learn from the Elder that reinforced what you had already learned in class and from the survey?
2. What did you learn that was new? Did anything surprise you?
3. How could western scientific monitoring work complement what you learned from the Elder?

Share your knowledge! Upload photos and sketches from our field work experience into the app. Be sure to label your photos and sketches with the following:

Location tag

Date and time the photo was taken

Brief description that includes key information, as applicable.

Compare with other communities! Navigate the map to explore fish health and populations in other communities throughout the Mackenzie River Basin. As with the survey, tally quantitative indicators if possible, and identify patterns in qualitative indicators.

Draw conclusions about the river as an entire system and the various factors that may be impacting fish populations system-side.

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 separate piece of paper:

1. It takes a team to run community-based monitoring projects, and everyone brings their own expertise. What are three types of "specialists" who are involved in this monitoring project, and what do they bring to the project?
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 was one of the earliest "methodological problems" that the MCFN had to deal with? What was the solution?
4. What tests/measurements do the scientists/fishers/students do to gather information about the fish? (List at least 5).
5. What is the limitation of doing research only with western scientists?

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

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: Community-Based Monitoring Career Profile

Community Based Monitoring (CBM) involves a number of experts, each of whom plays an important role in monitoring. CBM also communicates important research to policy makers, who then make decisions based on this research.

Choose one position involved in community based monitoring and create a profile of this position. If you like, you may choose a specific individual to profile, potentially emailing or interviewing this person for the assignment.

Some ideas:

- environmental consultant
- fish harvester
- scientific researcher (focusing on fish and/or water)
- member of UNESCO's World Heritage Committee
- director of a fish camp
- government official (local, territorial/provincial, or national) who receives data from CBM for decision-making
- experienced ecotourism fishing guide or ecotourism business owner

Your profile must include:

- Position title and general description (2 marks)
- Training, education, experience, or credentials required (3 marks)
- Activities and skills (i.e. what is involved with this position?) (5 marks)
- Relation of this person to CBM of fish and freshwater systems (i.e. how do they contribute to monitoring or what do they do with the information from CBM) (3 marks)
- Name and description of an actual person who fills this position (use online research or connect with this person via email or interview). (3 marks)
- Bonus: describe a day-in-the-life of this person! (2 marks)

Total: /16

Student Handout: Indigenous Knowledge and Fish Monitoring

INTRODUCTION

Indigenous knowledge is knowledge developed over long periods of time (hundreds or thousands of years) through direct contact with the land. It connects knowledge of the land with people's everyday lives. People note changes in the land over time that affect their communities. These people then use that knowledge to make daily decisions related to harvest and stable access to food. Do you know anyone who understands the land in this way?

Indigenous knowledge can involve things we usually think of as "science," like measuring, counting, and monitoring various things. For fish, this could include measuring numbers of fish, length of fish, and distribution of particular species. It can also involve things we may not think of as "science," like memories of how the river has changed (or stayed the same) over generations, or local knowledge of which fishing areas contain unhealthy fish. People keep and pass on this knowledge because it is relevant to their lives and wellbeing.

Oral histories are an important aspect of the knowledge held by Indigenous communities about the Mackenzie River Basin. Oral histories are histories that are not written down. Instead, they are passed on out loud from generation to generation. Elders and active harvesters are an important part of oral history. They are experts about environmental changes. Their past experiences, observations and perceptions represent important "data" that exists about the regions, places, and resources that matter most to communities.

A lot of knowledge about both social and ecological change is linked to specific places. Elders and active harvesters have knowledge about places that matter to them, including areas around traditional fish camps, travel routes, spiritual sites, sites for healing, and more. There is also knowledge that is place-related because of hazards or problems (e.g. an area affected by mining, a permafrost slump, an abandoned mine, etc.). There are different ways to document stories about places.



Women preparing fish in a Wellness Camp in Łutselk'e August 2020

Photo Credit: Łutselk'e Dene First Nation provided by LauraJane Michel

LOCAL AND TRADITIONAL KNOWLEDGE INDICATORS

Qualitative Indicators (Things we can describe)	Quantitative Indicators (Things we can count)
<ul style="list-style-type: none"> • risk perception (e.g. how comfortable we feel eating the fish) • quality of the habitat conditions • water quality (e.g. colour, algae blooms) • texture and colour of fish flesh • taste of water 	<ul style="list-style-type: none"> • number of fish in a catch • length and weight of fish • thickness of fat around organs (e.g. ducks, fish) • water levels

WAYS TO LEARN INDIGENOUS KNOWLEDGE OF THE LAND

1. Recording video of places
2. Interviewing Elders or land users
3. Taking photos of places over time to compare year to year
4. Combining interviews with Elders and land users with scientific measuring of the quality and quantity of water
5. Researching Indigenous place names
6. Gathering young people and Elders together to share knowledge

Researchers with Tracking Change have documented examples of Indigenous knowledge of fish populations. Read the following statements by local land users, and consider the following:

- What are three quantitative indicators of fish health?
- What are three qualitative indicators of fish health?
- What changes have people seen in fish populations over the years? How do people track changes in fish populations?
- In what ways do people relate the health of fish and fish populations to their own livelihoods?
- In what ways are these methods of monitoring fish similar to or different from the approaches of western science?

