



Site C Clean Energy Project

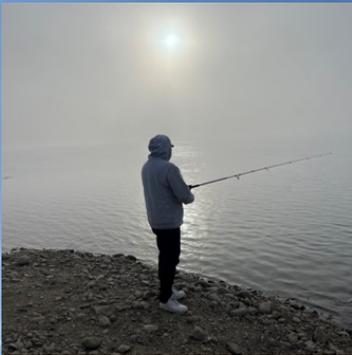
Methylmercury Monitoring Plan (MMP) Implementation: Baseline Fish Consumption Report

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Site C Clean Energy Project Methylmercury Monitoring Plan (MMP) Implementation: Baseline Fish Consumption Report



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EXECUTIVE SUMMARY

Azimuth Consulting Group Inc. (Azimuth) prepared this report on behalf of BC Hydro to document the results of the Site C Methylmercury Monitoring Plan (MMP) baseline fish consumption task.

Creation of the Site C reservoir is expected to cause a temporary increase in levels of methylmercury in fish that inhabit the Site C reservoir, the Peace River between the Site C dam and Many Islands, Alberta, or tributaries to these water bodies.

BC Hydro is responsible for the MMP, which was developed and is being implemented in collaboration with Indigenous Nations and health authorities. The MMP is intended to monitor and manage potential health risks associated with temporary increases in levels of methylmercury in fish resulting from the Site C Clean Energy Project.

Health risks from methylmercury in fish depend on (1) levels of methylmercury in fish, and (2) how much fish people eat. The MMP details how this information will be collected both prior to reservoir creation (i.e., the *baseline* period) and after it (i.e., the *operations* period). BC Hydro will monitor levels of methylmercury in fish from the Site C reservoir and the Peace River downstream to Many Islands, Alberta, annually for the first 10 years, or until levels of methylmercury in fish peak, and every five years thereafter until levels stabilize. In addition to monitoring mercury levels in fish, BC Hydro will collect information on how much fish Indigenous¹ and non-Indigenous fishers in the Peace Region eat before the Site C reservoir is created — baseline fish consumption — and after it has been operating for approximately 5 years.

Work on the MMP baseline fish consumption task started in 2022 and was completed in 2024. The work involved:

- Estimating how much fish people eat using existing sources of data on fish consumption; and
- Collecting new data on fish consumption.

Existing Information on Baseline Fish Consumption

Four sources of existing data provided information on baseline fish consumption. All provided information on baseline fish consumption by Indigenous people.

¹ The MMP requires that BC Hydro gather information on fish consumption for the following 13 specified Indigenous groups: Blueberry River First Nations, Dene Tha' First Nation, Doig River First Nation, Duncan's First Nation, Fort Nelson First Nation, Halfway River First Nation, Horse Lake First Nation, McLeod Lake Indian Band, Prophet River First Nation, Sauteau First Nations, West Moberly First Nations, Métis Nation British Columbia, and Kelly Lake Métis Settlement Society.

2009–2013 First Nations Food, Nutrition, and Environment Study. The First Nations Food, Nutrition, and Environment Study (FNFNES) was a rigorous study on the traditional diet of Indigenous adults living on reserve in sub-Arctic Canada. Six of the 13 specified Indigenous groups participated in the FNFNES, and the study results are considered broadly representative of all Indigenous adults living on reserve at the ecozone level. The FNFNES data provided estimates of fish consumption rates (grams of fish eaten per day) for wild-caught freshwater fish.

2010–11 Country Foods Harvest Questionnaires. Country Food Harvest Questionnaires were carried out as part of Traditional Land Use Surveys done in support of the Environmental Impact Statement for the Site C Clean Energy Project. Data on baseline fish consumption rates were available for wild-caught freshwater fish from Country Food Harvest Questionnaires completed by members of Duncan’s First Nation and Horse Lake First Nation.

2017 McLeod Lake Indian Band Environmental Livelihoods Study. Members of the McLeod Lake Indian Band participated in an Environmental Livelihoods Study as part of the Treaty 8 Regional Strategic Environmental Assessment. The Study included a household-based questionnaire of the traditional food harvesting and gathering practices of participants. The Study provided data on the number of days spent fishing and number of freshwater fish harvested in the 12 months prior to the questionnaire.

2018 Fish and Wildlife Compensation Program Information Gathering Project. The objective of the Fish and Wildlife Compensation Program Information Gathering Project was to gather information on Indigenous knowledge, concerns, and priorities related to kokanee, Bull Trout, and Arctic Grayling in the tributaries to the Williston Reservoir. Saulneau First Nations and McLeod Lake Indian Band participated in the study and agreed to share their data with BC Hydro. The results provided information on which species of fish were most important to the participants and the average sizes of the fish species that they most commonly catch.

Limitations of Existing Data

The existing sources of data provided valuable information on baseline fish consumption; however,

- Some of the data were over a decade old;
- The data did not provide information on how much fish from stores or restaurants people eat;
- The data were for Indigenous adults only.

Therefore, it was necessary to collect new data to complement the information available from existing data sources.

New Data on Baseline Fish Consumption

Azimuth conducted four surveys to collect new data on baseline fish consumption by Indigenous and non-Indigenous fishers in the Peace Region. All four surveys were based on the baseline fish consumption questionnaire, which was an anonymous food frequency questionnaire for fish, designed by Azimuth with input from a registered dietician. The baseline fish consumption questionnaire collected information on how frequently participants eat fish from the Peace River and other sources, how much fish they typically eat in a meal, and how much fish people they live with eat.

To keep the questionnaire as simple as possible, the questionnaire asked participants to provide information on fish they eat from the Peace River and tributaries as a whole, and not the section of the Peace River watershed between Peace Canyon Dam and Many Islands, Alberta where levels of methylmercury in fish could be affected by the Site C reservoir. This is an important limitation of the data from the baseline fish consumption surveys, because the Peace River watershed is large and includes the Williston and Dinosaur reservoir watersheds.

2022–23 Peace River Recreational Angling Creel Survey. A baseline fish consumption survey was conducted in conjunction with the 2022–23 Peace River Recreational Angling Creel Survey. Anglers were interviewed for the survey in July, August, and September 2022 and April, May, and June 2023. A total of 97 people participated in the survey; most were from Fort St. John or Hudson’s Hope.

2024 McLeod Lake Indian Band Baseline Fish Consumption Survey. Thirty-three members of the McLeod Lake Indian Band were interviewed for the baseline fish consumption survey in January or February 2024. Most of the participants were from McLeod Lake (82 %) or Prince George (15 %).

2024 Blueberry River First Nations Baseline Fish Consumption Survey. Twenty-nine members of the Blueberry River First Nations completed an on-line version of the baseline fish consumption questionnaire in February or March 2024. Most of the participants were living in Blueberry River (79 %) or Fort St. John (10 %).

2023 Peace Region Outdoors Club Baseline Fish Consumption Survey. The North Peace Rod and Gun Club, Hudson's Hope Rod and Gun Club, Peace Country River Rats, and the Chetwynd Outdoors Society were invited to ask their members to complete an on-line version of the baseline fish consumption questionnaire. Only five questionnaires were completed, and the data were not analyzed in detail because the sample size was too small.

Results and Discussion

Baseline fish consumption information was available and/or collected for each of the 13 specified Indigenous groups in the vicinity of the Site C Clean Energy project and for non-Indigenous anglers on the Peace River between Peace Canyon Dam in British Columbia and Many Islands, Alberta.

A total of 159 people completed the baseline fish consumption questionnaire. They ranged in age from 17 to 80 years old. They also provided fish consumption information for an additional 261 people in their households, including 66 children under 12 years old.

How Often do People Eat Fish?

The baseline fish consumption questionnaires asked participants how frequently they eat fish. About 60 % of participants in the creel survey baseline fish consumption questionnaire eat fish from the Peace River once a month or more, and about 15 % eat fish from the Peace River once a week or more. A smaller, but not insignificant, proportion of participants in the BRFN and MLIB baseline fish consumption surveys regularly eat fish from the Peace River. About 18 % of participants in the baseline BRFN and 12 % of participants in MLIB baseline fish consumption surveys eat fish from the Peace River once a month or more. As noted above, fish from the “Peace River” could include fish caught upstream of the Peace Canyon dam, which is upstream of the area where levels of methylmercury in fish could be affected by the Site C Project.

To put the above fish consumption frequencies into context, for a child under 12 years old, eating one serving a month of a 22” long Bull Trout from the Peace River under baseline conditions represents about 10 % of the child’s provisional tolerable daily intake of methylmercury. At predicted peak concentrations of methylmercury, this will increase to about 40 %.

What Species of Fish Do People Eat?

The baseline fish consumption data indicate that most participants tend to eat more than one species of fish. The most commonly eaten freshwater fish that have low levels of methylmercury were Rainbow Trout and whitefish species. Also among the most commonly eaten species of fish were Northern Pike, Walleye, Bull Trout, and Lake Trout, which are long-lived piscivores and generally have higher levels of methylmercury.

The baseline fish consumption data also suggest that participants in the MMP baseline fish consumption surveys may be exposed to methylmercury from eating fish from sources other than the Peace River. The most commonly consumed species of fish from sources other than the Peace River by participants in these surveys were Salmon, Halibut, Tuna (Light, Albacore, or Ahi), Rainbow Trout, and Lake Trout. Some of these species, like Salmon, Light Tuna, and Rainbow Trout, have very low levels of methylmercury. Others, like Albacore Tuna and Lake Trout, have moderately elevated levels of methylmercury.

Tabular fish consumption guidance, such as the format of the MMP baseline fish consumption guidance, provides limited value for people who eat more than one species of fish. This is because the

tabular guidance can not account for the possible combinations for people who eat a variety of fish species.

How Much Fish Do People Eat in a Serving?

The baseline fish consumption surveys collected information on the average amount, or mass, of fish participants consume in a meal of fish, which ranged from 118 to 262 grams of fish per meal. The upper end of this range exceeds estimates from other studies for the general Canadian population (approximately 100 to 150 grams of fish per meal) as well as for Indigenous adults living on reserve in British Columbia (109 to 163 grams of fish per meal).

The results from the baseline fish consumption surveys suggest that the average mass of fish some groups of people consume per meal may be higher than that assumed in the baseline MMP fish consumption guidance. If the average mass of fish per meal is higher than assumed in the baseline MMP, then the baseline fish consumption guidance is inaccurate and the number of meals of fish that a person can eat without exceeding their provisional tolerable daily intake for methylmercury will be less than indicated in the baseline MMP fish consumption guidance.

How Much Fish Do People Eat in a Day?

Estimates of baseline fish consumption rates (grams of fish eaten per day) were available from both existing sources of data as well as baseline fish consumption surveys. Estimates of average baseline fish consumption rates varied by approximately an order of magnitude and ranged from 7 to 81 g/day. Estimates of 95th percentile fish consumption rates varied by about the same margin and ranged from 31 to 244 g/day.

How Frequently do Children Eat Fish?

The MMP baseline fish consumption questionnaires collected information on fish consumption of people who lived with the participants, including children under 12 years old. The questionnaires asked participants whether children under 12 years old who live in the same house as the participant eat fish more or less frequently or about the same frequency as the participant. In general, the results indicate that it is common for children to eat fish about as frequently or less frequently than adults, but it is rare for children to eat fish more frequently than adults. These findings were consistent with other studies, which indicate that children generally do not eat fish as much as adults do.

Limitations

Dietary intake is difficult to measure and can change over time. The information on baseline fish consumption was based on food frequency questionnaires, and estimates of food intake based on food frequency questionnaires tend to over-estimate actual rates of food intake. Some of the baseline fish consumption data were collected more than 10 years ago, and people's fish consumption habits and preferences may have changed since then. Finally, people may not eat as much fish as they would like to, due, for example, to concerns about mercury in fish. Therefore, the information on baseline fish consumption should be interpreted with these limitations in mind.

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Appendix A4:	BRFN Baseline Fish Consumption Questionnaire
Appendix A5:	MLIB Baseline Fish Consumption Questionnaire

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 - 2024 McLeod Lake Indian Band baseline fish consumption survey

- 2024 Blueberry River First Nations baseline fish consumption survey
- 2022/23 Peace River Recreational Angler Creel Survey baseline fish consumption survey
- 2018 Peace Region Fish and Wildlife Compensation Program Information Gathering on Kokanee, Bull Trout, and Arctic Grayling project
- 2017 McLeod Lake Indian Band Environmental Livelihoods Survey
- 2013 Alberta First Nations, Food Nutrition, and Environment Study
- 2010/11 Duncan's First Nation and Horse Lake First Nation Country Food Harvest Questionnaires
- 2009 British Columbia and Alberta First Nations, Food Nutrition, and Environment Study

ACRONYMS

CCHS	Canadian Community Health Survey
BRFN	Burberry River First Nations
CS	Creel Survey
FNFNES	First Nations Food, Nutrition, and Environment Study
FWCP	Fish and Wildlife Compensation Project
MLIB	McLeod Lake Indian Band
pTDI	Health Canada's provisional Tolerable Daily Intakes
MMP	Methylmercury Monitoring Plan

1 INTRODUCTION

Azimuth Consulting Group Inc. (Azimuth) prepared this report on behalf of BC Hydro to document the results of the Methylmercury Monitoring Plan (MMP) baseline fish consumption task.

1.1 Background

1.1.1 The Peace River and Hydroelectric Developments

The Peace River is about 2,000 km long and stretches from the head of the Finlay River, located in British Columbia, to Lake Athabasca, In Alberta. The Peace River watershed is one of the largest river basins in Canada and covers an area of approximately 300,000 km² (Watrecon Consulting et al., 2012). Approximately 60% of the Peace River watershed is in Alberta and it covers about 30 % of the provincial land mass (Watrecon Consulting et al., 2012). There are three large hydroelectric developments on the Peace River, which are described below.

W.A.C. Bennet dam and the Williston reservoir – the W.A.C. Bennet dam is located approximately 20 km west of Hudson’s Hope, British Columbia. Construction of the W.A.C. Bennet dam was completed in 1967. At the time of construction, the W.A.C. Bennet dam was one of the largest earth-fill dams in the world (Stanley, 2010). The W.A.C. Bennet dam created the Williston reservoir, which is the largest water body in British Columbia and the seventh largest reservoir in the world, by volume (World Lake Database, ND).

Peace Canyon dam and Dinosaur reservoir - the Peace Canyon dam is located approximately 19 km downstream, of the W.A.C. Bennet dam. Construction of the Peace Canyon dam was completed in 1980 and the dam created the Dinosaur reservoir. The Dinosaur reservoir is relatively small – the volume of Dinosaur reservoir is about 90 times less than Williston reservoir (Stanley, 2010).

Site C dam and reservoir - BC Hydro is building the Site C Clean Energy Project to meet the increasing energy demands of the province. The Project includes creating the Site C reservoir upstream of the Site C hydroelectric dam. Construction of the Project started in 2015 and Site C is expected to be fully operational in 2025. One of the last steps in the Project is to fill the Site C reservoir with water; this started in August 2024 and was completed in November 2024.

1.1.2 Hydroelectric Reservoirs and Methylmercury in Fish

Creating a reservoir causes a temporary increase in levels of methylmercury in fish that inhabit the reservoir. Levels of methylmercury in fish that inhabit a river downstream of a hydroelectric dam can also increase temporarily after construction of a hydroelectric reservoir, but the increase in levels of methylmercury is not as large as that which occurs in fish that inhabit the reservoir.

This “reservoir effect” was not known at the time of the construction of the W.A.C. Bennet and Peace Canyon dams. There are some data on increased levels of methylmercury in fish from the Williston reservoir watershed after the W.A.C. Bennet dam was constructed, but there was not any systematic monitoring of levels of methylmercury in fish after construction of the dams. However, a comprehensive three-year study in 2016-18 showed that levels of methylmercury in fish from the Williston and Dinosaur reservoir watersheds have returned to levels that are similar to natural lakes and rivers in British Columbia (Azimuth, 2019). The location of the Williston and Dinosaur reservoir watersheds, which is the same as the boundaries of the Peace River watershed upstream of the Peace Canyon dam, are illustrated in **Figure 1**.

Site C Methylmercury Monitoring

The creation of the Site C reservoir is expected to cause a temporary increase in levels of methylmercury in fish. The Site C Methylmercury Monitoring Plan² (MMP) was developed and is being implemented in collaboration with Indigenous Nations and health authorities (BC Hydro 2022). The MMP is intended to monitor and manage potential health risks associated with changes in levels of methylmercury in fish due to the Site C Project. BC Hydro is responsible for the MMP.

The largest increase in levels of methylmercury in fish is expected to occur in Bull Trout that inhabit the Site C reservoir. Levels of methylmercury in Bull Trout that inhabit the Site C reservoir are expected to increase over five to eight years after the reservoir is filled, peak at levels that are three to four times higher than baseline, and gradually decline to levels that are similar to natural lakes in the region over the next 20 years or so. Levels of methylmercury in fish that inhabit the Peace River downstream of the Site C dam are also expected to be affected, but the magnitude of the peak is expected to be lower (only up to two times baseline) and the levels are expected to return to equilibrium sooner. The effect of the Site C reservoir on levels of methylmercury in fish that inhabit the Peace River is not expected to extend any further downstream than Many Islands, Alberta, which is approximately 120 km downstream of the Site C dam. The boundary of the Peace River watershed between Peace Canyon dam and Many Islands, Alberta, is illustrated in **Figure 1**.

² The MMP is available at <https://www.sitecproject.com/sites/default/files/site-c-methylmercury-monitoring-plan.pdf>

Thirty-two species of fish are known to inhabit the Peace River. Some species are relatively small “bait” fish and are unlikely to regularly eaten by people³. Not all species of fish occur in all parts of the Peace River. For example, Walleye are less abundant in the Peace River upstream of the confluence of the Beatton River.

Some species of fish that inhabit the Peace River and that are expected to inhabit the Site C reservoir are migratory. For example, Bull Trout, Rainbow Trout, Arctic Grayling, Goldeye, Mountain Whitefish, and Walleye are migratory species (ESSA technologies Ltd. et al., 2020). Migratory fish species are expected to spend some of their life in the Site C reservoir or the Peace River mainstem downstream of the Site C dam and some of their life in tributaries connected to these water bodies. This means that the area where levels of methylmercury in fish could be affected by Site C also includes tributaries connected to the Site C reservoir or the Peace River between the Site C dam and Many Islands, Alberta. The extent to which levels of methylmercury in migratory fish species caught in tributaries connected to the Site C reservoir or the Peace River between the Site C dam and Many Islands, Alberta will be affected by the Site C reservoir is uncertain because levels of methylmercury in these fish will depend, in part, on their life stage, duration of time, and their diet when they inhabit the Site C reservoir or the Peace River mainstem downstream of the Site C dam.

The two species of fish that have the greatest potential to Site C related increases in levels of methylmercury beyond the Site C reservoir or the Peace River mainstem downstream of the Site C dam are Bull Trout and Walleye. This is because Bull Trout and Walleye are:

- Long-lived, fish-eating (piscivorous) species⁴;
- Are relatively abundant in the Peace River and its tributaries; and
- Have large home ranges and migrate over relatively long distances.

Increased levels of methylmercury in fish can negatively affect people’s health in two ways: (1) direct toxic effects; and (2) indirect health effects arising from people avoiding fishing or eating fish because of concerns about methylmercury in fish.

1. Methylmercury can cause direct toxic effects to people who are exposed to too much methylmercury from eating fish. Methylmercury is a neurotoxin and exposure to too much methylmercury can damage the brain and the rest of the nervous system. To prevent this from occurring Health Canada sets maximum safe exposure limits for methylmercury. Children are

³ Examples of small “bait” fish that inhabit the Peace River and are unlikely to regularly eaten by people are Redside Shiner, Spottail Shiner, Brook Stickleback, Finescale Dace, Longnose Dace, Northern Redbelly Dace, Pearl Dace, Trout-Perch, Slimy Sculpin, Prickly Sculpin, and Spoonhead Sculpin.

⁴ Long-lived, piscivorous species of fish bioaccumulate higher levels of methylmercury than short-lived and/or insectivorous species of fish.

more sensitive to the toxic effects of methylmercury than adults. Also, methylmercury can pass through the placenta, and methylmercury that a pregnant person is exposed to is passed on to the fetus. Therefore, the maximum safe exposure limit for children and people who are, or could become pregnant, is lower than the maximum safe exposure limit for other people.

2. Concerns about methylmercury in fish can also be harmful to people if the concerns cause people to unnecessarily avoid fishing and eating fish. Since fishing and eating fish are good for people's health, avoiding these activities can have a negative effect on their health. Indigenous people are more vulnerable to the indirect effects of methylmercury in fish because fishing has cultural value to many Indigenous people and because Indigenous people are more likely than non-Indigenous people to experience food insecurity. For example, Indigenous households are five times more likely to experience food insecurity than non-Indigenous households, and families with children are more likely to be food insecure (Batal et al. 2021).

The potential adverse health effects of increased levels of methylmercury in fish can be successfully mitigated by measuring levels of methylmercury in fish and effective public communications on how much fish can safely be eaten.

Site C MMP and Fish Consumption

Health risks from methylmercury in fish depend on (1) levels of methylmercury in fish, and (2) how much fish people eat. The MMP details how this information will be collected both prior to reservoir creation (i.e., the baseline period) and after it (i.e., the operations period). BC Hydro will monitor levels of methylmercury in fish from the Site C reservoir and the Peace River downstream to Many Islands, Alberta, annually for the first 10 years, or until levels of methylmercury in fish peak, and every five years thereafter until levels stabilize. In addition to monitoring mercury levels in fish, BC Hydro will collect information on how much fish Indigenous and non-Indigenous fishers in the Peace Region eat before the Site C reservoir is created — baseline fish consumption — and after it has been operating for approximately 5 years.

The requirements for BC Hydro to collect information on fish consumption are addressed by the plans described in Section 7.0 Fish Consumption Program of the MMP (BC Hydro 2022). Information on fish consumption will be collected for non-Indigenous people and the following 13 specified Indigenous groups: Blueberry River First Nations, Dene Tha' First Nation, Doig River First Nation, Duncan's First Nation, Fort Nelson First Nation, Halfway River First Nation, Horse Lake First Nation, McLeod Lake Indian Band, Prophet River First Nation, Sauteau First Nations, West Moberly First Nations, Métis Nation British Columbia, and Kelly Lake Métis Settlement Society. The locations of the 13 specified Indigenous groups are shown in **Figure 1**.

The current report describes the methods and results of the MMP baseline fish consumption task. Work on this task started in 2022 and was completed in 2024.