STATEMENTS FROM LAND USERS AND RESEARCH SUMMARIES: FISH HEALTH

A participant explained that these unhealthy fish will come in waves or batches. For some, he can feel the stomach and it is solid like a bone whereas the next batch will be thin and he will almost put his thumb right through the stomach of the fish. - p. 38, 2016-2017 Report

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." - Decho participant, p. 38, 2016-2017 Report

In Nonacho Lake, there are "lots of sick fish, the colours are different, they're blacker" according to elders from Lutsel K'e Dene First Nation - no source mentioned, p. 55, 2016-2017 Report

There are concerns about the health of the fish from the river, which also affects the willingness of people to eat a lot of fish from the river. There is currently a Health Canada Advisory to limit the consumption of fish from the Williston (which flows into the Peace River), which has changed the dependence on fish as a major source in the past 20 years. - Eagle Island Fish Camp participant, Treaty 8 area, p. 64, 2016-2017 Report

There are a lot of fish that look like they have cancer. People might eat it but if you open it up and you see how it looks, then there are things growing in the stomach, then you throw it away. There are more and more fish that seem to have growths inside. There are little spots and little lumps in it. About 2 of 10 fish you might get are no good. It's all kinds of fish—whitefish, walleye, jackfish etc., but there is no lake trout. The trout left a long time ago. When they had mink farms and fox farms back before the 1950s, they were allowed to fish all year round. The Indians could not fish for food to feed their families but the mink farmers could take as much fish as they wanted - Lesser Slave Lake Elder, Treaty 8 FN Alberta, p. 88-89, 2016-2017 Report

"...We do see more parasites in the fish at Shingle...people notice more soft skin... like so soft you can't even cut the darn thing... Salmon I've never ever seen any parasites. Char, maybe the odd one, the odd like worm in there. Rarely in whitefish...Loche is got that ugly liver and eggs..." - Michelle Gruben (2017-18 FJMC Report)

"I notice the difference in the loche, not sick or nothing, but the eggs are not ready like they should be, too late in the season, they should be ready...they are just white, some are ready, some are white..." - Deninu K'ue First Nation (2016 ATG Report)

"...In the summer I make a living off fish, and I don't wanna be selling bad fish... without myself knowing it... I don't wanna sell fish to somebody and then have them get sick... You hear them talking about if they've got chemicals in them you know and people up the river don't even like. There's people up the river

buy fish from down here." – Anonymous Participant, (2016-17 GRRB Report)

"The fish in Great Slave Lake and Artillery Lake used to be the same. After the [Cosmos] satellite crash they changed. The stomach and liver changed. And the fish became very skinny." - Madeline Drybones (2016-17 LKDFN Report)

"There are boils on fish. I caught some trout and it had boils. White fish never use to have boils but they do now. If fish have boils, they are thrown away." (AJ Hatchet Lake area, p. 30, 2018- 2019 Report)

"It's more like dark red, that's a good liver. The fish is more lively when you catch it in the net. I seen them catch yesterday, when they checked net, I seen them when they gut them open, that's a good fish line. I will always go by the liver, then I know I'm eating the right fish." No source, Mikisew Cree First Nation area, p. 36, 2018-2019 Report

"I've been fishing all my life. At one time, I caught a fish with 2 mouths. I gave it to Steve. That was years ago, about 5 years ago. 2 mouths. A fish. So now I can tell you if one is sick or deformed. Some fish I caught, they have lumps all over their body, red lumps. Those I don't bother with, destroy them. I don't even feed them to the dogs. Some of them, they are abnormal, they look like whitefish, but they have a big hump back. They look like those fish that eat people, piranhas. They look something like that, deformed fish." No source, Mikisew Cree First Nation area, p. 36, 2018-2019 Report

STATEMENTS FROM LAND USERS AND RESEARCH SUMMARIES: FISH POPULATIONS

"Overfishing...The number of fish seems to diminish the further downstream. In tributary rivers...it is common knowledge among local fishers that fish populations are in rapid decline...This change has been observed since the mid 1960's after the first dam was built on the Peace River." -- Treaty 8 Tribal Association of BC Report

"It was only once in a while. Long time ago, ... People used to catch a lot of salmon ... And then they were gone for 20 years nobody caught one, and then all of a sudden, ... somebody caught a salmon and said, 'hey this never happened before we never seen this before.' It was. [...] was always there [...] long ago." - William Storr, 2018, Inuvialuit, p.11, 2018-2019 Report

"There are more fish out east. Not as many people fish out there as much. There are less fish in the Slave River"; "Sometimes the fish can't move up creeks and small rivers along the Slave River to spawn because of low water." - Smith's Landing First Nation (2016-17 ATG Report)