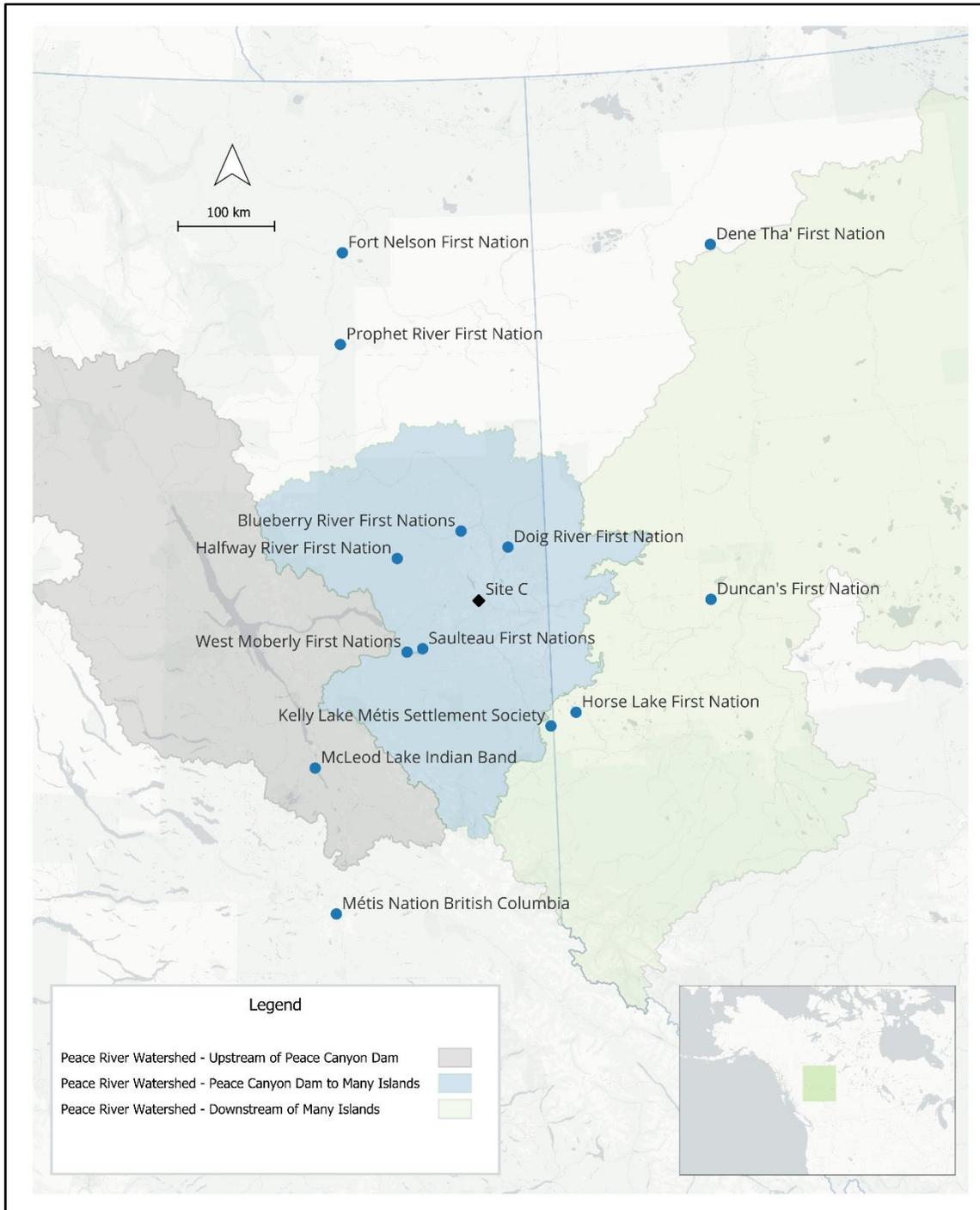


Figure 1. Locations of 13 specified Indigenous groups in the vicinity of Site C

1.2 Objectives

The objective of the MMP baseline fish consumption task was to collect data on baseline fish consumption by Indigenous and non-Indigenous people who may eat fish from water bodies where methylmercury in fish is expected to increase temporarily because of the Site C reservoir.

1.3 Approach

The approach to collect information on baseline fish consumption is described in detail in Section 7.0 of the MMP (BC Hydro 2022). The approach included two strategies:

- Estimating how much fish people eat using existing sources of data on fish consumption; and
- Collecting new data on fish consumption.

The methods for and results of collecting baseline data on fish consumption under these two strategies are described in detail in the following sections of this report.

2 EXISTING INFORMATION ON BASELINE FISH CONSUMPTION

Azimuth attempted to identify suitable existing sources of data on baseline fish consumption from 2021 to 2024 through the following methods:

- Presentations and discussions on the topic at meetings of the Site C Environmental Forum and the Methylmercury Subcommittee;
- Information-sharing meetings with individual Indigenous groups; and
- Searching published literature.

Through these efforts, Azimuth identified the following existing sources of data relevant to the baseline fish consumption task:

- First Nations Food, Nutrition, and Environment Study (FNFNES);
- Country Foods Harvest Questionnaires for Duncan’s First Nation and Horse Lake First Nation;
- McLeod Lake Indian Band (MLIB) Environmental Livelihoods Study; and
- Fish and Wildlife Compensation Program Information Gathering project for Saulteau First Nations and MLIB.

The following sections of the report provide a summary of the background, methods, and results for each of these existing sources of information on baseline fish consumption.

Azimuth subcontracted detailed analyses of data from the FNFNES and the Country Foods Harvest Questionnaires to Reciprocity Research Inc. The methods and results of their analyses are reported under separate cover (Reciprocity Research Inc., 2024).

2.1 First Nations Food Nutrition and Environment Study

The First Nations Food, Nutrition, and Environment Study was a rigorous study on the traditional diet of Indigenous adults living on reserve in sub-Arctic Canada. The study filled an important data gap because previous provincial and national nutrition surveys did not include Indigenous communities. The FNFNES was based on random sampling of households within participating First Nations communities. The FNFNES was designed to be statistically representative of all Indigenous adults living on reserve within an ecozone⁵. The FNFNES provides high quality data on baseline fish consumption of Indigenous adults living on reserve in the Peace Region. Six of the 13 specified Indigenous groups participated in the FNFNES as sampling communities (**Figure 2**), but the FNFNES data are considered statistically representative of all Indigenous adults living on reserve within an ecozone.

Azimuth collaborated with scientists from the FNFNES to re-analyze the data for the MMP baseline fish consumption task. The following sections provide an overview of the methods of the original FNFNES and the re-analysis, and they also highlight the results for the three ecozones that overlap the territories of the 13 specified Indigenous groups.

⁵ An ecozone is a broad geographic area in which there are distinctive climate patterns, types of landscapes and species of plants and animals. There are 15 terrestrial ecozones in Canada.

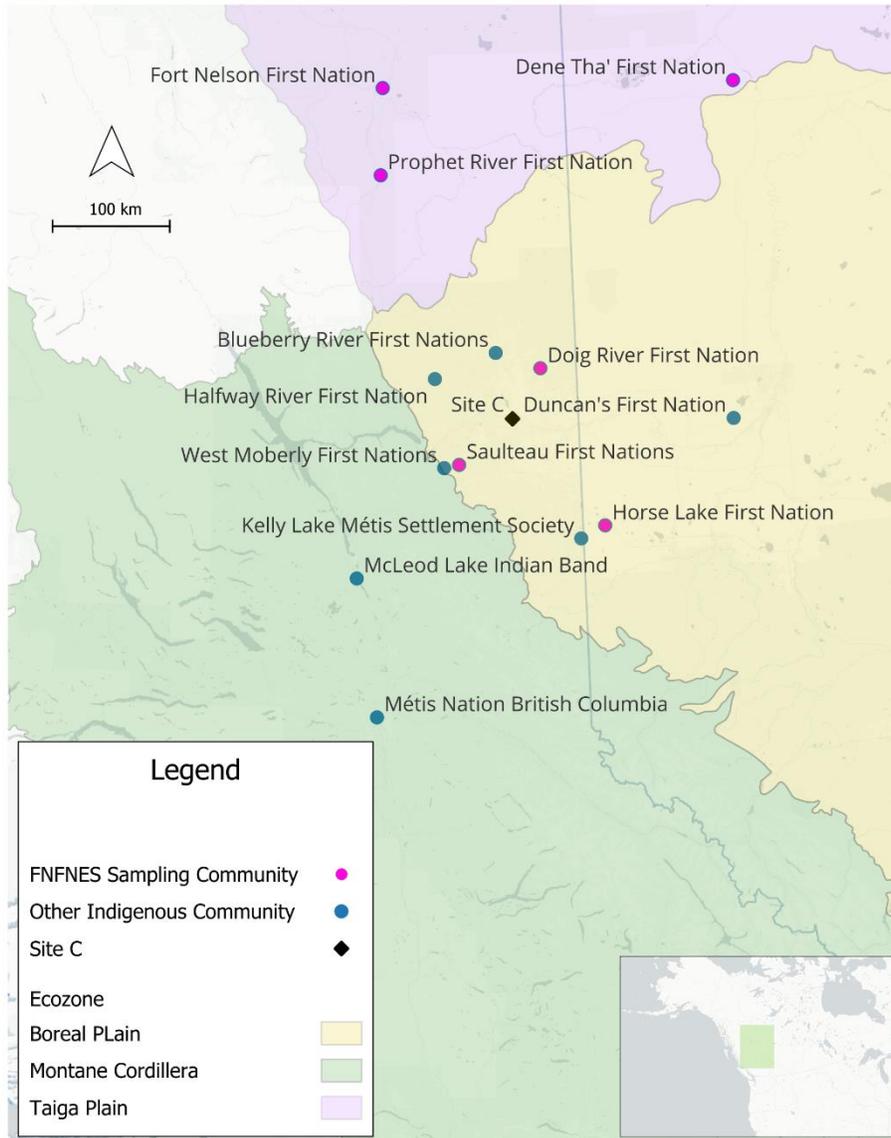


Figure 2. Specified Indigenous groups in the vicinity of Site C and those that were sampled in the First Nations Food, Nutrition, and Environment Study

2.1.1 Background and Methods

The FNFNES was a comprehensive study of traditional diet and environmental exposures of Indigenous people living on reserve at locations in Canada south of 60 degrees latitude. The study was implemented sequentially in 10 provinces from 2008 to 2018, included 92 First Nations, and was jointly led by the Assembly of First Nations, the University of Ottawa, the Université de Montréal, and the University of Northern British Columbia. The FNFNES study design was based on random sampling within 11 ecozones, and the results are considered representative of the population of adult Indigenous people living on reserve within an ecozone.

The FNFNES collected data on the traditional diet of adults in the fall, using a food frequency questionnaire and 24-hour dietary recall — both of which are standard and validated dietary survey methods. The food frequency questionnaire asked how many days participants ate traditional foods within the last 12 months, by season. For the B.C. region study, the food frequency questionnaire included 58 different fish taxa, including fresh and saltwater finfish and shellfish. In the Alberta region study, the food frequency questionnaire included 22 different taxa of freshwater fish.

The following six of the 13 specified Indigenous groups participated in the FNFNES (**Figure 2**):

- Dene Tha' First Nation and Horse Lake First Nation participated in the 2013 Alberta FNFNES; and
- Fort Nelson First Nation, Prophet River First Nation, Doig River First Nation, and Sauteau First Nations participated in the 2009 B.C. FNFNES.

Azimuth collaborated with Ms. Karen Fediuk, the registered dietitian on the study, and Dr. Peter Berti, the statistician on the study, to analyze the FNFNES fish consumption data for the Peace Region. Ms. Fediuk and Dr. Berti sought and obtained permission to access B.C. and Alberta ecozone-level food frequency questionnaire data for the three ecozones that fall within the MMP project area: Taiga Plains, Boreal Plains, and Montane Cordillera. Food frequency results were integrated with portion size estimates from the 24-hour dietary recall to calculate consumer-only⁶ fish intake rates (i.e., grams of fish consumed per day). Detailed methods and results of the analysis of FNFNES fish consumption data are reported in Reciprocity Research Inc. (2024). Highlights of the results are summarized below.

⁶ Data were filtered to only include participants that reported eating fish (i.e., non-consumers were excluded).

2.1.2 Results

General Findings

Reciprocity Research Inc. (2024) reported that, based on their re-analysis of the FNFNES data, there was minor seasonal variation in patterns of fish consumption, and fish consumption tended to be higher in older people and males.

Taiga Plains

Fish consumption data for the Taiga Plains ecozone was based on community sampling in Dene Tha' First Nation, Fort Nelson First Nation, and Prophet River First Nation.

The average fish consumption rate for wild-caught freshwater fish for fish-eating Indigenous adults living on reserve in the Taiga Plains ecozone in B.C. and Alberta was 20 g/day, and the 95th percentile fish consumption rate was 97 g/day. The most popular freshwater fish, as measured by the percentage of fish consumers who reported eating the taxa in the prior 12 months, were: Northern Pike (33 %), Lake Whitefish (30 %), Walleye (27 %), Bull Trout (22 %), Burbot (14 %), Rainbow Trout (14 %), Lake Trout (11 %), and sucker (8 %).

Boreal Plains

Fish consumption data for the Boreal Plains ecozone was based on community sampling in Sauleau First Nations, Doig River First Nation, Horse Lake First Nation, Little Red River Cree Nation, Miskisew Cree First Nation, Driftpile First Nation, Whitefish (Goodfish) Lake First Nation #128, Wesley First Nation, and Chiniki First Nation. Other specified Indigenous communities in the Boreal Plains ecozone — Blueberry River First Nations, Halfway River First Nation, Duncan's First Nation, and Kelly Lake Métis Settlement Society — did not participate directly in the FNFNES. Nonetheless, the data for Boreal Plains ecozone are considered statistically representative of all Indigenous adults living on reserve within the ecozone.

The average rate at which fish-eating Indigenous adults living on reserve in the Boreal Plains ecozone in B.C. and Alberta consumed wild-caught freshwater fish was 7 g/day, and the 95th percentile fish consumption rate was 32 g/day. The most popular freshwater fish, as measured by the percentage of fish consumers who reported eating the taxa in the prior 12 months, were: Lake Whitefish (33 %), Walleye (33 %), Northern Pike (31 %), Bull Trout (30 %), Rainbow Trout (11 %), and Burbot (10 %).

Montane Cordillera

Fish consumption data for the Montane Cordillera ecozone were based on community sampling in Lower Nicola First Nation, Spltasin First Nation, Tsay Keh Dene First Nation, Tl'azt'en Nation, Witset First Nation⁷, and Nat'oot'en Nation⁸. Other specified Indigenous communities in the Montane Cordillera ecozone, namely MLIB, West Moberly First Nations, and Métis Nation of British Columbia, did not participate directly in the FNFNES. Nonetheless, the data for Montane Cordillera ecozone are considered statistically representative of all Indigenous adults living on reserve within the ecozone.

The average fish consumption rate for wild-caught freshwater fish for fish-eating Indigenous adults living on reserve in the Montane Cordillera ecozone in B.C. was 9 g/day, and the 95th percentile fish consumption rate was 35 g/day. The most popular freshwater fish, as measured by the percentage of fish consumers who reported eating the taxa in the prior 12 months, were: Rainbow Trout (25 %), Lake Trout (18 %), Burbot (14 %), Bull Trout (11 %), and kokanee (8 %).

Comparisons Among Ecozones

Freshwater fish consumption rates for Montane Cordillera and Boreal Plains were similar (mean 7–9 g/day and 95th percentile 32–35 g/day) and about three-fold lower than rates for Taiga Plains (mean 20 g/day and 95th percentile 97 g/day). There were some differences in the most commonly eaten freshwater fish. Rainbow Trout and Lake Trout were the most commonly eaten freshwater fish in the Montane Cordillera, whereas Lake Whitefish, Walleye, Northern Pike, and Bull Trout were the most commonly eaten freshwater fish in the Boreal Plains and Taiga Plains ecozones.

Community-level analysis of the FNFNES data was not feasible. Therefore, it is unclear if the differences in fish consumption between ecozones highlighted here are greater or less than potential differences in fish consumption among Indigenous communities within an ecozone.

2.2 Country Food Harvest Questionnaires

2.2.1 Background and Methods

Existing data on baseline fish consumption were available for Horse Lake First Nation and Duncan's First Nation from Country Food Harvest Questionnaires. These Questionnaires were carried out as part of Traditional Land Use Surveys done in support of the Environmental Impact Statement for the Site C Clean Energy Project (BC Hydro, 2013).

⁷ Formerly known as Moricetown First Nation

⁸ Also known as Lake Babine First Nation

The Country Food Harvest Questionnaires collected data on how frequently participants eat wild-caught fish and the average amount of fish they eat in a meal. The Questionnaire provided opportunities for participants to provide this information for 10 species of wild-caught freshwater fish, but responses for Bull Trout, Rainbow Trout, and Lake Trout were collapsed by the study authors into an aggregate category of “trout,” and responses for Goldeye, “Ling Cod⁹,” and Dolly Varden¹⁰ were collapsed into an aggregate category of “other fish.”

The Country Food Harvest Questionnaires did not use standard nutrition or country food harvest study methods. The researchers who conducted the Country Food Harvest Questionnaire noted:

- The Questionnaires were based on relatively small samples of convenience, and that while the data are valid for highlighting general trends, the results are not considered statistically representative of the community as a whole; and,
- There may have been some misidentification of fish species, particularly Bull Trout.

Combining the responses for Bull Trout in one aggregate category of fish (trout) and Dolly Varden in another (other fish) likely further contributed to inaccuracies in the data for Bull Trout because some people use the names interchangeably.

Data for the Country Food Harvest Questionnaires were collected in 2010 and 2011. BC Hydro provided copies of the questionnaires and data to Azimuth. Average and 95th percentile fish consumption rates were calculated by Reciprocity Research Inc. (2024).

2.2.2 Results for Duncan’s First Nation

Forty-seven out of 284 eligible members of Duncan’s First Nation (17 %) completed the Country Food Harvest Questionnaire. The participants ranged in age from 15 to 74 years old; of those who responded, 29 participants identified as male (63 %) and 17 as female (37 %).

The fish that participants reported eating most frequently were, in descending order: trout, Northern Pike, Walleye, whitefish, other fish, and Arctic Grayling.

The average number of meals per month of fish ranged from 0 to 16, with an average of 4.19 meals a month. The average and 95th percentile of fish consumption rates for fish-eating individuals were 27 g/day and 67 g/day.

⁹ Burbot are sometimes locally referred to as Ling Cod.

¹⁰ Bull Trout are sometimes locally referred to as Dolly Varden.

2.2.3 Results for Horse Lake First Nation

Ninety-two out of 500 eligible members of Horse Lake First Nation (18 %) completed the Country Food Harvest Questionnaire. The participants ranged in age from 20 to 77 years old; 64 identified as male (70 %) and 28 as female (30 %).

The fish that participants reported eating most frequently were, in descending order: Northern Pike, trout, other fish, Walleye, whitefish and Arctic Grayling.

The average number of meals per month of fish ranged from 0 to 16, with an average of 1.42 meals a month. The average and 95th percentile of fish consumption rates for fish-eating individuals were 13 g/day and 45 g/day.

2.3 McLeod Lake Indian Band 2017 Environmental Livelihoods Study

2.3.1 Methods

Members of the McLeod Lake Indian Band (MLIB) participated in an Environmental Livelihoods Survey in 2017. The Environmental Livelihoods Study was conducted as part of the Treaty 8 Regional Strategic Environmental Assessment. The study was a household-based questionnaire of the traditional food harvesting and gathering practices of participants. The results of the Environmental Livelihoods Survey were intended to provide information to allow the Treaty 8 First Nations to identify land use planning objectives that protect the rights and livelihoods of member First Nations.

The 2017 Environmental Livelihoods Survey included data on MLIB fishing practices. The MLIB agreed to provide anonymous data from the Survey to BC Hydro in support of BC Hydro's objective to collect data on baseline fish consumption. The MLIB 2017 Environmental Livelihoods Survey data do not provide direct information on rates of fish consumption, but they provide information on MLIB baseline fishing practices and were considered valid to support inferences about the rates of capture of various fish species.

Azimuth provided MLIB with a list of requested data fields from the 2017 Environmental Livelihoods Survey and a data template in Microsoft Excel. McLeod Lake Indian Band transcribed data from hard copies of the Survey to the Microsoft Excel data template and provided Azimuth with the completed data template and a data dictionary. All data were anonymous and did not include any information that would allow the respondent household to be identified.

The MLIB 2017 Environmental Livelihoods Survey data contained information about:

- The age of participants and their community of residence;

- A categorical variable ("Yes" or "No"), indicating whether participants were concerned about mercury in fish; and
- The numbers of days participants spent fishing in the last 12 months and species-specific numbers of the fish they captured. Species listed were Bull Trout, Lake Trout, whitefish, suckers, Rainbow Trout, Burbot, Brook Trout, Arctic Grayling, Brown Trout, Char, Walleye, Salmon, Northern Pike, Burbot, and kokanee.

2.3.2 Results

Ninety-three members of the MLIB participated in the MLIB 2017 Environmental Livelihoods Survey.

Communities of Participants

Participants were from six different communities (**Figure 3**). Most participants were from McLeod Lake (~45 %) and Prince George (44 %).

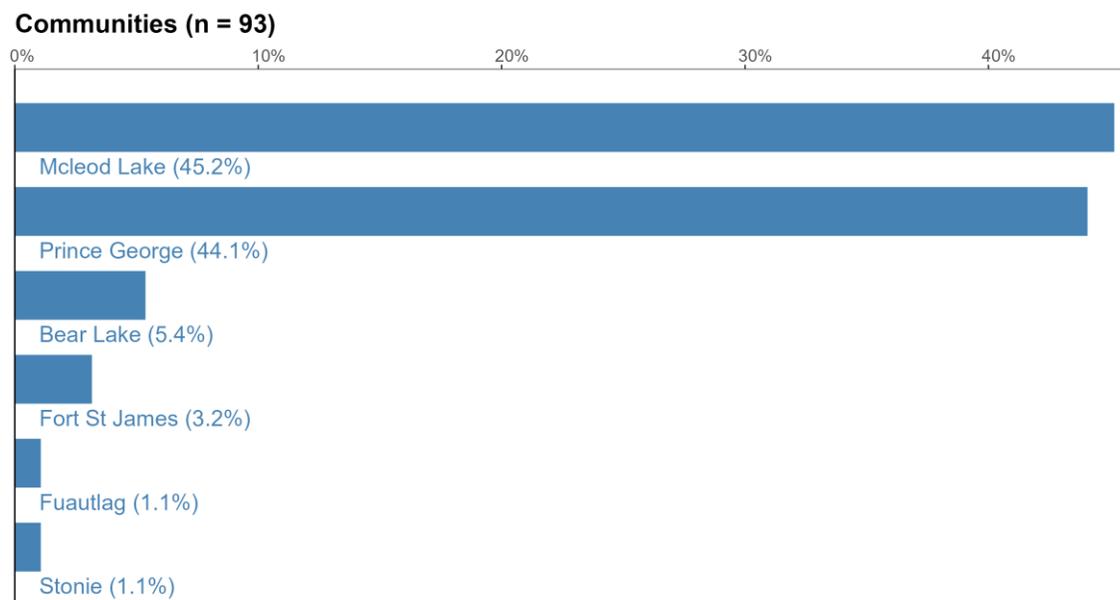


Figure 3. Communities of participants (Environmental Livelihoods Survey)

Age Distribution

Age of participants and household members ranged from 1 to 91 years (**Figure 4**).

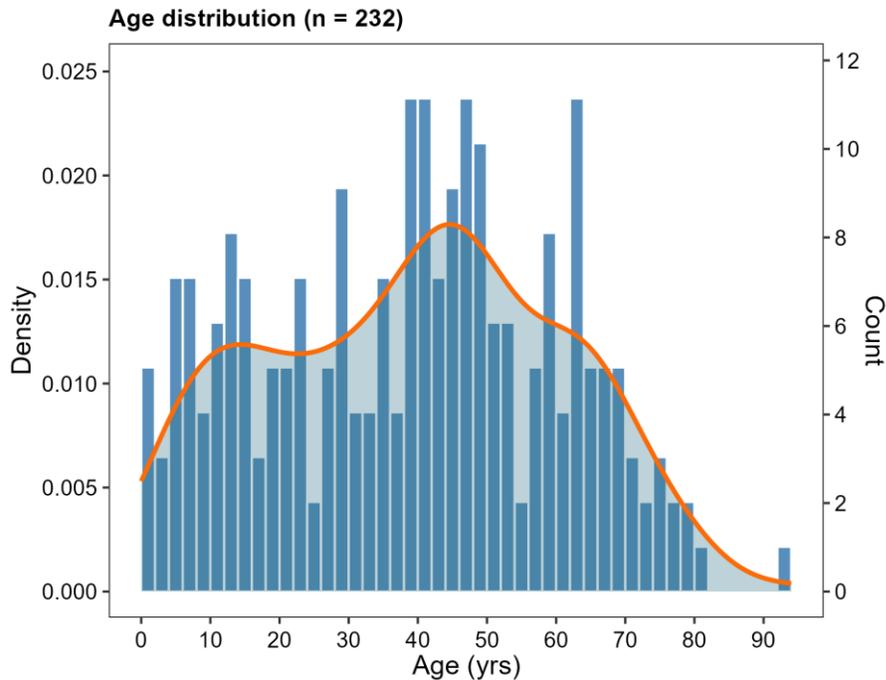


Figure 4. Age of participants and household members (Environmental Livelihoods Survey)

Fishing Days and Harvests

Data for total numbers of days spent fishing in the last 12 months were available for 88 participants (**Figure 5**). Almost two-thirds of participants fished in the last 12 months, although the number of fishing days varied among participants. Of those participants that reported fishing in the last 12 months, about 75 % fished from 8 and 30 days. A small proportion of participants (2.4 %) fished very frequently (i.e., 121 – 365 days in the last 12 months).

Most participants reported catching less than 25 fish in the last 12 months, but some participants caught more than 50 fish during that period (**Figure 6**).

Participants who reported they were concerned about mercury in fish spent fewer days fishing and caught fewer fish than participants who were not concerned about mercury in fish (**Figure 7**).

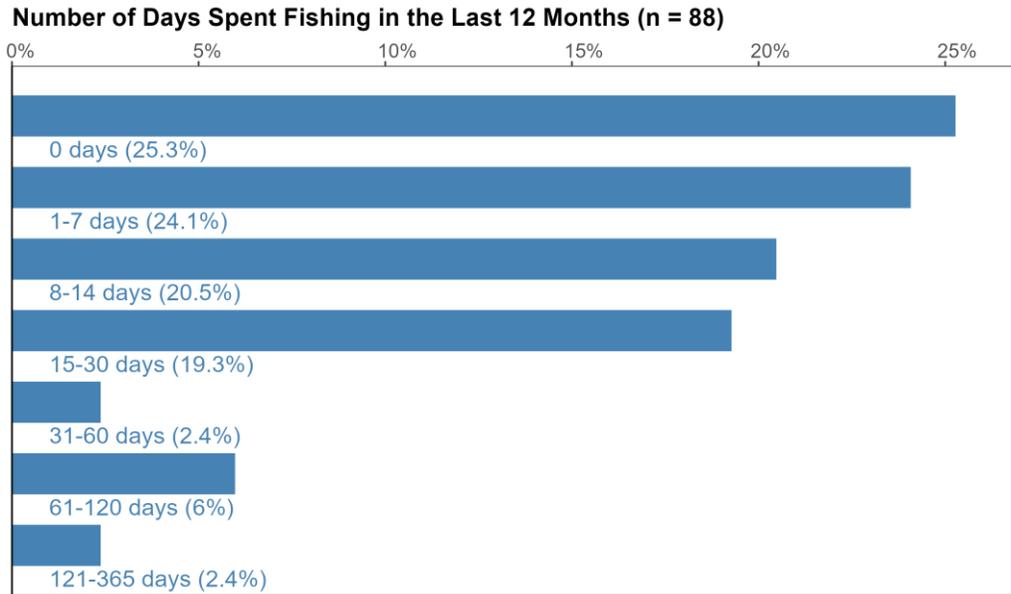


Figure 5. Numbers of days spent fishing by participants (Environmental Livelihoods Survey)

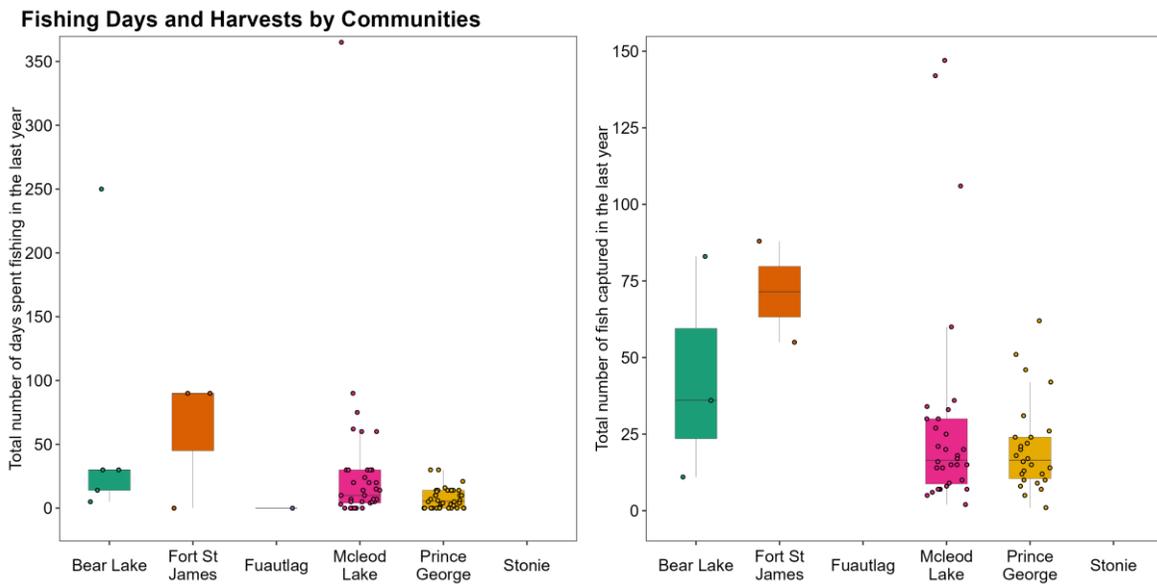


Figure 6. Community-specific fishing days and harvests by participants (Environmental Livelihoods Survey)

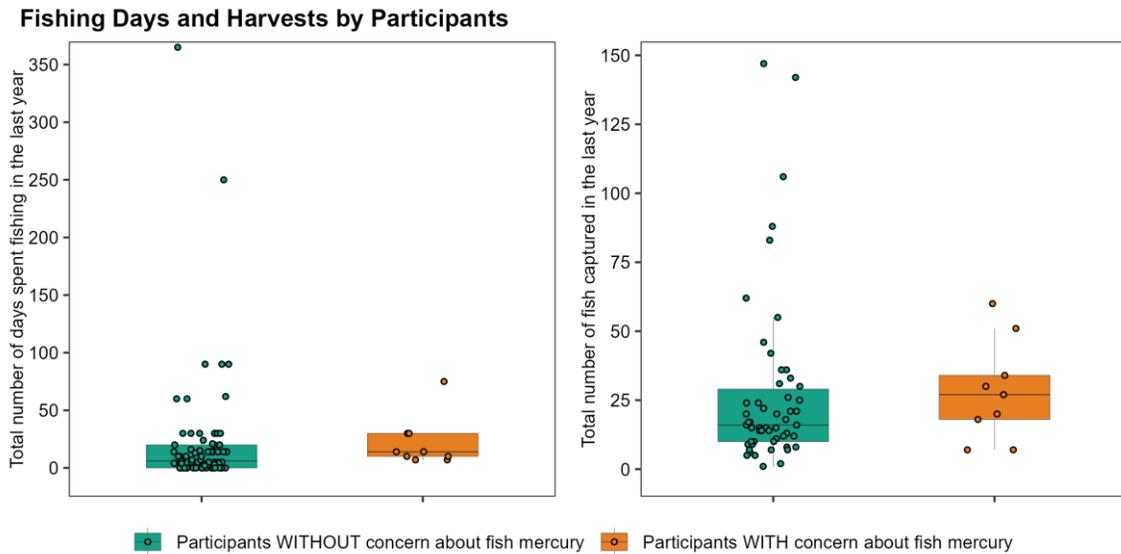


Figure 7. Fishing days and harvests by participants with and without fish mercury concern (Environmental Livelihoods Survey)

Commonly Caught Fish Species

A total of 1,731 fish from 13 species were captured by 65 Participants (Figure 8). The species that were caught the most were Bull Trout, Lake Trout, Rainbow Trout, suckers, and whitefish. No participants reported catching Walleye or Northern Pike in the last 12 months.

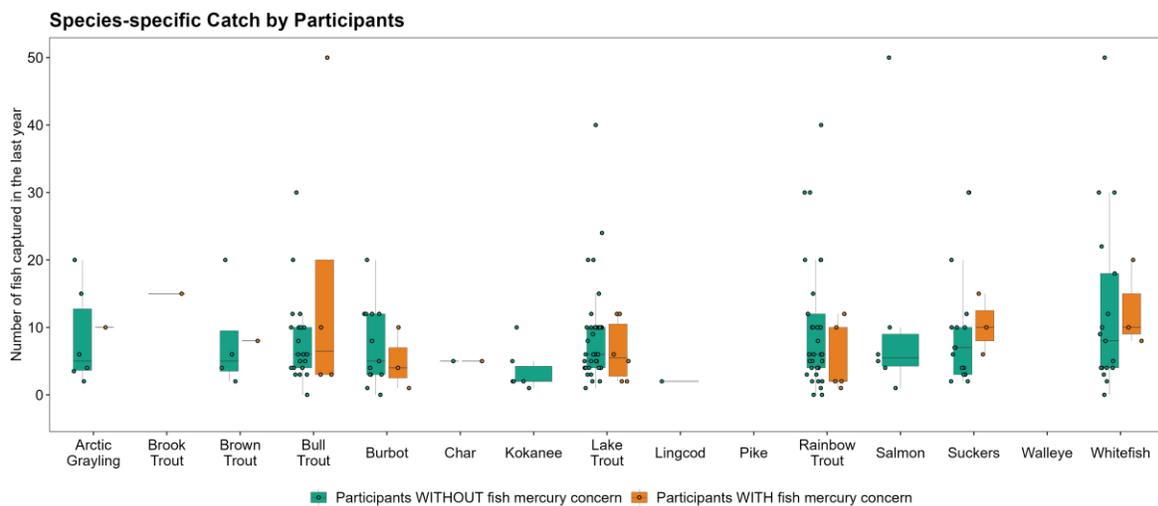


Figure 8. Species-specific proportions of catch by participants (Environmental Livelihoods Survey)

2.4 Information Gathering on Kokanee, Bull Trout, and Arctic Grayling

The Information Gathering on Kokanee, Bull Trout, and Arctic Grayling (Information Gathering) project was a research project on Indigenous fishing funded by the Peace Region Fish and Wildlife Compensation Project (FWCP). The research was led by Dr. Tristian Pearce at the University of Northern British Columbia, and data were gathered in the fall of 2018. McLeod Lake Indian Band¹¹ and Saulteau First Nations participated in the study and, with their permission, FWCP shared the results of the research with Azimuth for the purposes of gathering information on baseline fish consumption.

The goal of the project was to record First Nations knowledge, concerns, and priorities related to kokanee¹², Bull Trout, and Arctic Grayling in the tributaries to the Williston Reservoir to guide priorities for future FWCP monitoring, conservation, and enhancement projects. The Information Gathering project did not collect direct data on how much fish people eat, but it did include the following research questions relevant to the MMP baseline fish consumption task:

- What species of fish are important?
- What streams and rivers are important for fishing?
- Where is the best place to catch kokanee, Bull Trout, and Arctic Grayling?
- What size of kokanee, Bull Trout, and Arctic Grayling do you catch?
- What are your concerns about the health of fish?

The following sections summarize the results of the Information Gathering project for the MLIB and Saulteau First Nations that are relevant to the MMP. The summaries are based on the full project reports for these two First Nations (Pearce et al. 2019a, Pearce et al. 2019b).

2.4.1 McLeod Lake Indian Band

Twenty-three elders¹³ of the MLIB who live in McLeod Lake and have experience fishing in the tributaries to Williston Reservoir provided information through group discussion, interviews, and participatory mapping. The following points summarize the information gathered through this process:

¹¹ Reporting for the Information Gathering project referred to McLeod Lake Indian Band as Tse'kene First Nations.

¹² A kokanee stocking program for the Williston Reservoir was started in 1990s, and today kokanee is the most abundant fish species in the Reservoir.

¹³ 60+ years of age

- Every lake, river, and stream in the Tse'khene territory is important. Tse'khene have a holistic, integrative view of the environment and consider individual fish species as part of a broader complex web of relationships.
- Over the last 50 years, the abundance and health of traditional foods (wildlife, fish, and berries) have generally declined. Participants attributed the decrease in abundance and health of fish to:
 - Increased forest fires (climate change);
 - Decreased snowpack and water levels (climate change);
 - Increased water temperature (climate change);
 - Creation of the Williston Reservoir;
 - Logging;
 - Herbicides (glyphosate);
 - Natural gas development;
 - Increased fishing pressure; and
 - Introduction and stocking of non-native fish (kokanee)
- The Crooked River, Pack River, McLeod Lake, and Carp Lake are particularly important areas for fishing. Participants seldom fish in the Williston Reservoir. Since the Williston Reservoir was created, fishing has shifted away from the Parsnip River to other waterways (e.g., Pack River, McLeod Lake, Carp Lake). This has been due to fishing areas being lost when the Reservoir was created and to concerns about mercury.
- Bull Trout are a preferred fish to eat. The abundance and size of Bull Trout in tributaries to the Williston Reservoir have declined; injured and diseased fish are more common; and the quality of the meat, in terms of taste, has declined.
- Tse'khene are concerned about mercury levels in all fish, particularly Bull Trout, and are uncertain what fish are safe to eat.
- The abundance of Arctic Grayling in tributaries to the Williston Reservoir have declined, and few Arctic Grayling have been caught in the past 30 years.
- Participants do not fish for kokanee, except in a few headwater lakes that native kokanee inhabit.

The data from the Information Gathering project made available to Azimuth did not include information on the size of kokanee, Bull Trout, and Arctic Grayling that were caught by MLIB.

2.4.2 Saulteau First Nations

Fifteen members of the Saulteau First Nations who live near Moberly Lake and fish in the tributaries to Williston Reservoir provided information through group discussion, interviews, and participatory mapping. The following summarizes the information gathered through this process:

- Every lake, river, and stream in the Saulteau First Nations territory is important for fishing.
- Fish are an important source of protein for members of the Saulteau First Nations and for wildlife species.
- The most important fish species to the Saulteau First Nations for subsistence are Arctic Grayling, Northern Pike, Bull Trout, Lake Trout, Rainbow Trout, Burbot, Walleye, and whitefish species.
- The abundance and size of Bull Trout have declined; the average size of Bull Trout caught was estimated to be 8–12 inches (approximately 200–300 mm) long.
- The abundance of Arctic Grayling has declined; the average size of Arctic Grayling caught was estimated to be 8–15 inches (approximately 200–400 mm) long and 1–2 pounds (approximately 450–900 grams).
- Kokanee are increasing in number and are considered an invasive species. Members of the Saulteau First Nations do not fish for kokanee.
- Members of the Saulteau First Nations are concerned about mercury levels in all fish. They believe that some fish, especially those in Moberly Lake and tributaries to the Peace River and Williston Reservoir are contaminated with mercury and not suitable to eat.

2.5 Limitations to Existing Sources of Information on Baseline Fish Consumption

The MMP sought to minimize demands on Indigenous Nations and relied on existing information for baseline fish consumption. The existing information, however, had some important limitations. These included:

- Some of the data were over a decade old (e.g., B.C. FNFNES 2009, Alberta FNFNES 2013);
- The data were for adults only and did not include information on how much fish children eat; and
- The data were for wild-caught fish only; they did not include information on how much fish from stores or restaurants people eat.

Because of these limitations, efforts were also made to collect new data on baseline fish consumption, as described in the next section.

3 MMP BASELINE FISH CONSUMPTION SURVEYS

3.1 Background and General Methods

Azimuth conducted four surveys to collect new data on baseline fish consumption for the MMP. The MMP requires that baseline fish consumption information be collected for Indigenous and non-Indigenous people. Two of the baseline fish consumption surveys were restricted to members of Indigenous Nations and two of the surveys targeted the general population of fishers in the Peace Region. All four of the surveys used a version of the baseline fish consumption questionnaire (see [Section 3.1.1](#) for more details), which was developed for this purpose.

MMP Indigenous Baseline Fish Consumption Surveys. Indigenous Nations were briefed on the reasons for collecting new data on baseline fish consumption and invited to participate. Information-sharing meetings with Indigenous Nations on this topic occurred on the following occasions:

- May 2022 Methylmercury Subcommittee meeting;
- October 2022 Environmental Forum meeting;
- October 2022 Doig River First Nation community open house;
- November 2022 Sauleau First Nations community dinner; and
- 2022 fourth quarter Quarterly Project Update meetings.

The following Nations expressed interest in participating in a process to provide new data on baseline fish consumption:

- Blueberry River First Nations;
- Halfway River First Nation;
- McLeod Lake Indian Band; and
- Sauleau First Nations.

Baseline fish consumption surveys were conducted for the Blueberry River First Nations and McLeod Lake Indian Band in 2024. For various reasons, Sauleau First Nations and Halfway River First Nation were not able to participate in baseline fish consumption data collection.

MMP General Baseline Fish Consumption Surveys. The baseline fish consumption task included two surveys of the general population of fishers in the Peace Region, including non-Indigenous people. These two surveys were:

- The Peace River Creel Survey; and

- The Peace Region Outdoors Clubs Survey.

Details on the methods and results of each of the four baseline fish consumption surveys are provided in later sections of this report. The baseline fish consumption questionnaire and how data from the questionnaire were analyzed were common to all of the baseline fish consumption surveys. They are described below.

3.1.1 Baseline Fish Consumption Questionnaire

The baseline fish consumption questionnaire was an anonymous, quantitative food frequency questionnaire for fish. The questionnaire was developed specifically to support the baseline fish consumption surveys, and it included questions about:

- How frequently participants eat:
 - Fish caught in the Peace River and its tributaries;
 - Fish caught in other locations; and
 - Fish purchased at stores and restaurants;
- The average amount of fish eaten in a meal;
- The participants' weight, gender, and community of residence; and
- How much fish people who live with the participant eat.

The baseline fish consumption questionnaire was developed by Azimuth, in collaboration with Karen Fediuk, a Registered Dietician with Reciprocity Research Inc., and Aski Reclamation. LGL Ltd. and BC Hydro provided review comments on draft versions of the questionnaires.

The baseline fish consumption questionnaire was adapted slightly, as needed, for each of the baseline fish consumption surveys. Copies of the specific versions of the questionnaire that were used in each of the surveys are appended to this report.

Detailed fish consumption information was not collected for participants who reported eating fish less than once a month because they do not eat fish frequently enough for exposure to methylmercury to be a potential concern. The first question in the questionnaire asked, "How often do you eat fish?" Participants selected one of the following responses:

- I don't eat fish;
- Less than once a month;
- 1 to 3 times a month; or
- Once a week or more.

Participants who responded that they don't eat fish or they eat fish less than once a month were directed to skip the remaining questions about their fish consumption and jump ahead in the questionnaire to questions about their gender, age, community of residence, and how much fish people they live with eat.

The second question asked participants how frequently they eat fish caught in the Peace River, or lakes or rivers connected to the Peace River¹⁴. As explained in **Section 1.1.2**, the Site C reservoir is expected to cause temporary increases in levels of methylmercury in fish that inhabit the Site C reservoir and the mainstem of the Peace River between the Site C dam and Many Islands, Alberta. Levels of methylmercury in some migratory fish species that inhabit tributaries to the Site C reservoir and the mainstem of the Peace River between the Site C dam and Many Islands, Alberta may also increase temporarily. The precise boundaries of the geographic extent of waterbodies where levels of methylmercury in fish will increase temporarily as a result of the Site C reservoir are uncertain, but they are not expected to extend beyond the boundaries of the Peace River watershed between Peace Canyon dam and Many Islands, Alberta (illustrated in **Figure 1**). In an effort to keep the questionnaire as simple as possible and in the context of the uncertainty about the precise boundaries of the geographic extent of waterbodies where levels of methylmercury in fish will increase temporarily as a result of the Site C reservoir, the questionnaire simply asked participants how frequently they eat fish caught "in the Peace River, or lakes or rivers connected to the Peace River". This simplification has implications for interpretation of the results.

Participants who responded that they frequently eat fish caught in the Peace River system were asked to provide detailed information about their fish consumption, including:

- The average amount of fish that they eat in a meal;
- How many meals a month they eat of each species of fish caught in the Peace River system; and
- How many meals a month they eat of each species of fish from stores or restaurants or caught in places other than the Peace River system.

¹⁴ The Peace River and lakes or rivers connected to the Peace River are subsequently referred to in this report as the "Peace River system."

The questionnaire provided the opportunity for people to indicate how many meals a month, on average, they eat fish caught in the Peace River system¹⁵. Participants were not asked explicitly about fish consumption between Hudson's Hope, B.C., and Many Islands, A.B. The questionnaire provided space for participants to provide a response for 13 named species of fish and up to three other species¹⁶.

For reasons related to privacy and ethical consent, the baseline fish consumption surveys did not collect fish consumption data directly from minors. Participants that completed baseline fish consumption questionnaire affirmed that they were at least 16 years old. The baseline fish consumption questionnaire included questions about the fish consumption of people who live with the participant, including children younger than 12 years old. These questions allowed the baseline fish consumption surveys to gather indirect information on fish consumption among children.

The baseline fish consumption questionnaire asked participants to provide fish consumption information for up to five people they live with. Household members were identified as:

- Children < 12;
- Females 12–50; or
- General Population.

Participants were asked to provide information about the household members' fish consumption behaviour. The frequency of fish consumption for household members was reported relative to the participant's rate, and it included the following consumption frequencies:

- Less;
- Same;
- More.

3.1.2 How Data from the Baseline Fish Consumption Questionnaires Were Analyzed

Azimuth analyzed the data from the fish consumption questionnaire using R v4.3.1 (R Core Team, 2023). Where possible, data were summarized according to the following gender groups and population categories:

¹⁵ The Peace River system was defined as the "Peace River and lakes or rivers connected to the Peace River".

¹⁶ Thirty-two species of fish are known to inhabit the Peace River. Some species are relatively small "bait" fish and are unlikely to regularly eaten by people. Examples are Redside Shiner, Spottail Shiner, Brook Stickleback, Finescale Dace, Longnose Dace, Northern Redbelly Dace, Pearl Dace, Trout-Perch, Slimy Sculpin, Prickly Sculpin, and Spoonhead Sculpin. Not all species of fish occur in all parts of the Peace River. For example, Northern Pike are not abundant above Many Islands, A.B.