"Some harvesters are observing reduced harvest rates for Broad Whitefish and Burbot (Loche) harvested in the Mackenzie River Delta, as well as new observations of chum salmon in the area. This change has been observed more regularly in the past 5 years.. " - 2016 FJMC Report

"[T]here's a number of places where people still harvest fish, and we're just not

seeing the numbers we saw 25 years ago. Which brings us again to the decline in fish that were once there... [The decline is in] mostly all kinds of fish, because it's mostly due likely to climate change, and it could be toxicities in the water." - Dehcho K'ehodi Program participant, p. 36, 2016-2017 Report

"However certain fish, bottom feeders, like suckers have gone missing. There are no more bottom feeders. That's in the Liard River. In the Mackenzie, there are no more bluefish or grayling....Now you could go fishing for a week and you won't even catch 1 - 2 grayling. They all disappeared." - Dehcho K'ehodi Program participant, p. 36, 2016-2017 Report

Grayling in the Mackenzie - participant not identified, p. 36, 2016-2017 Report

- *Another participant described that grayling would make the Mackenzie River at Fort Simpson in the 1960s "boil with their activity as they jumped for bugs to eat."*
- *In those days, people fished grayling frequently from the Deh Cho, using horseflies and grasshoppers for bait. "You could fill up a bucket in an hour with graylings," he said, "now you are lucky if you get one."*
- *In accordance with other observations, the drastic decline in grayling along the Mackenzie happened in the 1970s, "they all just seemed to disappear. Maybe they went up the creeks. Grayling were always plentiful but not anymore."*

"[W]e know for a fact that within the last five years there has been a change with the salmon. Where let's say fifteen years ago you would be lucky to harvest two to three salmon, but today we're harvesting five to ten so the numbers are going up, and we're learning a lot more about the salmon and how global warming and chemicals in the water might be affecting them. It helps to know what's going on out there in different seasons of the year, and we know this because like I said there's five to ten more salmon coming up our rivers than there was twenty years ago." - Dehcho K'ehodi Program participant, p. 37, 2016-2017 Report

"My cousin before he passed away he used to set nets on the river and right by the mouth of that creek he used to catch lots of fish and I think two years before he passed on he hardly caught any... My cousin told me that just spring time only then there is lots of people fishing when the water is high but now nobody even bothers even though they fish they don't get nothing and they used to catch huge jackfish on that creek now there is no water up there so how can you, you catch fish because mainly we catch our jackfish from that creek." - Elaine Lamalice (2017-18 KFN Report)

Optional Handout: Additional Quotes on Indigenous Knowledge & Fish Monitoring

STATEMENTS FROM LAND USERS AND RESEARCH SUMMARIES: FISH HEALTH

"... Loche ... started to get more ... bad liver, bad eggs, ... You gotta throw it all away cuz it's no good. But ...we see more parasites in the fish at Shingle..., ... kinda the same, whitefish and coney. But ... people notice ... I [don't know] if that's to do with the water or,... fish being drowned in your net ... [...] ... so soft you can't even cut [it]..., I would just either chuck that fish or [...] roast it or something... And ... the loche ...[have].. more parasites at Shingle Salmon I've never ever seen any parasites. Char, maybe... the odd ... worm ... a little white worm. Rarely in... whitefish... loche ... [has] that ugly liver and eggs and herring has got more." - Michelle Gruben, 2018) Inuvialuit, p.11, 2018-2019 Report

"There are different fish now and deformed ones too. I have seen some fish with two heads too...About four years ago, Jules and myself set a net out on the lake, we caught a small trout and it's back was bent in a weird way and that is the second time I saw strange fish like that from the lake..." - Mercredi, 2017-18 Prince Albert Grand Council Report

"Didn't used to have to check fish nets every day, now you have to check. Lots of elders were saying the water is getting warm so the fish is spawning right away. So we have to look at the net every day. Before, like way back, how long ago when we don't have to worry about the fish overnight. We could leave our nets for one night, maybe two nights. And now you can't, you go check it every day. This change has been observed since the 70s, about 1975." - 2017-18 SRRB Report

"... weather get[s] hot we have to steadily look at [the] net. And even ... fish got soft because the water was too hot [...] And then when [there's] no fish,... when it's too hot. The elders said ... they go to the bottom ... to keep cool." - Emma Kay, 2018. Gwich'in area, p. 15, 2018-2019 Report

"Some fish are different. Some have scars. One time we ate fish and it tasted different. One time I caught a fish and it had something inside its stomach. They were round. I threw that fish away. That was by Gilly's island." - PJD, Hatchet Lake area, p. 30, 2018- 2019 Report

STATEMENTS FROM LAND USERS AND RESEARCH SUMMARIES: FISH POPULATIONS

"Coney—we started getting Coneys around here now, last spring, a guy came over said he caught a Coney, you want some? I said yaaa, I'll have some Coney." - Lustel K'e Dene First Nation Elder, p. 56, 2016-2017 Report (coney is not usually seen in the area)