- **Gender groups:**
 - **Female.** This group included participants who identified as female.
 - **Male.** This group included participants who identified as male.
- **Population categories:**
 - **Children < 12.** This category included children under 12 years old.
 - **Females 12–50.** This category included females from 12 to 50 years old.
 - **General Population.** This category included teen and adult males, females over 50 years old, and participants whose age and gender, or both, were not known.

The questionnaire asked respondents to report their body weight in pounds (lbs). Data from this question were converted to kilograms (kg) by multiplying data in pounds by 0.454 kg/lb.

When calculating daily rates of fish consumption, we assumed there were 30.44 days per month. This was based on 365.25 days in year divided by 12 months.

Relative Popularity of Fish Species

The relative popularity of fish species was calculated by the ranked sum of the total number of participants in a survey that responded that they eat a particular species. For example, if 35 of 50 participants responded that they eat Rainbow Trout and 20 of 50 participants responded that they eat Lake Trout, Rainbow Trout was considered more popular than Lake Trout.

Mass of Fish per Meal

The questionnaire asked respondents how many portions of fish they eat per meal on average. Responses were used to calculate average mass of fish per meal in grams, based on the following conversions: 1 portion = 3 oz and 1 oz = 28.3495 g.

Fish Consumption Rates

Fish consumption rates, in grams per day, were calculated for each participant if enough data were available. To calculate the rates, the annual average number of meals per month were first multiplied by the average mass of fish consumed per meal (g) and then divided by 30.44 days/month. Species-specific consumption rates were then summed to calculate a total fish consumption rate for fish from the Peace River system (Fish Consumption Rate – Peace), a total fish consumption rate for fish from other sources (Fish Consumption Rate – Other), and a grand total fish consumption rate for all fish (Fish Consumption Rate – Total).

Relationships Between Body Weight and Fish Consumption

We used linear regressions to investigate relationships between a participant's body weight and their fish consumption rates (g/day), as well as between their body weight and the average mass of fish consumed per meal (g).

3.2 Peace River Recreational Angling Creel Survey

3.2.1 Background and Methods

BC Hydro contracted Aski Reclamation LP and LGL Ltd. to conduct a recreational angling creel survey from July 1, 2022, to June 30, 2024, from Peace Canyon Dam to Many Islands, Alberta¹⁷. The goals of the creel survey were to describe the demographics of recreational anglers and obtain statistically valid estimates of fishing activity patterns, levels of fishing effort, and catch and harvest rates for 11 taxa of fish. The baseline fish consumption questionnaire was added to the 2022/23 Peace River Recreational Angling Creel Survey to collect baseline fish consumption data for recreational anglers on the Peace River.

The 2022/23 Peace River Recreational Angling Creel Survey was part of the Site C Fisheries and Aquatic Habitat Monitoring and Follow-Up Program. It was conducted by Aski Reclamation with support from LGL Ltd. Environmental Research Associates. The creel survey collected data on the timing, duration, location, type of fishing gear used, and the species of fish that anglers caught. Data were collected using the following three methods:

- Interviews with anglers at public access points to the Peace River, such as parks and boat launches;
- Traffic counters and cameras at boat launches; and,
- Aerial overflights with an observer in a fixed wing aircraft.

The baseline fish consumption questionnaire was included with the creel survey interviews with anglers at public access points to the Peace River.

¹⁷ The study is referred to as the 2022/23 Peace River Recreational Angling Creel Survey

The creel survey baseline fish consumption questionnaire was based on the baseline fish consumption questionnaire. A general description of the baseline fish consumption questionnaire was provided in **Section 3.1.1**. A copy of the initial fish consumption questionnaire for the creel survey is included in this report in **Appendix A1**. The creel survey fish consumption questionnaire was subsequently updated twice in response to recommendations from the Aski Reclamation Ltd. staff administering the questionnaire in the field.

The first update on August 31, 2022, was primarily to change the directions that accompanied question 2, which asked participants how often they eat fish from the Peace River system. The initial version of the questionnaire asked for detailed information about their fish consumption if they ate fish from the Peace River system once a week or more. Aski Reclamation Ltd. reported that very few of the people interviewed in July and August 2022 responded that they ate fish from the Peace River system once a week or more. Therefore, the questionnaire was updated to ask for detailed information about their fish consumption if they ate fish from the Peace River system *once a month or more*. A copy of the August 31, 2022, version of the creel survey fish consumption questionnaire is included in this report in **Appendix A2**.

The second update occurred in February 2023. Minor updates were made, which included:

- Switching the order of questions 3a and 3b so that the question about the average amount of fish consumed in a meal preceded questions about fish consumption frequency; and,
- Editing the text of question 3b and the text in the header of the consumption frequency table so the question explicitly asks how many meals of fish are consumed in a month, instead of how many times fish is consumed in a month.

A copy of the February 3, 2023, version of the creel survey fish consumption questionnaire is included in this report in **Appendix A3**.

Interviews for the creel survey fish consumption questionnaire were completed in July, August, and September 2022 and April, May, and June 2023. Information from the questionnaires was recorded in the field in hard copy by technicians from Aski Reclamation Ltd. The company then digitized the hard-copy data into a Microsoft Excel database and provided it to Azimuth. Results

3.2.2 Results

Data from the creel survey (CS) fish consumption questionnaire were analyzed as described above in **Section 3.1.2**. In total, 97 people completed the creel survey fish consumption questionnaire. The initial questionnaire was completed by 38 % of participants, and 61 % of participants completed one of the updated versions. The version of the questionnaire was unknown in one case, where almost all questions were also unanswered.

Population Profile

Community. Ninety-one participants provided information on where they were from (Figure 9). Of these, about 96 % were from British Columbia, and the remaining were from Alberta (2 %), Ontario (1 %), and Newfoundland (1 %). The participants from British Columbia represented 20 communities; most were from Fort St John (58.6 %), followed by Hudson’s Hope (10.4 %), Moberly Lake (4.6 %), and Dawson Creek (3.5 %).

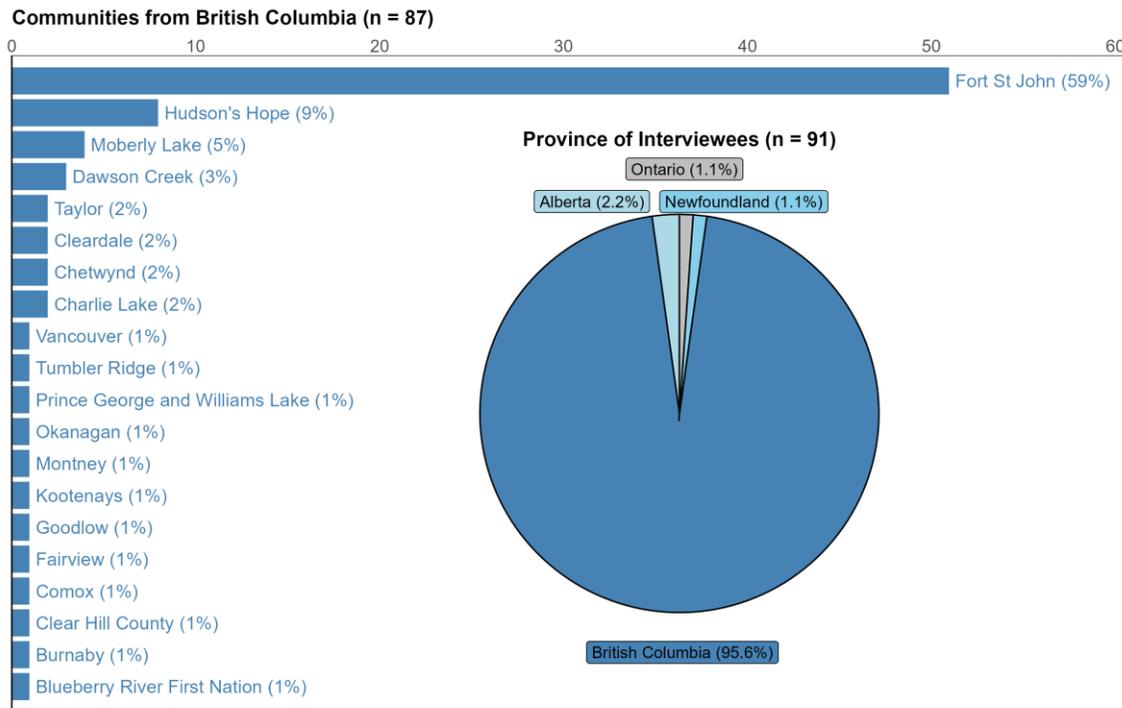


Figure 9. Data for provinces and communities (CS data)

Age. The creel survey questionnaire provided age data for a total of 94 participants (Figure 10). The age data ranged from 3 to 67 years old, with most participants in the range of 20 to 45 years old. The age data followed a relatively normal distribution.

The creel survey collected data on the age of people in a fishing party. We assumed that the age of the first person in the fishing party was also the age of the person that was interviewed for the fish consumption questionnaire. This assumption likely led to some inaccuracies in the age data. For example, it is unlikely that a three-year-old was interviewed for the fish consumption questionnaire.

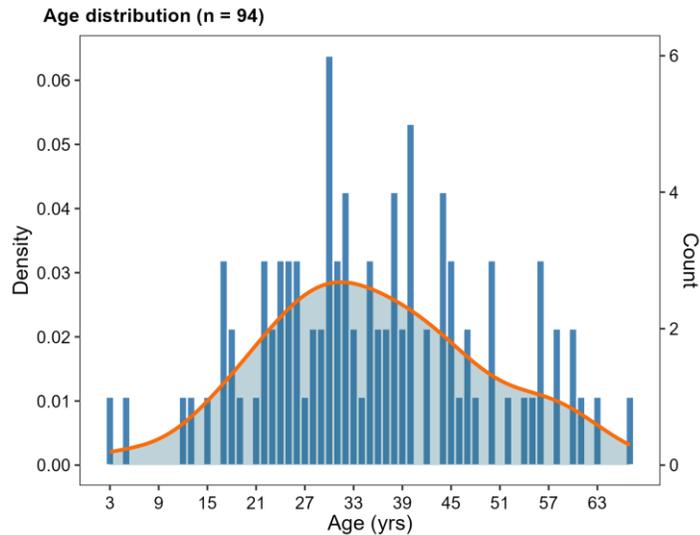


Figure 10. Age distribution (CS data)

Gender. Fifty-nine participants provided information on their gender. Of these, 15 % were female and 45 % were male (**Figure 11**). The gender of about 40 % of participants was not reported (unknown), and no one identified their gender as other.

Population Categories. Based on the available age and gender data, 87 % percent of the participants were categorized as general population, which included males over 12 years old; females over 50 years old; and participants with unknown age, gender, or both (**Figure 11**). Eleven percent of the participants were females 12 to 50 years old, and 2 % of the participants were children under 12 years old.

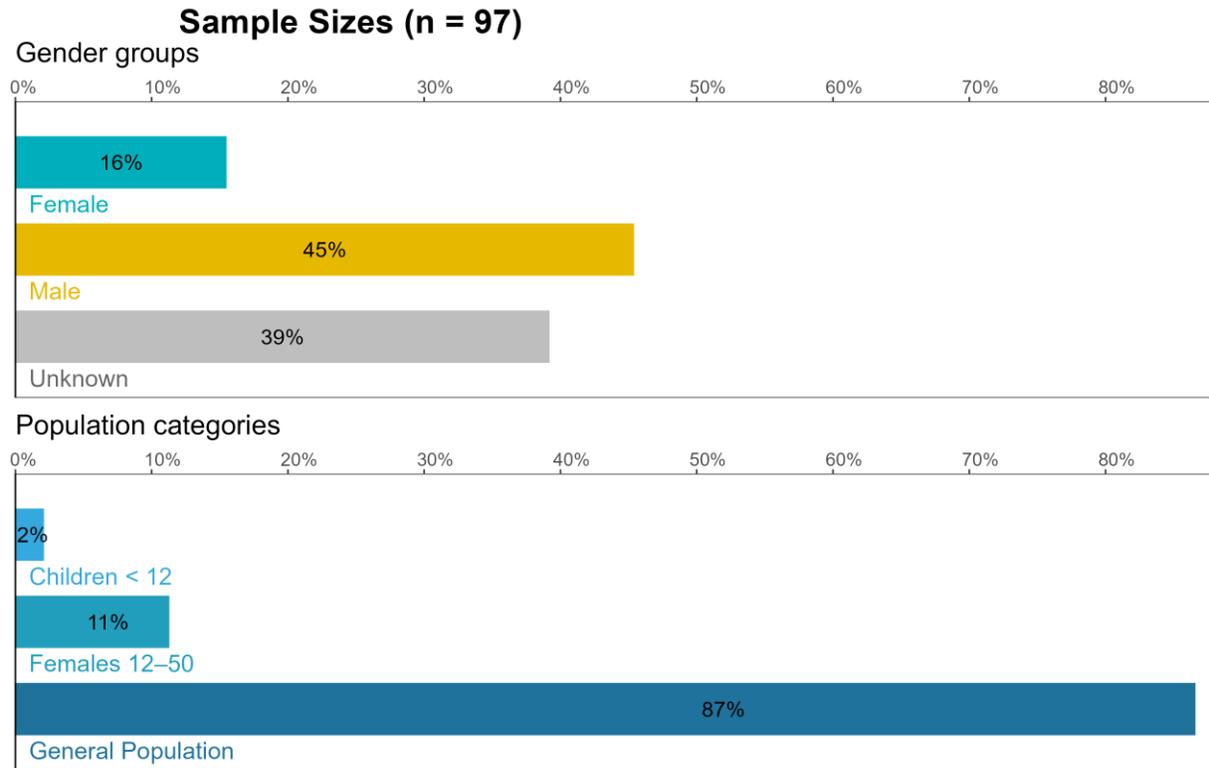


Figure 11. Gender and population categories (CS data)

Weight. Fifty-eight participants provided information about their weight (**Figure 12**), which ranged from approximately 59 to 136 kg. Mean \pm standard deviation of body weight was 95 ± 17 kg in males and 79 ± 18 kg in females.

Body Weight

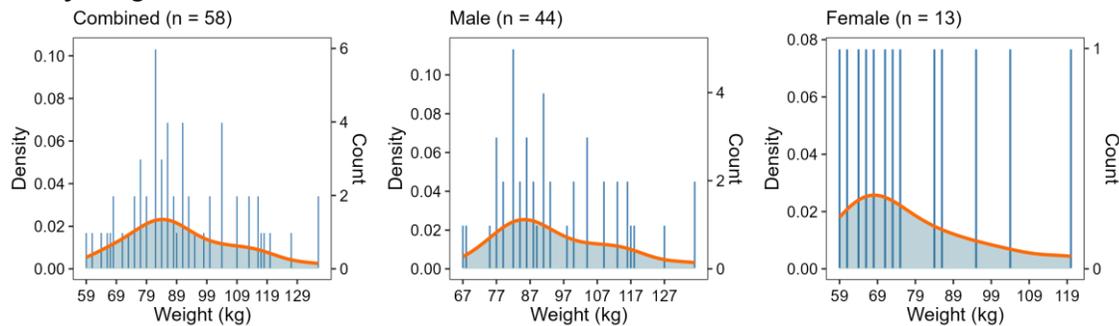


Figure 12. Body weight distribution (CS data)

Frequency of Fish Consumption

Consumption Frequency of Fish in General

Ninety-four participants provided information on how frequently they eat fish in general (**Figure 13**):

- 7 % do not eat fish;
- 35 % eat fish less than once a month;
- 42 % eat fish 1–3 times a month; and
- 16 % eat fish 4 times a month or more.

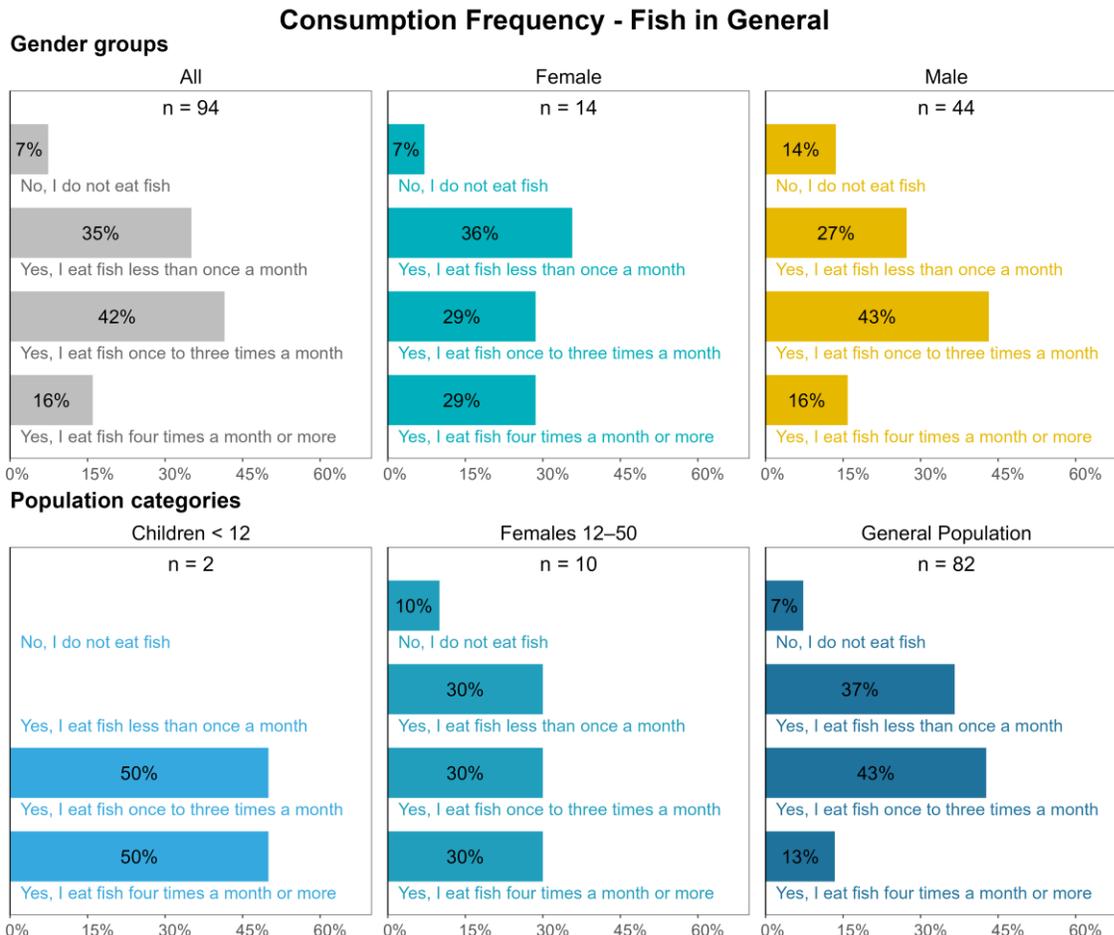


Figure 13. Consumption frequency of fish in general (CS data)

Consumption frequency of fish in general varied by gender and population categories (Figure 13), as summarized in the next two paragraphs:

Gender. Among participants who provided information on how frequently they eat fish in general, 14 were female, 44 were male, and 36 did not reveal their gender. Compared to males, a lower percentage of females eat fish one to three times a month (43 % of males vs. 29 % of females), although the percentage of females who eat fish four or more times a month (29 %) was higher than the percentage of males (16 %). In addition, the percentage of females who do not eat fish (7 %) was half that of males (14 %).

Population categories. In terms of population categories, two participants were children under 12 years old. One child eats fish one to three times a month and the other eats fish four or more times. Among the 10 female participants 12 to 50 years old, 30 % eat fish less than once a month, 30 % eat fish one to three times a month, and 30 % eat fish four or more times a month. The remaining 10 % do not eat fish. Among the other 82 participants, including those in the unknown age or gender category, 43 % eat fish one to three times a month, followed by those who eat fish less than once a month (37 %). About 13 % eat fish four or more times a month, and the remaining 7 % do not eat fish.

Consumption Frequency of Fish from Peace Sources

Ninety-two participants provided information on how frequently they eat fish from Peace sources (**Figure 14**).

Among the 36 people who completed the original questionnaire:

- 97 % do not eat fish from the Peace River once a week or more; and
- 3 % eat fish from the Peace River once a week or more.

Among the 56 people who completed an updated version of the questionnaire:

- 39 % do not eat fish from the Peace River once a month or more; and
- 61 % eat fish from the Peace River once a month or more.

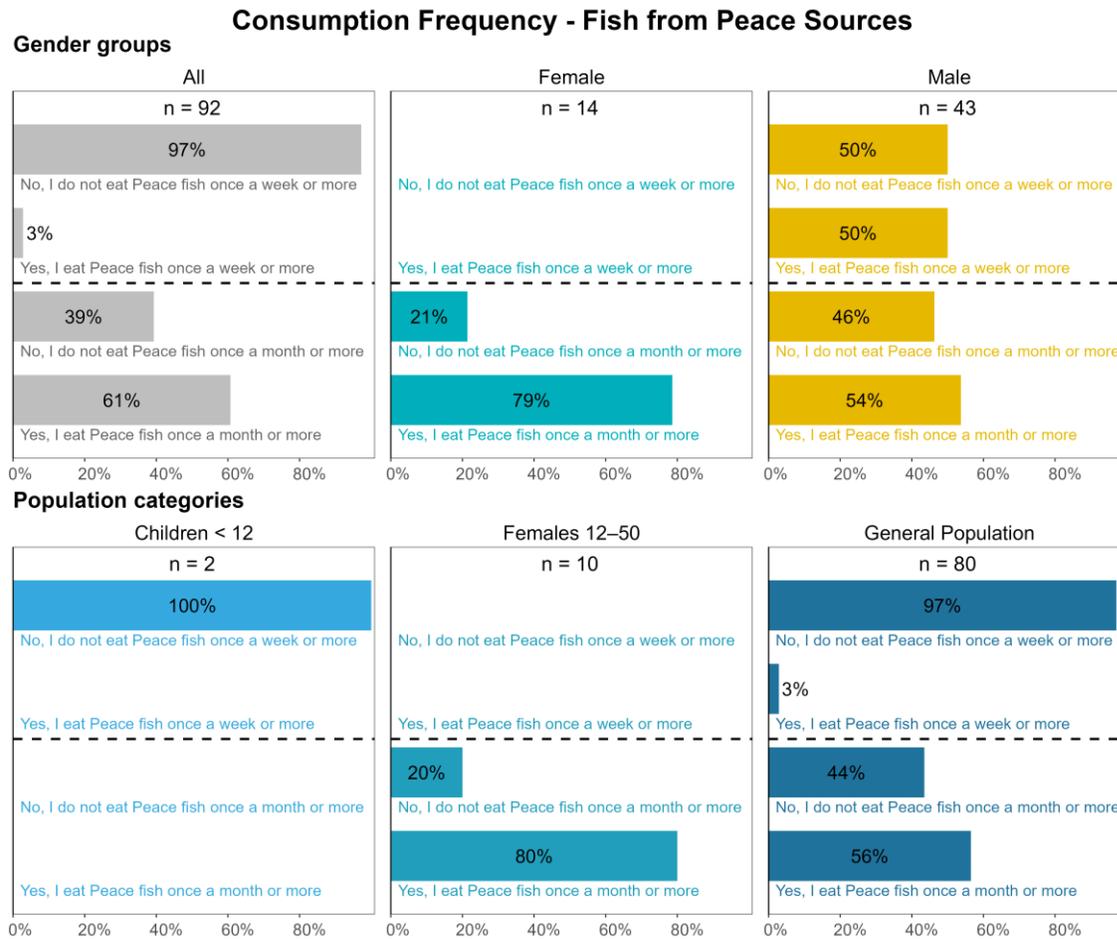


Figure 14. Consumption frequency of fish from Peace River system (CS data)

Consumption frequency of fish from Peace sources varied by gender groups and population categories (Figure 14), as summarized in the next two paragraphs,

Gender groups. Among participants who provided answers about consumption frequency of fish from Peace sources, 14 were female and 43 were male; 36 participants did not provide information on their gender. Zero female and two male participants completed the original questionnaire. One male reported consuming Peace fish once a week or more, and one reported not consuming fish once a week or more. The updated versions of questionnaires were completed by 14 female and 41 male participants. Seventy-nine percent of female participants and 54 % of males stated that they consume Peace fish once a month or more.

Population categories. Among participants who provided answers to how frequently they consume fish from Peace sources, two were children under 12 years old, 10 were females 12 to 50 years old, and 80 were categorized as general population, including those of unknown age, gender, or both (Figure 14). Both children under 12 years old completed the original version of the questionnaire and

stated that they do not consume Peace fish once a week or more. No participants in the category females 12 to 50 years old completed the original version, but it was completed by 34 participants categorized as general population, including unknown age, gender, or both. Of those in the general population category, 97 % stated that they do not consume Peace fish once a week or more. The updated versions of questionnaire were completed by 10 females 12 to 50 years old and by 46 participants categorized as general population. Eighty percent of females 12 to 50 years old stated that they consume Peace fish once a month or more, and 56 % of those in the general population category stated that they consume Peace fish once a month or more.

Consumption of Different Fish Species

Most participants reported eating more than one species of fish (**Figure 15**). While there were participants who eat only one type of fish species from the Peace River system (26 %) and non-Peace sources (17 %), the majority reported consuming more than one type of fish species from both the Peace River system (74 %) and non-Peace sources (83 %). Overall, more than half of participants eat four or more different fish species.

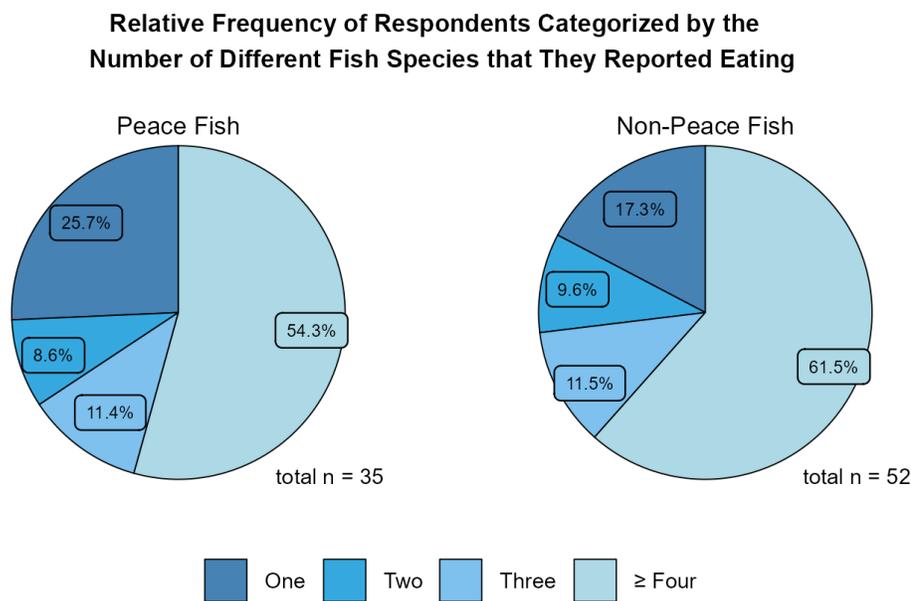


Figure 15. Relative frequency of consuming different fish species (CS data)

Popularity of Fish Species

Popularity of Fish Species from Peace Sources

Thirty-five participants provided information on the average number of meals of fish from the Peace River system that they eat in a month (**Figure 16**). The most popular species of fish from the Peace River system, determined by the total number of participants who reported eating them, were, in

descending order: Rainbow Trout, Lake Trout, Walleye, Northern Pike, Arctic Grayling, and Bull Trout. The least popular fish species were: Goldeye, Sucker, and Northern Pikeminnow.

For all species of fish from the Peace River system that people reported eating, the average number of monthly meals varied from one to three (Figure 16), with most participants (83 % to 100 %) eating an average of one meal a month of any particular species. Only Bull Trout, Lake Trout, and Rainbow Trout were eaten three times a month and only by a small percentage of participants (5 % to 8 %).

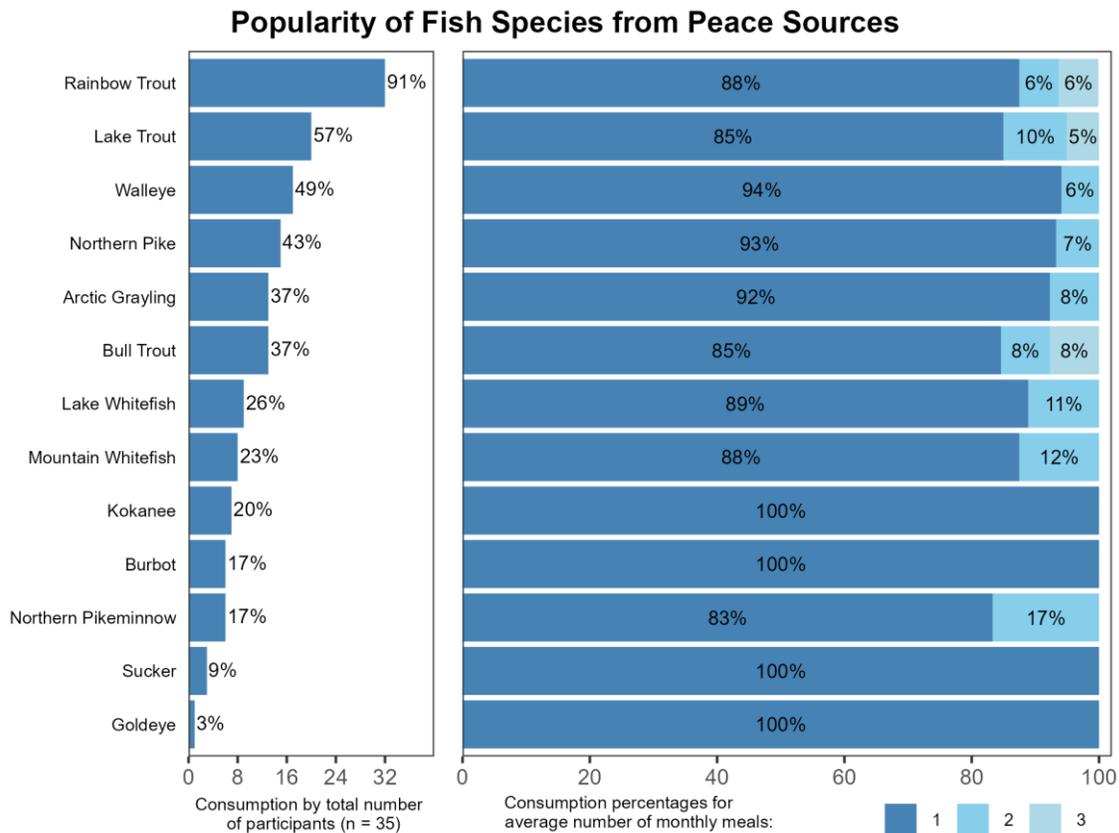


Figure 16. Popularity of fish species consumed from Peace River system (CS data)

Popularity of Fish Species from Other Sources

Fifty-two participants provided information on the average number of meals of fish from sources other than the Peace River that they eat in a month (Figure 17). The most popular species of fish from sources other than the Peace River, determined by the total number of participants who reported eating them, were, in descending order: Salmon, Halibut, Other (not specified), Light Tuna, and Albacore Tuna. The least popular fish species were: Mountain Whitefish; Burbot; Shark, Swordfish or Marlin; and Goldeye.

For all species of fish from sources other than the Peace River that people reported eating, the average number of monthly meals varied from one to three (Figure 17), with most participants (83 % to 100 %) eating an average of one meal a month of any particular species. Only Ahi Tuna was eaten three times a month and only by 6 % of the participants who reported that they eat Ahi Tuna.

Thirty-one participants indicated that they eat fish species other than those listed. Although the questionnaire made it possible to indicate the names of other species that people eat, no participants provided that information.

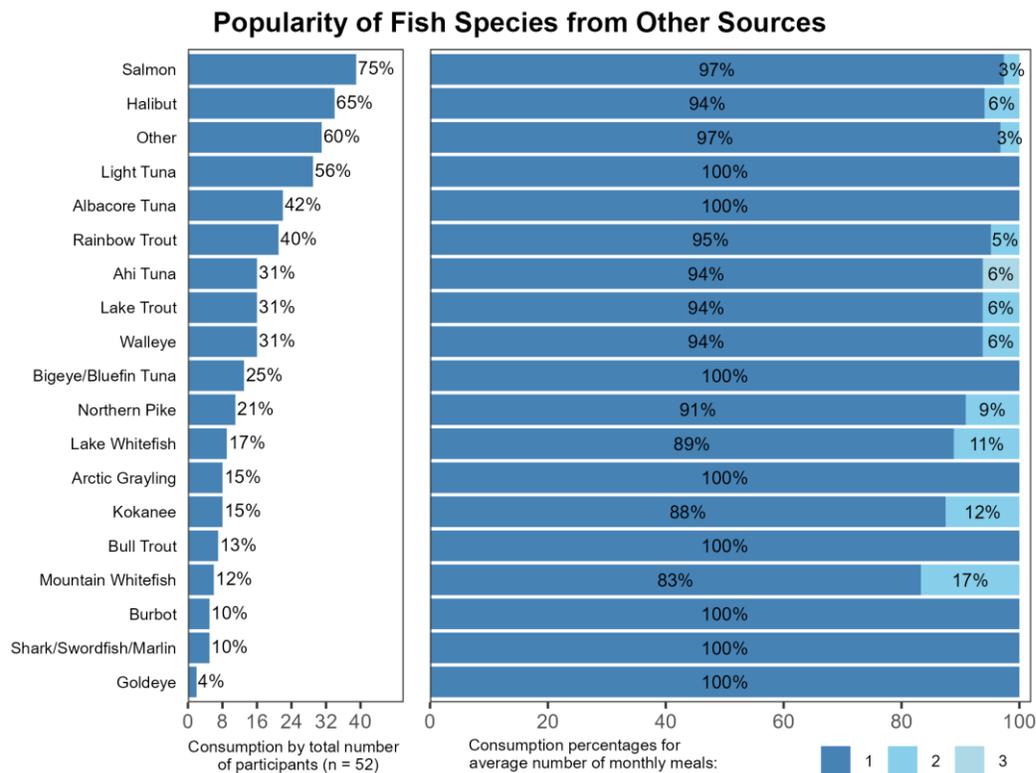


Figure 17. Popularity of fish species consumed from other sources (CS data)

Fish Mass Consumed per Meal

Fifty-five participants provided information on the average number of portions of fish they consume when they eat a meal of fish (**Figure 18**).

- Among all 55 participants, the average mass of fish per meal ranged from 85 to 680 g, with an arithmetic mean and standard deviation (SD) of 262 ± 165 g.
- The average mass of fish per meal for females was 291 g (SD ± 210 g), and the average mass of fish per meal for males was 254 g (SD ± 150 g).
- The average mass of fish per meal for females 12 to 50 years old was 298 g (SD ± 193 g), and the average mass of fish per meal for the general population was 254 g (SD ± 160 g).

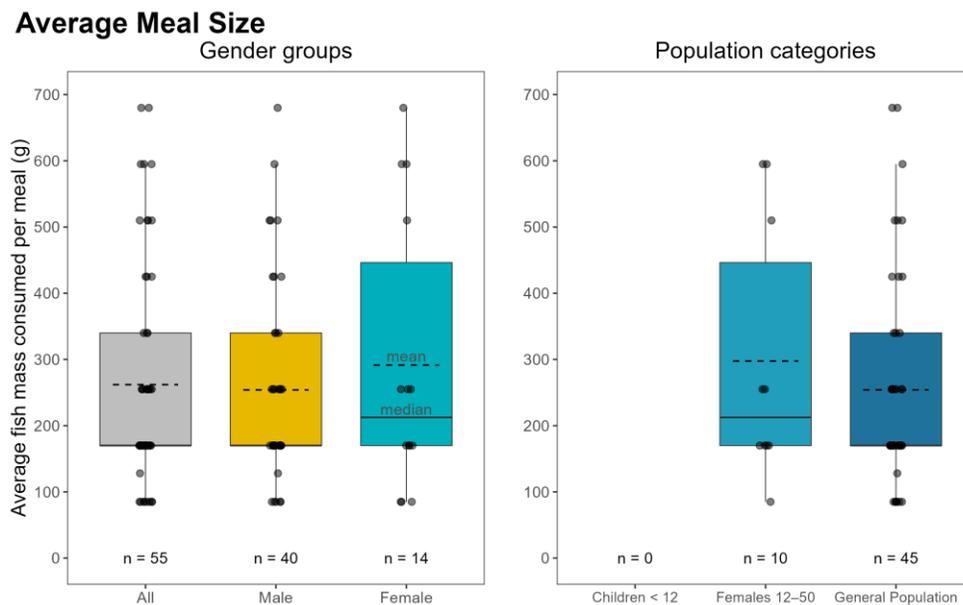


Figure 18. Average amount of fish eaten in a meal for participants (CS data)

Fish Consumption Rates

Fish consumption rates were calculated for fish species from the Peace River system (Fish Consumption Rate – Peace) and from other sources (Fish Consumption Rate – Other).

Fish Consumption Rate – Peace

Fish Consumption Rate – Peace was calculated for 35 participants. Among all participants and across all species, the rates of consumption for a single species of fish from the Peace River system ranged from 2.8 to 22.4 g/day (Figure 19). The Species-Specific Fish Consumption Rate – Peace varied among participants by both gender groups and population categories, but it was generally higher in females than males and higher in females 12 to 50 years old than in the general population.

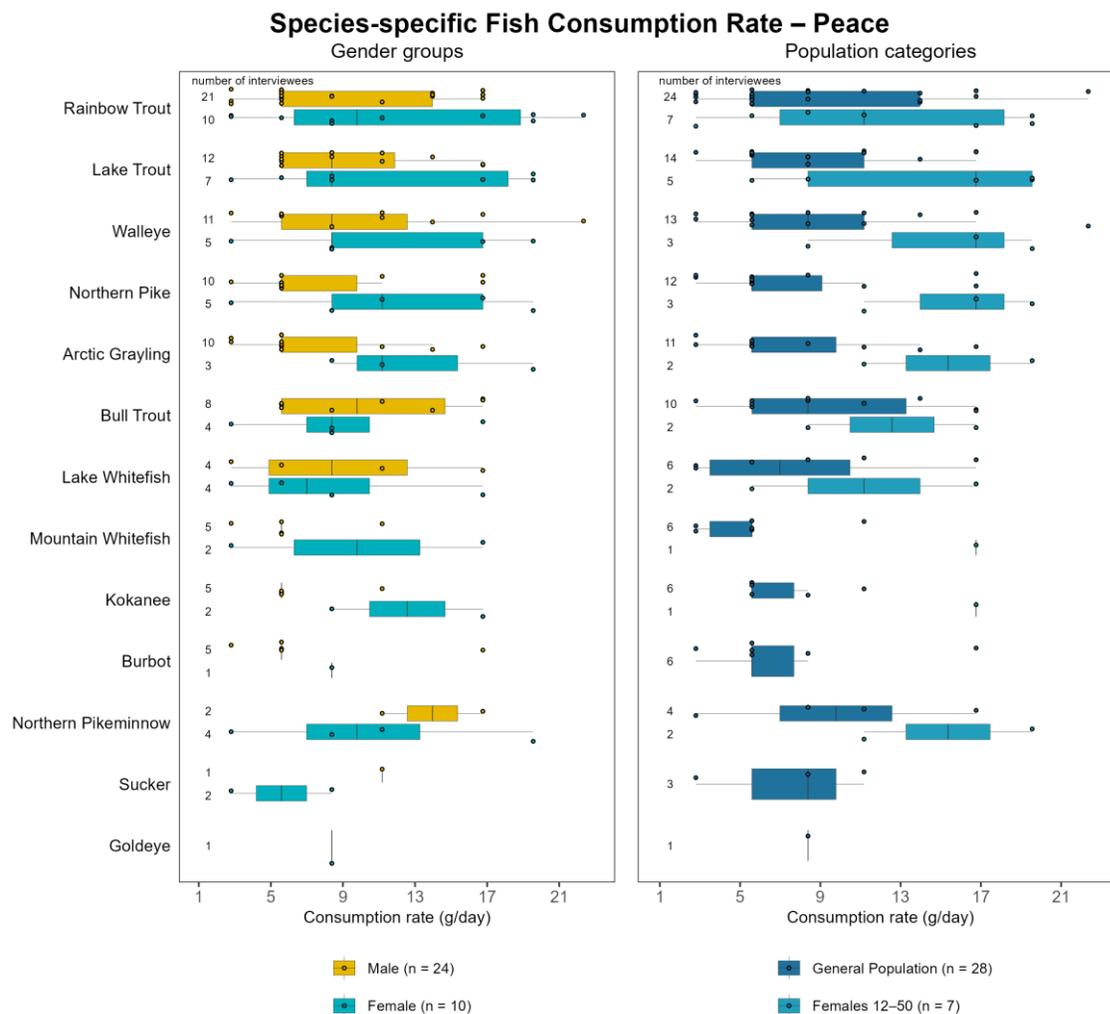


Figure 19. Species-specific consumption rates of fish from Peace River system (CS data)

The sum of species-specific consumption rates for fish from the Peace River system ranged from 2.8 g/day to 134 g/day, with mean \pm SD of 40.6 ± 36.2 g/day, and 95th percentile of 119 g/day (**Figure 20**).

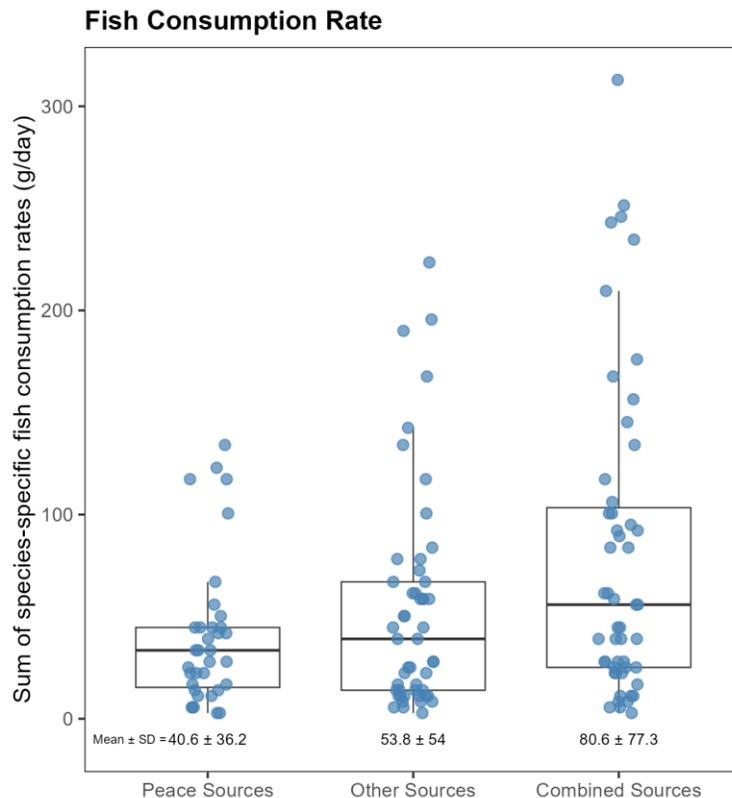


Figure 20. Sum of species-specific fish consumption rates (CS data)

Fish Consumption Rate – Other

Fish Consumption Rate – Other was calculated for 50 participants (**Figure 21**). Among all participants and across all species, the rates of consumption for a single species of fish ranged from 2.8 to 22.4 g/day. The Species-Specific Fish Consumption Rate – Other varied among individuals by both gender groups and population categories, but the rates were generally higher in females than males and higher in females 12 to 50 years old than the general population.

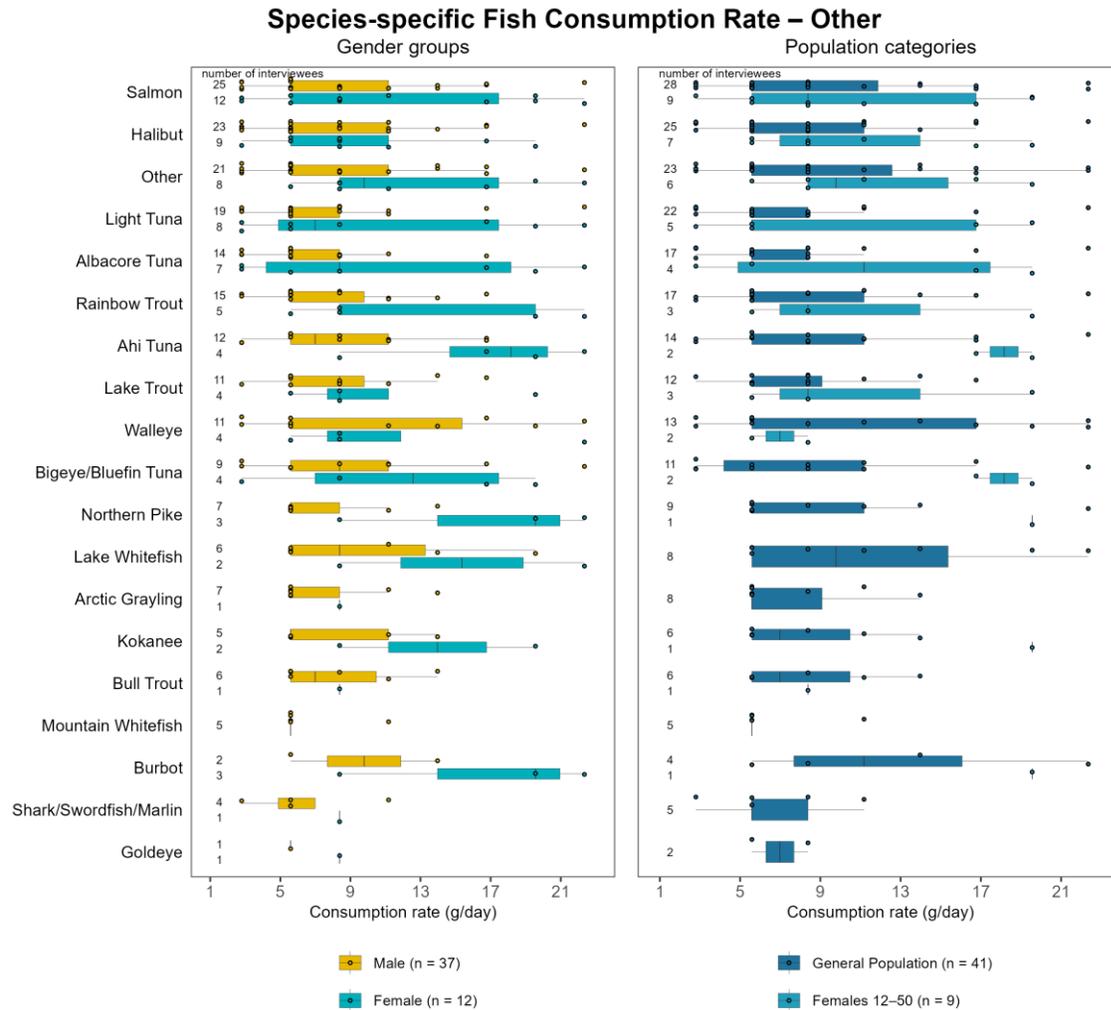


Figure 21. Species-specific consumption rates of fish from other sources (CS data)

The sum of species-specific consumption rates for fish from sources other than the Peace River system ranged from 2.8 g/day to 224 g/day, with mean ± SD of 53.8 ± 54 g/day, and 95th percentile of 180 g/day (Figure 20).

Fish Consumption Rate – Total

Overall, the sum of species-specific consumption rates from both Peace and other sources ranged from 2.8 g/day to 313 g/day, with mean ± SD of 80.6 ± 77.3 g/day, and 95th percentile of 244 g/day (Figure 20). Among participants, there was large variability in the sum of species-specific fish consumption rates from both sources, with the variability being larger for fish species from other than Peace sources.

Relationships Between Body Weight and Fish Consumption

Fish consumption rates were not related to the body weights of participants (**Figure 22**). Results from simple linear regression analysis showed that there was no statistically significant ($p > 0.05$) relationship between body weight and sum of species-specific consumption rates of fish from Peace and other sources.

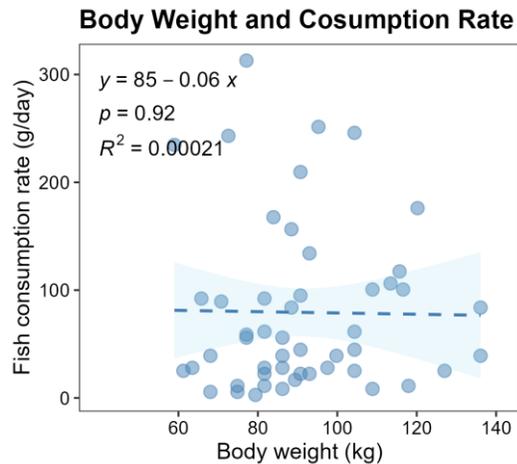


Figure 22. Relationships between fish consumption rate and participants' body weight (CS data)

There appeared to be an increase in the average amount of fish consumed per meal as body weight of participants increased (**Figure 23**), although the relationship was not statistically significant ($p > 0.05$).

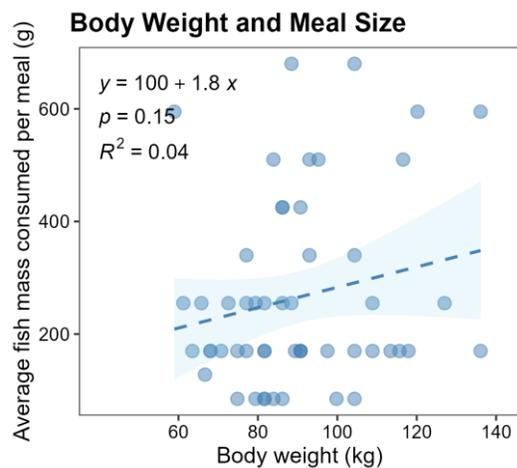


Figure 23. Relationships between fish mass consumed per meal and participants' body weight (CS data)

Fish Consumption of Household Members

Overall, the creel survey participants provided age and gender information for 156 household members (**Figure 24**). About half (49 %) of household members were females 12 to 50 years old, with children under 12 and general population each representing about one-quarter of household members.

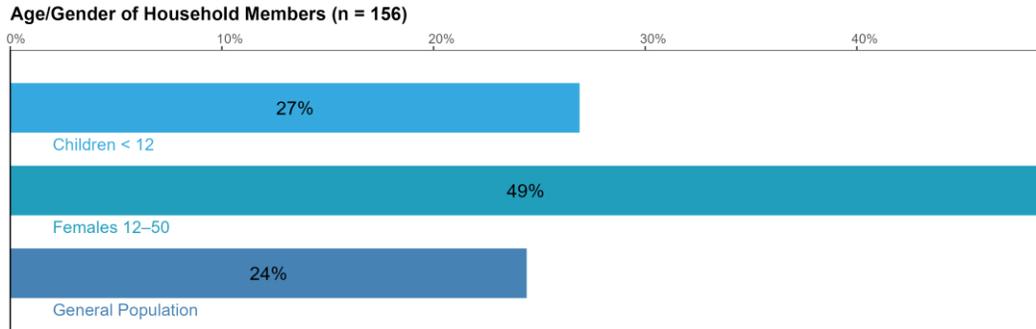


Figure 24. Age and gender of household members (CS data)

Fish consumption behaviour of household members was mostly similar to that of participants (**Figure 25**): 71 % ate the same amount of fish as the participants, 5 % ate more fish, and 24 % ate less fish.

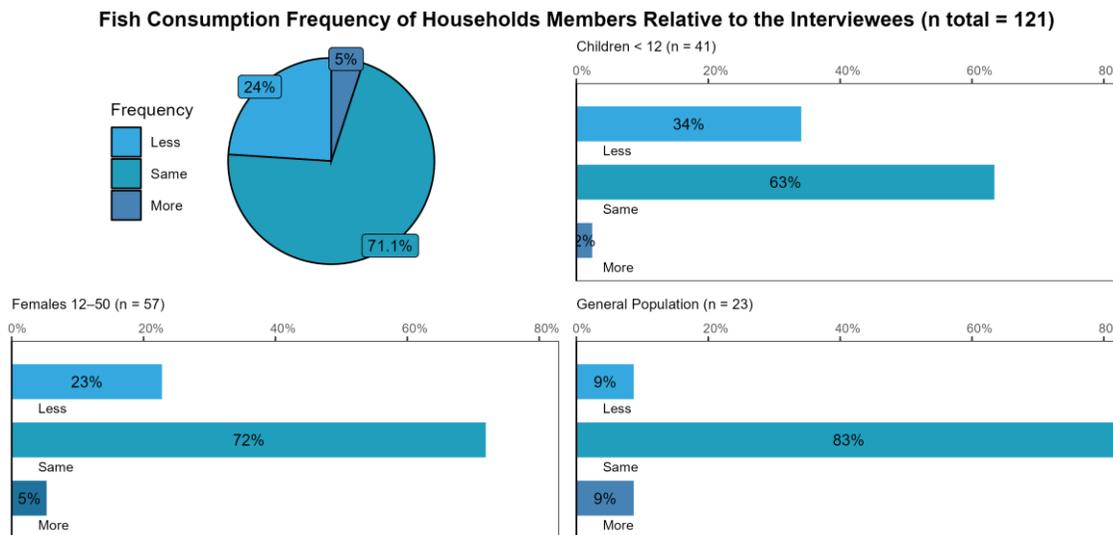


Figure 25. Fish consumption frequency of household members (CS data)

3.3 McLeod Lake Indian Band Baseline Fish Consumption Survey

3.3.1 Background and Methods

McLeod Lake Indian Band (MLIB) participated in a baseline fish consumption survey. The questionnaire used in the MLIB baseline fish consumption survey was based on the creel survey fish consumption questionnaire. The MLIB reviewed the questionnaire prior to it being used, and a copy is provided in **Appendix A5**. While an on-line version of the questionnaire was prepared by Leger¹⁸ for the survey, MLIB decided that they preferred to use the hard-copy format.

Two sessions were held to share information on methylmercury in fish and promote the MLIB baseline fish consumption survey. One information session occurred on March 28, 2023, in Prince George, and a second occurred on March 29, 2023, in McLeod Lake.

The MLIB baseline fish consumption survey was conducted from January 10 to February 20, 2024. The MLIB Traditional Land Use Coordinator conducted telephone interviews with MLIB members and recorded their responses on hard copies of the questionnaire. The MLIB retained possession of the completed hard-copy questionnaires but scanned them and provided Azimuth with a .pdf file of the scanned completed questionnaires. Azimuth transcribed the scanned, completed questionnaires into digital format for data analyses.

3.3.2 Results

In total, 33 participants completed the MLIB baseline fish consumption questionnaire.

Population Profile

All participants (n = 33) were from were from British Columbia, and they represented three communities: McLeod Lake (82 %), Prince George (15 %), and Bear Lake (3 %) (**Figure 26**).

¹⁸ Leger is a Canadian-owned market research and analytics company with expertise in on-line surveys.

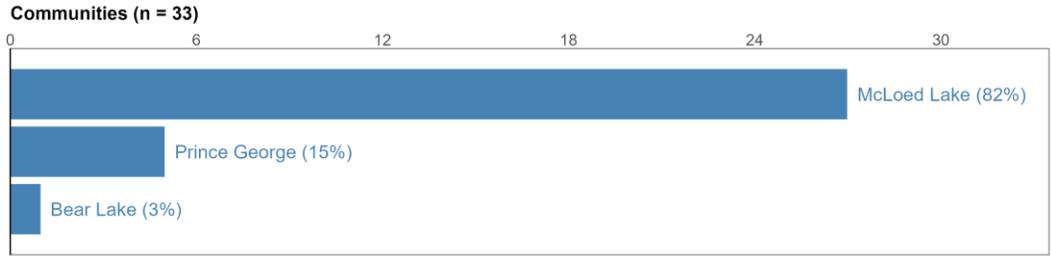


Figure 26. Participating communities (MLIB data)

The participants ranged in age from 18 to 74 years old, and the age distribution was slightly more weighted to the 45- to 65-year-old bracket (Figure 27).

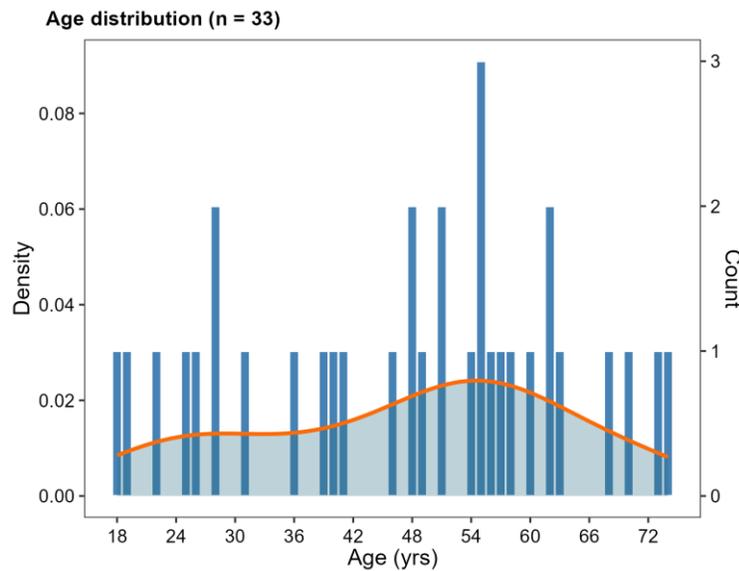


Figure 27. Age distribution (MLIB data)

Fifty-two percent of the participants were female and 48 % were male; no one identified their gender as other. Based on the available age and gender information, no children under 12 years old completed the questionnaire. Nine participants were females 12 to 50 years old and 24 were in the general population (Figure 28).

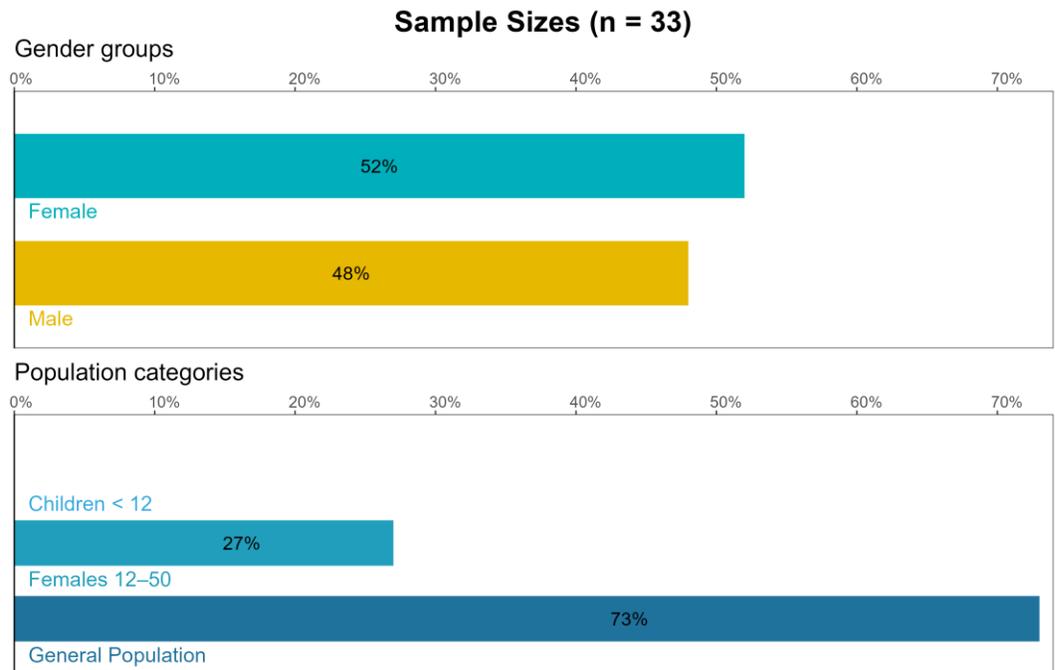


Figure 28. Sample sizes (MLIB data)

Thirty participants provided their body weight, which ranged from 48 to 93 kg (Figure 29). Mean \pm standard deviation of body weight was 77 ± 9 kg in males and 64 ± 12 kg in females

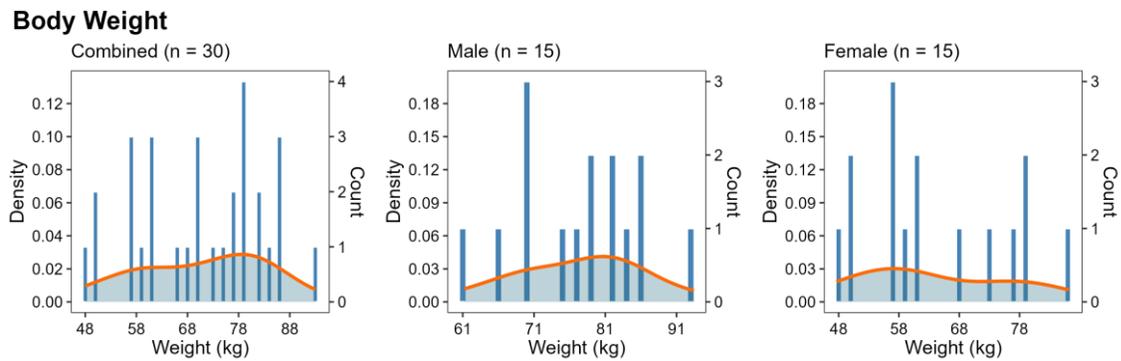


Figure 29. Body weight distribution (MLIB data)

Frequency of Fish Consumption

Consumption Frequency of Fish in General

Thirty-three participants provided information on the frequency of fish consumption in general (**Figure 30**):

- 6 % do not eat fish;
- 15 % eat fish less than once a month;
- 67 % eat fish one to three times a month; and
- 12 % eat fish four times a month or more.

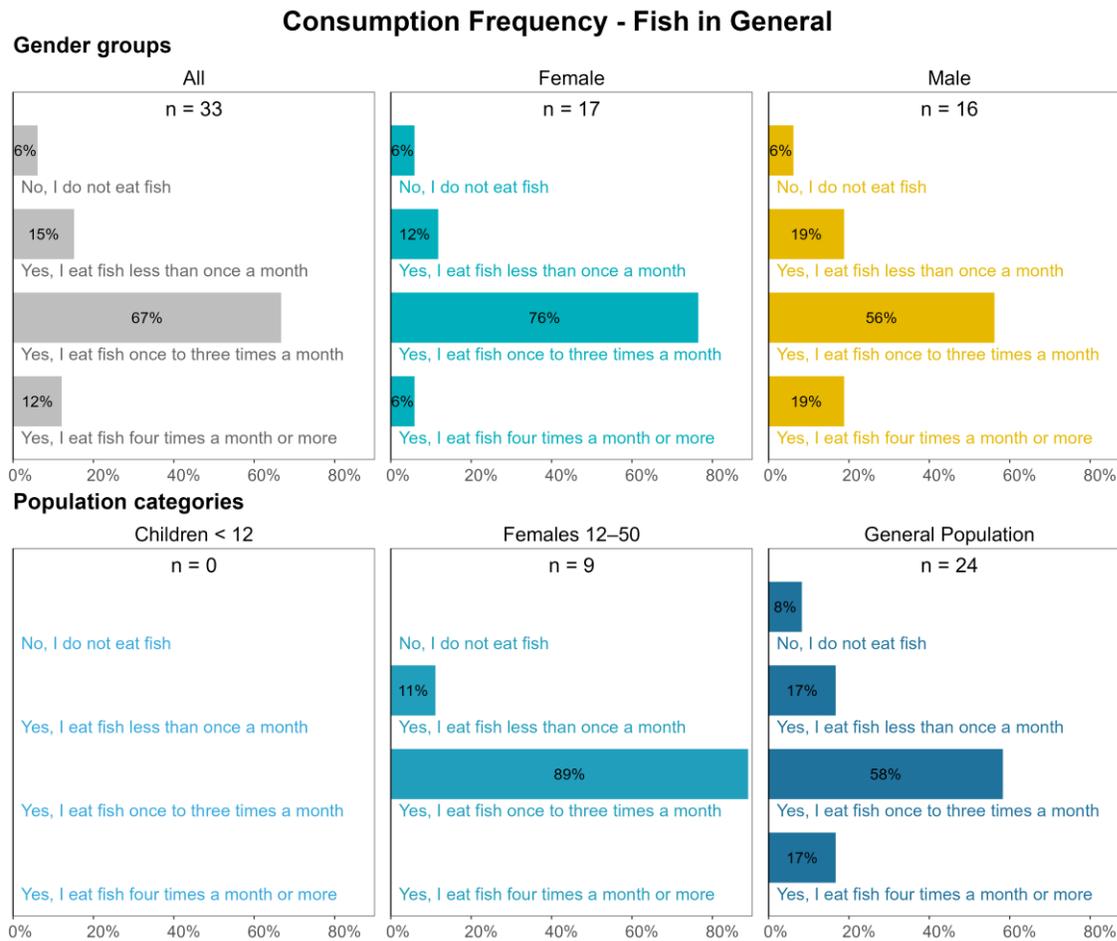


Figure 30. Consumption frequency of fish in general (MLIB data)

Consumption frequency of fish in general varied by gender groups and population categories (**Figure 31**), as summarized in the next two paragraphs:

Gender groups. Among participants who provided answers about consumption frequency of fish in general, 17 were female and 16 were male. Compared to males, a higher percentage of females eat fish one to three times a month (56 % of male vs 76 % of female participants). The percentage of female participants who eat fish four or more times a month (6 %) was lower than male participants (19 %). The percentage of participants that do not eat fish was the same in both gender groups (6 %). The percentage of participants who eat fish less than once a month was higher in males (19 %) than in females (12 %).

Population categories. In terms of population categories, 89 % of females 12 to 50 years old eat fish one to three times a month and 11 % eat fish less than once a month. Fifty-eight percent of the general population ate fish one to three times a month, 17 % ate fish less than once a month, and 17 % ate fish four times a month or more. The remaining 8 % do not eat fish.

Consumption Frequency of Fish from Peace Sources

Thirty-three participants provided information on consumption frequency of fish from Peace sources (Figure 31):

- 88 % do not eat Peace Fish once a month or more; and,
- 12 % eat Peace Fish once a month or more.

Consumption frequency of fish from Peace sources was similar among participants from different gender groups and population categories.

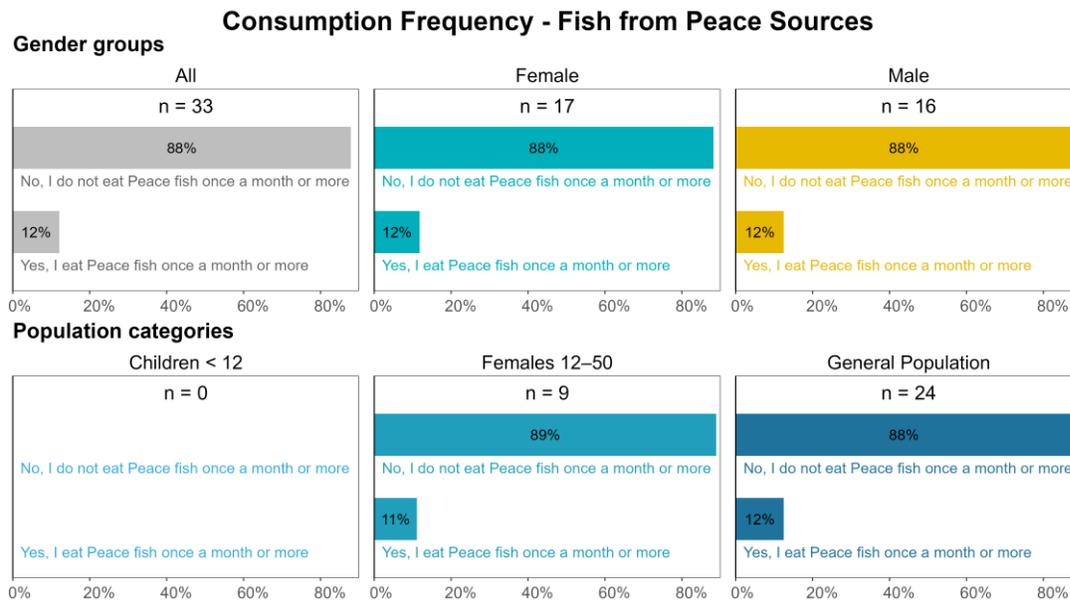


Figure 31. Consumption frequency of fish from Peace River system (MLIB data)

Consumption of Different Fish Species

Most participants in the MLIB baseline fish consumption survey reported eating more than one species of fish (Figure 32). Three participants provided consumption information for Peace fish species and 26 participants provided consumption information for non-Peace fish species. While there were participants who stated that they only eat one species of fish either from the Peace River system (33 %) or non-Peace sources (47 %), most participants reported consuming more than one species of fish from the Peace River system (67 %) and non-Peace sources (53 %).

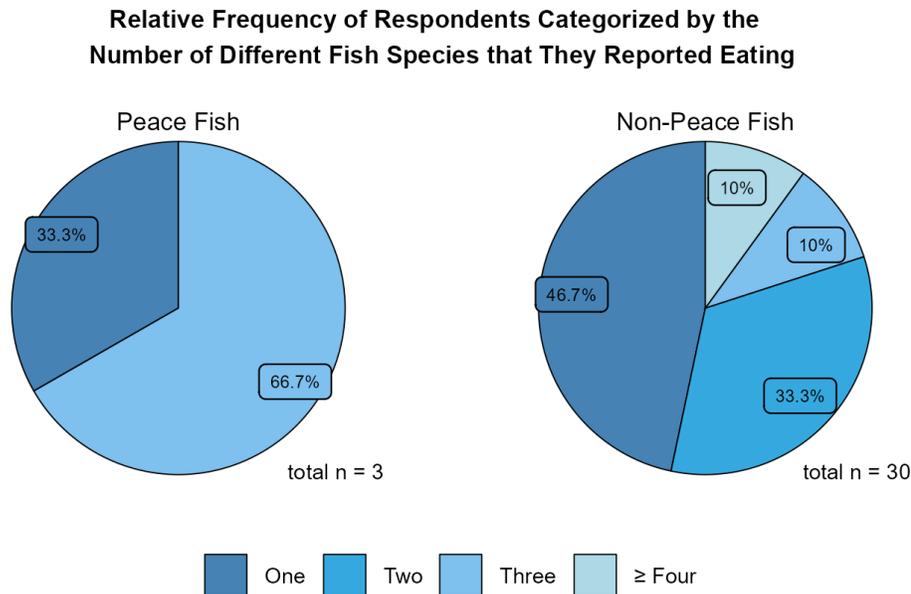


Figure 32. Relative frequency of consuming different fish species (MLIB data)

Popularity of Fish Species

Popularity of Fish Species Consumed from Peace Sources

Of the three participants who provided consumption information about Peace fish species, two stated that they consume Lake Trout and Rainbow Trout. At least one of the two participants reported consuming Arctic Grayling, Bull Trout, or Burbot. The average number of monthly meals for fish species from Peace sources ranged from one to four or more.

Popularity of Fish Species Consumed from Other Sources

Thirty participants provided information about the average number of monthly meals they eat for 10 different fish species from sources other than the Peace River system (Figure 33). Two participants ate fish species other than those listed. One ate Cod and the other Herring.

The most popular fish species from sources other than the Peace River system, determined by the total number of participants who consume them, were: Lake Trout, Salmon, and Halibut.

The least popular fish species from sources other than the Peace River system were: Walleye, Rainbow Trout, and Arctic Graying.

The average number of monthly meals varied from one to four or more depending on the species (**Figure 33**). Most species were eaten in one or two meals a month. Participants also reported eating three to four meals per month of some species (e.g., Lake Trout and Salmon). Participants who reported eating Lake Whitefish and Light Tuna all ate two or more meals a month of these species.

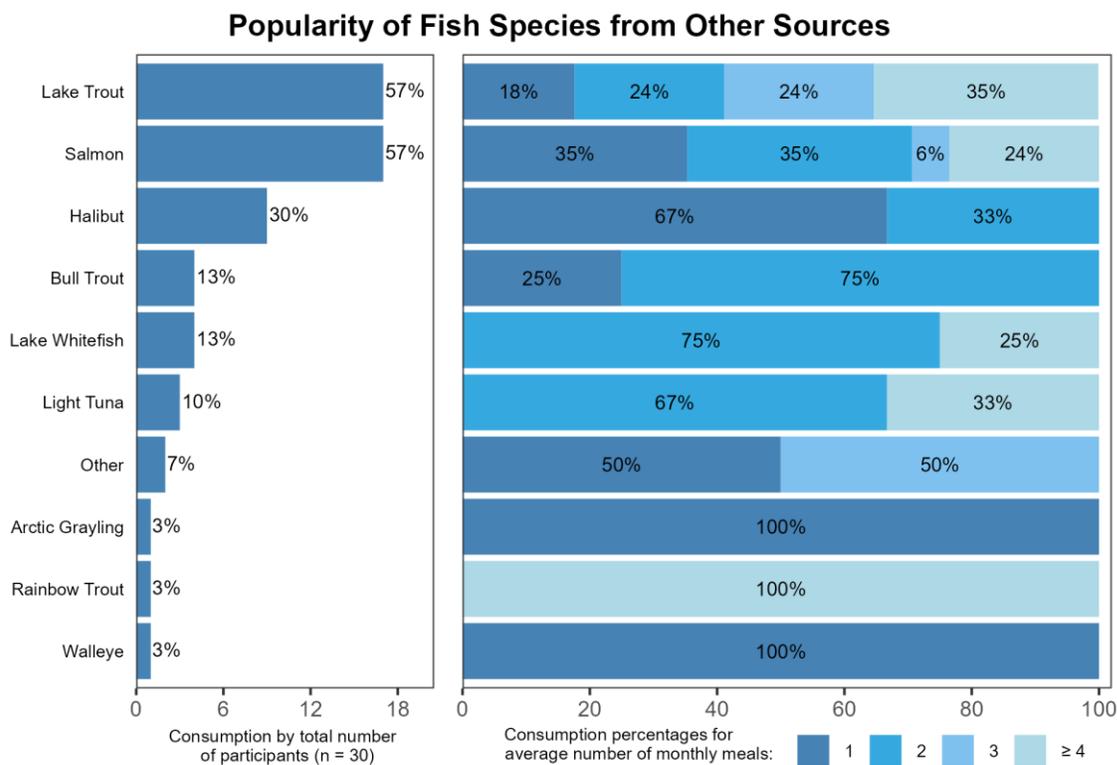


Figure 33. Popularity of fish species consumed from other sources (MLIB data)

Fish Mass Consumed per Meal

Thirty-one participants provided information on the average number of portions of fish they eat per meal (**Figure 34**). Among all participants, the average mass of fish per meal was either 85 or 170 g (equivalent to 1 or 2 portions), with a mean \pm SD of 118 ± 42 g. The average mass of fish per meal was similar among the participants from different gender groups and population categories.

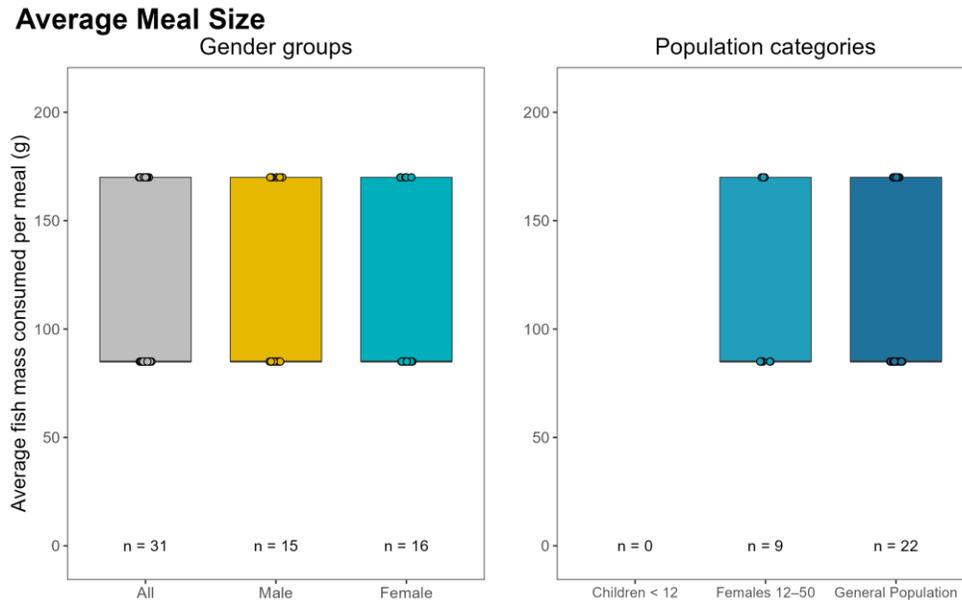


Figure 34. Average fish mass consumed per meal (MLIB data)

Fish Consumption Rates

Fish consumption rates were calculated for fish species from Peace River system (Fish Consumption Rate – Peace) and from other sources (Fish Consumption Rate – Other).

Fish Consumption Rate – Peace

Based on the availability of data from questions about fish consumption frequency, species-specific fish consumption rates for fish consumed from Peace sources were calculated for three participants: two females and one male. One participant was in the population category females 12 to 50 years old. Species-specific fish consumption rates for fish consumed from Peace sources ranged from 5.6 to 16.8 g/day.

The sum of species-specific consumption rates for fish from the Peace River system ranged from 8.4 g/day to 30.7 g/day, with mean \pm SD of 22.4 ± 12.2 g/day, and 95th percentile of 30.5 g/day (**Figure 36**).

Fish Consumption Rate – Other

The Species-Specific Fish Consumption Rate – Other was calculated for 30 participants (**Figure 35**). Among all participants and across all species, the rate ranged from 2.8 to 67.1 g/day.

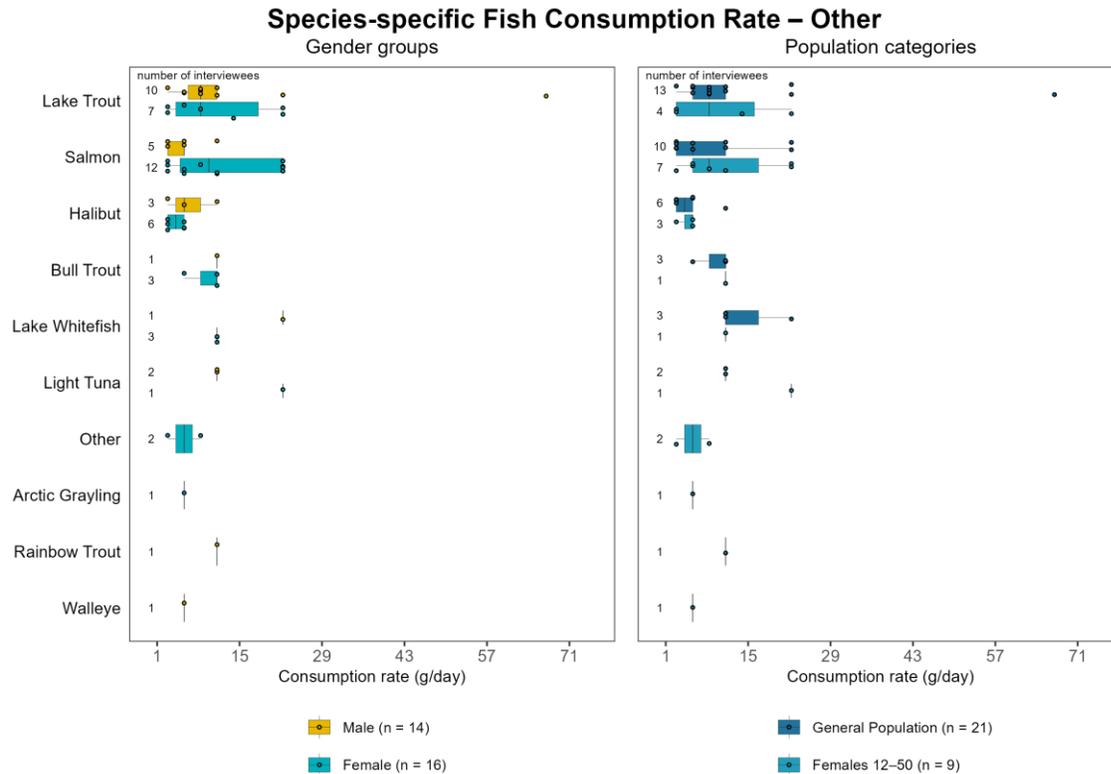


Figure 35. Species-specific consumption rates of fish from other sources (MLIB data)

The sum of species-specific consumption rates for fish from sources other than the Peace River system ranged from 2.8 g/day to 95 g/day, with mean \pm SD of 20.5 \pm 24.4 g/day, and 95th percentile of 79.3 g/day (Figure 36).

Fish Consumption Rate - Total

On average, total fish consumption rate (sum of species-specific fish consumption rates) was higher for Peace fish species than other fish species (Figure 36). Among participants, there was large variability in the sum of species-specific fish consumption rates from both sources, and the variability was larger for fish species from Peace than other sources. Overall, the sum of species-specific consumption rates from both Peace and other sources ranged from 2.8 g/day to 95 g/day, with mean \pm SD of 22.7 \pm 25.6 g/day and 95th percentile of 79.3 g/day.

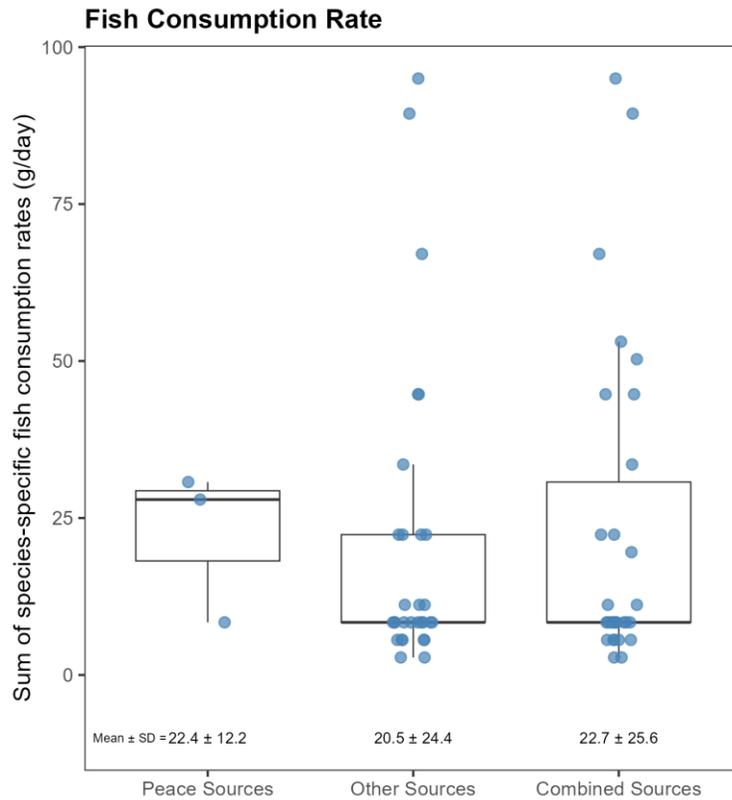


Figure 36. Sum of species-specific fish consumption rates (MLIB data)

Relationships Between Body Weight and Fish Consumption

There appeared to be a negative relationship between body weight of participants and fish consumption rate, but this relationship was not statistically significant. Results from simple linear regression analysis showed that there was no statistically significant ($p > 0.05$) relationship between body weight and sum of species-specific consumption rates of fish from Peace and other sources (Figure 37).

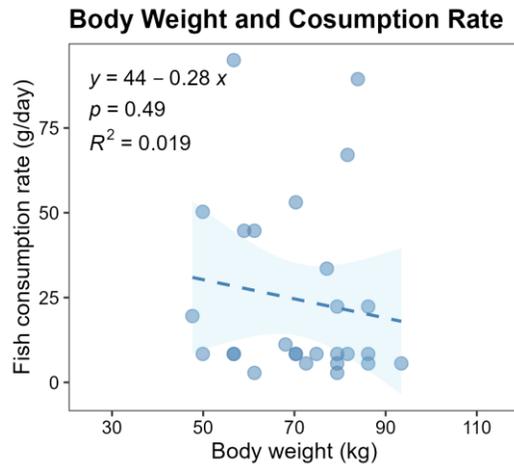


Figure 37. Relationship between fish consumption rate and participants' body weight (MLIB data)

There appeared to be a positive relationship between the amount of fish consumed per meal and body weight of participants, but this was likely driven by the bimodal distribution of the underlying data (Figure 38). The relationship between fish mass consumed per meal and body weight of participants was not statistically significant ($p > 0.05$).

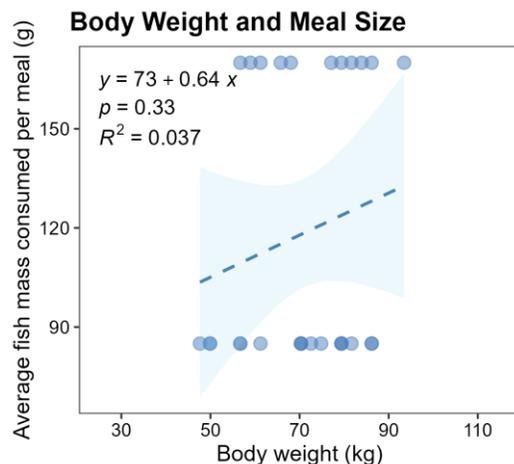


Figure 38. Relationship between fish mass consumed per meal and participants' body weight (MLIB data)

Fish Consumption of Household Members

Participants in the MLIB baseline fish consumption survey provided fish consumption information for 25 household members (Figure 39). More than half (56 %) of household members were in the general population category, 36 % were females 12 to 50 years old, and 8 % were children less than 12 years old.

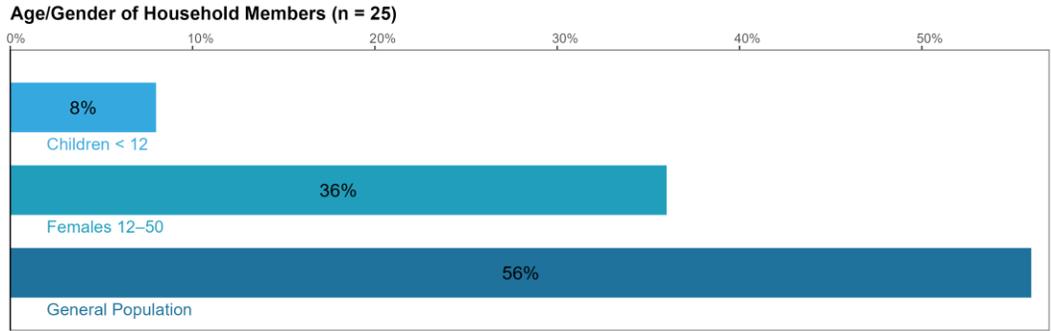


Figure 39. Age and gender of household members (MLIB data)

Among household members of participants in the MLIB baseline fish consumption survey, 80 % ate a similar amount of fish as the participant, 5 % ate more fish, and 15 % ate less fish (Figure 40). All household members that were children less than 12 years old ate less fish than the participants.

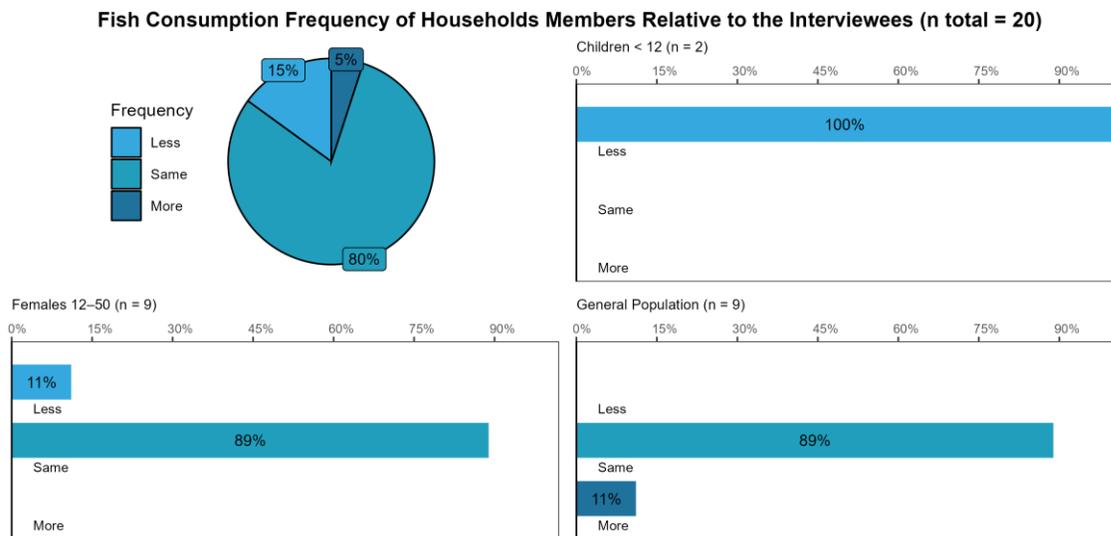


Figure 40. Fish consumption frequency of household members (MLIB data)

3.4 Blueberry River First Nations Baseline Fish Consumption Survey

3.4.1 Background and Methods

Blueberry River First Nations (BRFN) participated in a baseline fish consumption survey. The survey questionnaire was administered as a digital, on-line format, and the questions were based on the creel survey fish consumption questionnaire. A digital version of the fish consumption questionnaire was coded and hosted by Leger. The BRFN reviewed and approved the questionnaire prior to it being used. A copy is provided in [Appendix A4](#).

Two information sessions were held on February 29, 2024, at the BRFN community hall. The purpose was to provide information on methylmercury in fish and introduce the baseline fish consumption questionnaire to members of the BRFN. The on-line baseline fish consumption survey remained open from February 29, 2024, to March 9, 2024. The questionnaire was promoted by BRFN and a draw prize was provided as an incentive for members of the BRFN to complete the questionnaire.

3.4.2 Results

In total, 29 participants completed BRFN baseline fish consumption questionnaire. Only two participants, both female, responded that they eat fish from the Peace River once a month or more. Therefore, the BRFN baseline fish consumption survey only included information from two participants on the average amount of fish in a meal and species-specific fish consumption information.

Population Profile

All of the participants in the BRFN baseline fish consumption survey were from British Columbia, and they represented five communities ([Figure 41](#)). Most were from Blueberry River First Nation (79 %), followed by Fort St John (10 %). The communities of Saulteau First Nations, Lue Errs, and Blueberry Reserve each represented 3 % of the participants.

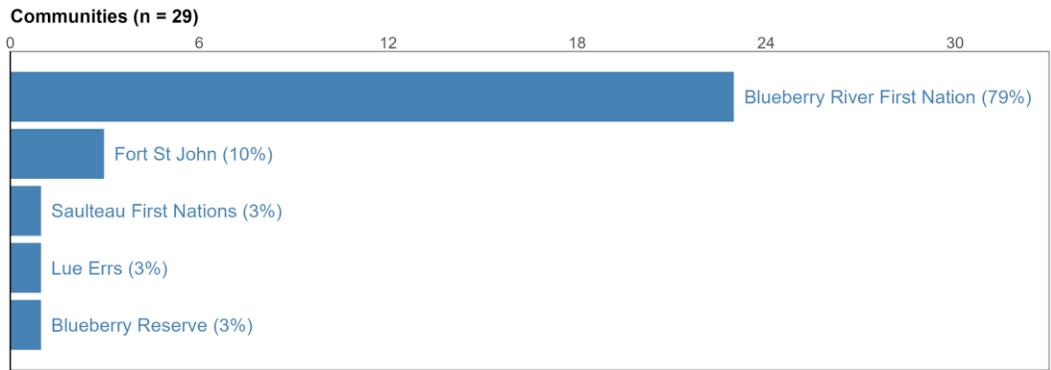


Figure 41. Participating communities (BRFN data)

Twenty-seven participants in the BRFN baseline fish consumption survey reported their ages (Figure 42), which ranged from 17 to 80 years old.

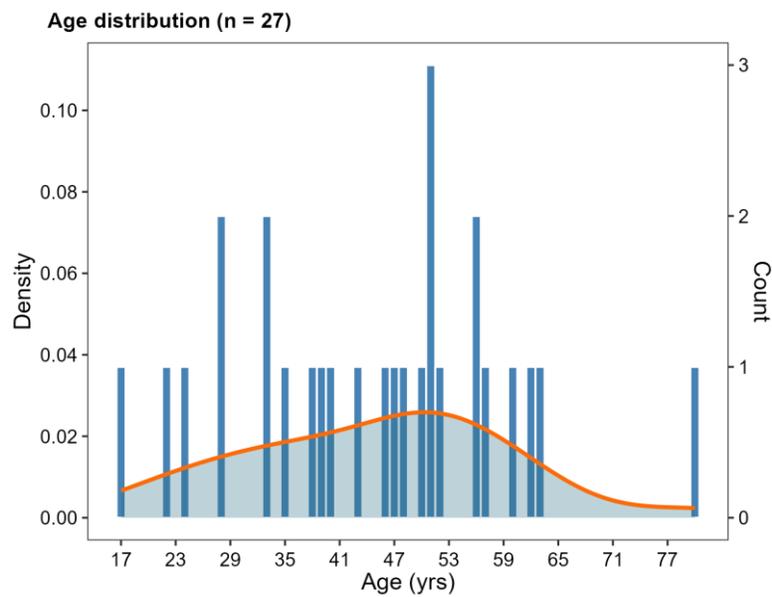


Figure 42. Age distribution (BFRN data)

Twenty-eight participants in the BRFN baseline fish consumption survey provided information on their gender: 72 % identified as female and 24 % as male. The gender of one interviewee was unknown, and no one identified their gender as other. Based on the age and gender information provided, nine participants were females 12–50 years old and nine participants were in the general population category (Figure 43).

Only one participant in BRFN baseline fish consumption survey provided information on their body weight.

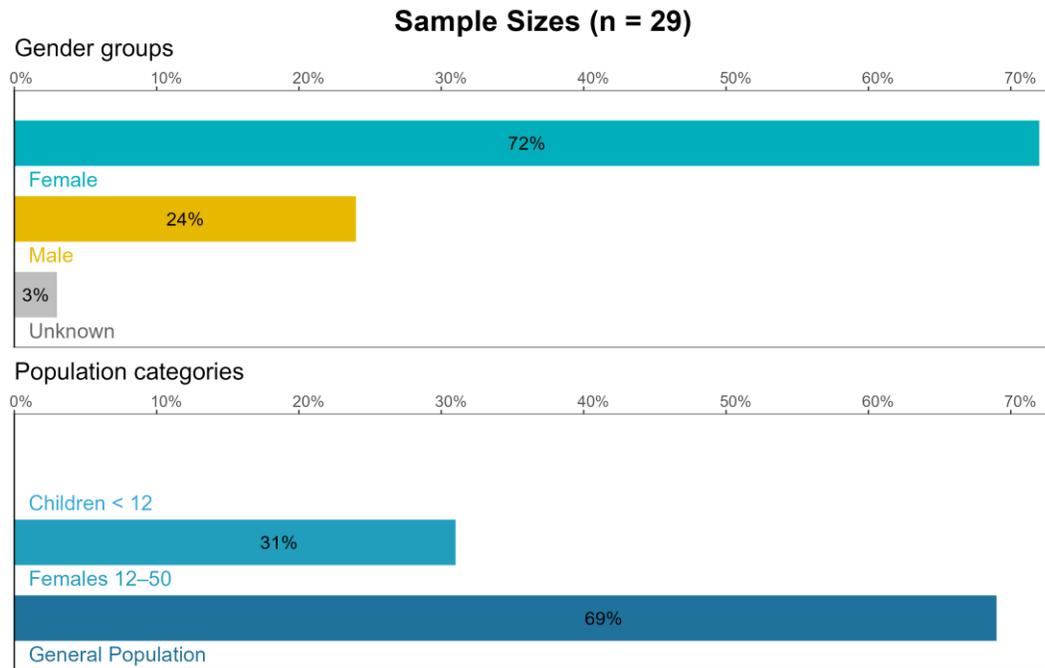


Figure 43. Sample sizes (BFRN data)

Frequency of Fish Consumption

Consumption Frequency of Fish in General

Twenty-nine participants in the BRFN baseline fish consumption survey provided information on how frequently they eat fish in general (**Figure 44**):

- 28 % do not eat fish;
- 34 % eat fish less than once a month;
- 38 % eat fish one to three times a month; and
- No participants eat fish four times a month or more.

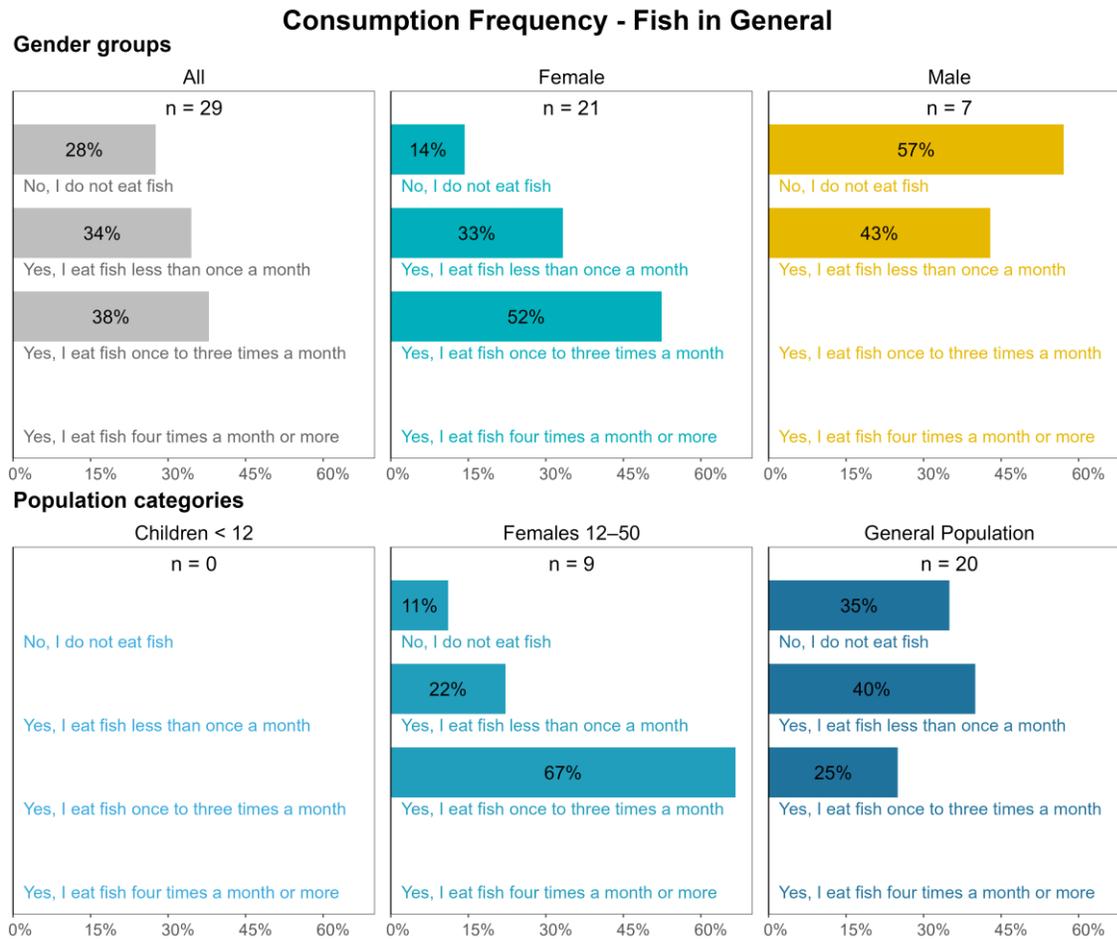


Figure 44. Consumption frequency of fish in general (BFRN data)

Consumption frequency of fish in general varied by gender and population categories (**Figure 44**). Females tended to eat fish more frequently than males. No male participants ate fish once a month or more, whereas 52 % of females ate fish once a month or more.

Fish from Peace Sources

Eleven participants in the BRFN baseline fish consumption survey provided information on how frequently they eat fish from the Peace River (**Figure 45**). Eighty-two percent responded that they do not eat fish from the Peace River once a month or more.

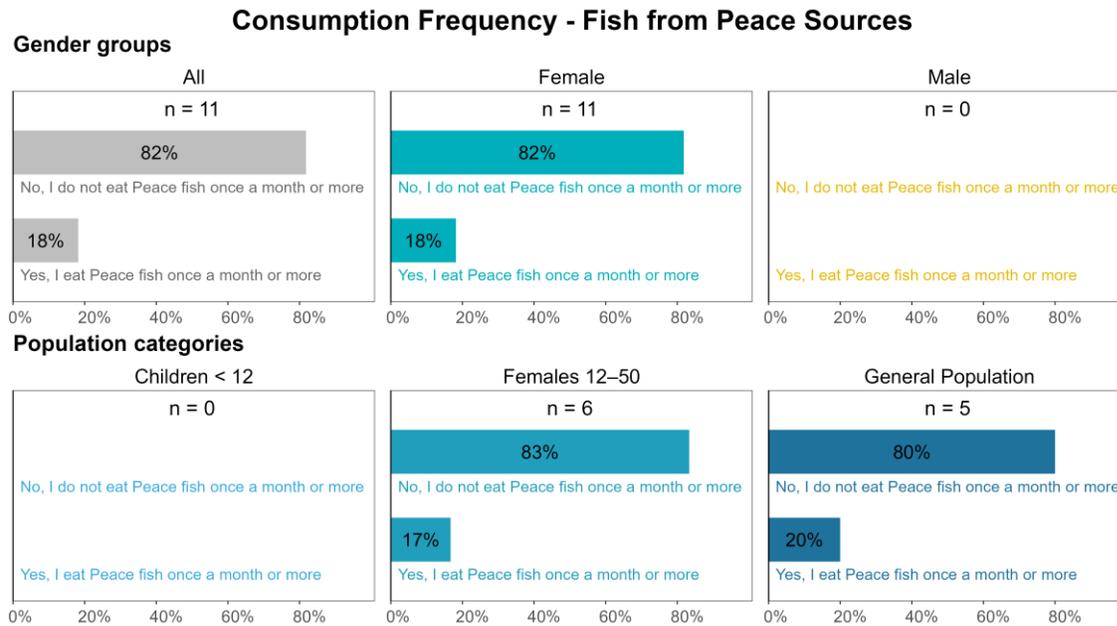


Figure 45. Consumption frequency of fish from Peace River system (BFRN data)

Consumption of Different Fish Species

Information about species-specific fish consumption was provided by two participants. Both stated that they eat four or more fish species from each of Peace sources and non-Peace sources. The species of fish from the Peace River included Lake Trout, Lake Whitefish, Mountain Whitefish, Rainbow Trout, Bull Trout, and Northern Pike. The species of fish eaten from non-Peace sources included Salmon, Albacore Tuna, Lake Trout, Lake Whitefish, Light Tuna, Mountain Whitefish, Northern Pike, Rainbow Trout, and Other Groundfish.

Fish Mass Consumed per Meal

The average amounts of fish per meal were 255 g and 340 g, which is equivalent to three and four 3-ounce portions.

Fish Consumption Rate

Fish consumption rates for the BFRN baseline fish consumption survey were calculated for only two participants, because only two participants provided information on the mass of fish consumed per meal.

The fish consumption rates from the BFRN baseline fish consumption survey were:

- Species-Specific Fish Consumption Rate – Peace: 11.2 and 25.2 g/day

- Species-Specific Fish Consumption Rate – Other: 8.4 and 11.8 g/day

Fish Consumption of Household Members

The participants provided baseline fish consumption information for 80 household members. The ages and genders of the household members are illustrated in **Figure 46**: 28 % were children under 12 years old, 34 % were females 12 to 50 years old, and 39 % were general population.

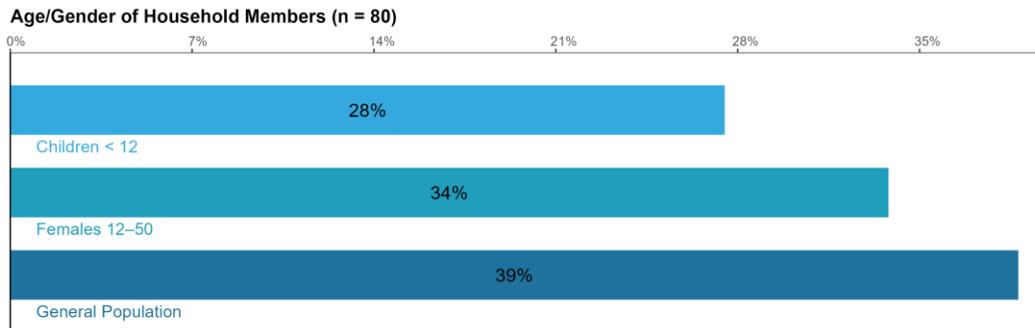


Figure 46. Age and gender of household members (BFRN data)

Most household members (66 %) ate the same amount of fish as the participant; 14 % ate more fish, and 20 % ate less (**Figure 47**). Of household members that were children less than 12 years old, 40 % ate less fish than the participant and 60 % ate the same amount. Of household members that were females 12 to 50 years old, 8 % ate more fish than the participant and 23 % ate less.

Fish Consumption Frequency of Households Members Relative to the Interviewees (n total = 29)

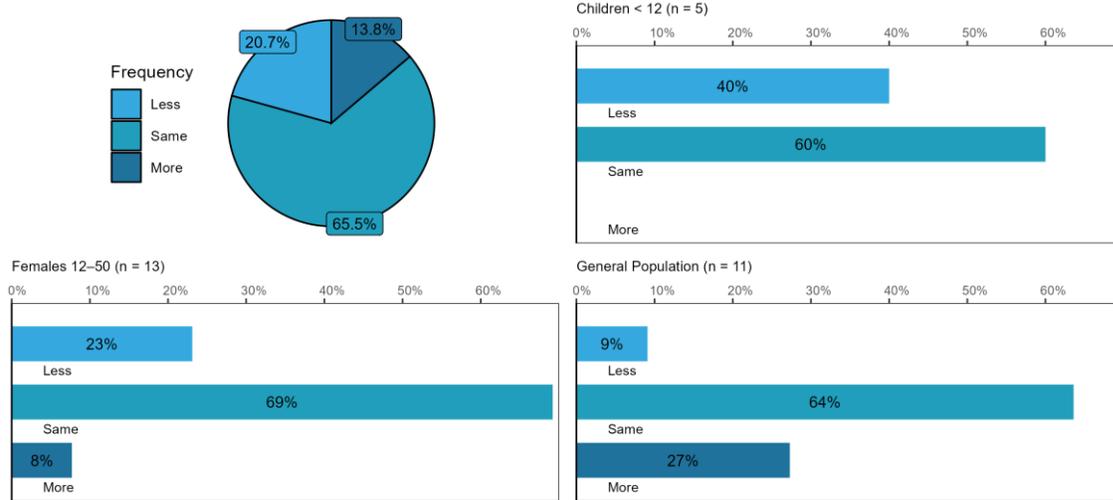


Figure 47. Fish consumption frequency of household members (BFRN data)

3.5 Peace Region Outdoors Clubs Baseline Fish Consumption Survey

Azimuth and BC Hydro attempted to collect baseline fish consumption information from members of outdoors clubs in the Peace Region. Azimuth developed a version of the baseline fish consumption questionnaire and Leger coded and hosted a digital version of the questionnaire for the survey. In early August 2023, Azimuth emailed a letter to North Peace Rod and Gun Club, Hudson's Hope Rod and Gun Club, Peace Country River Rats, and the Chetwynd Outdoors Society. The letter provided background information and invited members to participate in the survey by completing the on-line questionnaire. A draw prize was offered as an incentive for members to participate. Azimuth sent a follow-up email to the same organizations in early September 2023. The on-line questionnaire was closed on November 1, 2023.

Leger received five completed questionnaires from the Peace Region Outdoors Clubs Baseline Fish Consumption Survey. The data are summarized below, but were not included in any formal analyses because the sample size was too small to generalize the conclusions to the wider community of Peace River anglers with any degree of confidence.

The ages of the five participants in the Peace Region Outdoors Clubs Baseline Fish Consumption Survey ranged from 34 to 66 years old; two identified as male, one identified as female, and two responded that they preferred not to provide information about their gender. Participants were from Prince George, Charlie Lake, Chetwynd, or Fort St. John. One participant (20 %) responded that they do not eat fish, one participant (20 %) responded that they eat fish less than once a month, and three participants (60%) responded that they eat fish one to three times a month. No participants ate fish four or more times a month. One participant (20 %) responded that they eat fish from the Peace River system once a month or more and this participant indicated that, on average, they eat one 3 oz portion of Bull Trout from the peace River system once a month.

4 DISCUSSION

4.1 Available Data

The MMP describes plans for BC Hydro to collect baseline information on the amount of fish consumed by specified Indigenous groups and non-Indigenous fish harvesters in the vicinity of the Site C Project. Azimuth, with support from BC Hydro, led this task from 2022 to 2024. We used two general approaches to collect baseline fish consumption information. First, we reviewed and analyzed existing sources of data. Second, we implemented four MMP baseline fish consumption surveys. Two of the MMP baseline fish consumption surveys were for Indigenous Nations and two of the surveys targeted general fishers and outdoors people, including non-Indigenous fish harvesters.

Through these efforts we were able to identify or produce and analyze the following data on baseline fish consumption:

4.1.1 Sources of Information on Baseline Fish Consumption

Existing Data Sources

- Data were available for members of the Duncan’s First Nation and Horse Lake First Nation who participated in the 2010/11 Country Food Harvest Questionnaires;
- Data from the First Nation Food, Nutrition, and Environment Study (FNFNES), ecozone level, collected in 2009, were available for Indigenous groups in the Montane Cordillera, including Métis Nation of British Columbia, MLIB, and West Moberly First Nations;
- Data collected from the FNFNES ecozone-level study in 2009 and 2013 were available for Indigenous groups in the Taiga Plain, including Fort Nelson First Nation, Dene Tha’ First Nation, and Prophet River First Nation;
- Data collected from the FNFNES ecozone-level study in 2009 and 2013 were available for Indigenous groups in the Boreal Plain, including BRFN, Doig River First Nations, Halfway River First Nation, Sauteau First Nations, Duncan’s First Nation, Horse Lake First Nation, and Kelly Lake Métis Settlement Society;
- Data were available for members of the MLIB that participated in the 2017 Environmental Livelihoods Study; and
- Data were available for members of the MLIB and Sauteau First Nations that participated in the 2018 Fish and Wildlife Compensation Program (FWCP) Information Gathering on Kokanee, Bull Trout, and Arctic Grayling projects.

New Data Sources

- Data were available for recreational anglers on the Peace River between Peace Canyon dam and Many Islands, Alberta from the 2022/23 Peace River Recreational Angling Creel Survey MMP baseline fish consumption survey; and
- Data were available for members of the MLIB and BRFN that participated in MMP baseline fish consumption surveys.

Summary of new and existing data sources

Collectively, between the existing and new data sources, baseline fish consumption information was available and/or collected for each of the 13 specified Indigenous groups. Data for the 13 specified Indigenous groups were available either from surveys that Indigenous Groups directly participated in (for example, members of Nations that participated in the 2010/11 Country Food Harvest Questionnaires, 2017 Environmental Livelihoods Study, 2018 FWCP information gathering projects, or MMP baseline fish consumption surveys) or from statistically representative regional-level data (for example, FNFNES ecozone-level data).

Baseline fish consumption information was also collected for non-Indigenous fishers. These data are from the MMP baseline fish consumption survey that was part of the 2022/23 Peace River Recreational Angling Creel Survey. This study sampled recreational anglers on the Peace River and did not exclude non-Indigenous anglers. Azimuth and BC Hydro attempted to collect additional baseline fish consumption data for non-Indigenous fishers through a MMP baseline fish consumption questionnaire targeted at outdoor clubs in the Peace Region. However, we only received five completed questionnaires from this survey, and the data were not analyzed because the response rate was considered too low to provide information that could be generalized beyond the sample.

4.1.2 Demographic Characteristics of the Sample Populations that Participated in MMP Baseline Fish Consumption Surveys

Peace River Recreational Angling Creel Survey Baseline Fish Consumption Questionnaire

Ninety-seven people completed the creel survey baseline fish consumption questionnaire. They provided fish consumption information for 156 additional people living in their households, including 41 children under 12 years old. Participants in the creel survey baseline fish consumption questionnaire were predominantly middle-aged males from Fort St. John, Hudson's Hope, or Moberly Lake.

According to the 2021 census, the population of the Peace River Regional District was approximately 62,000. Therefore, the sample of 99 direct and 156 indirect participants in the creel survey baseline fish consumption survey represented about 0.4 % of the regional population.

McLeod Lake Indian Band Baseline Fish Consumption Survey

Thirty-three people completed the MLIB baseline fish consumption questionnaire and provided fish consumption information for 25 additional people living in their households, including two children under 12 years old. Most participants were from McLeod Lake and between 20 and 65 years old. Approximately equal numbers of male and female participants completed the MLIB baseline fish consumption questionnaire.

According to the MLIB, the total registered population of MLIB is about 515 members, with 300 members living in McLeod Lake, Mackenzie, Chetwynd, or Prince George. Therefore, the sample of 33 direct and 25 indirect participants in the MLIB baseline fish consumption survey represented about 20% of members of MLIB living in McLeod Lake, Mackenzie, Chetwynd, or Prince George.

Blueberry River First Nations Baseline Fish Consumption Survey

Twenty-nine people completed the BRFN baseline fish consumption questionnaire. They provided fish consumption information for 80 additional people living in their households, including 22 children under 12 years old. Most participants were from BRFN, from 20 and 65 years old, and female.

According to the British Columbia Assembly of First Nations, the total registered population of BRFN is 531. Therefore, the sample of 29 direct and 80 indirect participants in the BRFN baseline fish consumption survey represented about 20% of the registered population of BRFN.

Summary

A total of 159 people completed a baseline fish consumption questionnaire. They ranged in age from 17 to 80 years old. They also provided fish consumption information for an additional 261 people in their households, including 66 children less than 12 years old.

The vast majority of people who completed a baseline fish consumption questionnaire lived in the communities of Fort St. John, Hudson's Hope, BRFN, or McLeod Lake. Only two participants lived in Alberta and only two of 13 specified Indigenous groups participated in baseline fish consumption surveys.

The sample populations that completed the BRFN and MLIB baseline fish consumption questionnaires tended to be slightly older and had a higher proportion of female participants than the sample population that completed the creel survey baseline fish consumption questionnaire.

4.2 How Often Do People Eat Fish?

The MMP baseline fish consumption questionnaires asked participants how frequently they eat fish. Between about 30 to 80 % of participants, depending on the survey sample, eat fish at least once a month. More than 10 % of participants in the creel survey and MLIB survey eat fish more than once a week. Depending on what species of fish they eat, people who eat fish from the Site C reservoir more than once a week when levels of methylmercury in fish approach their peak could be at risk of exceeding their tolerable daily intake of methylmercury.

Baseline data on the frequency with which people eat fish, both in general and from the Peace River system, were available from the creel survey, MLIB, and BRFN baseline fish consumption surveys (**Table 1** and **Table 2**). These data indicate:

- A large proportion of participants in the baseline fish consumption surveys, from 38 to 79 %, eat fish at least once a month;
- Participants most commonly eat fish one to three times a month;
- From 12 to 61 % of participants eat fish from the Peace River system more than once a month; and
- Participants in the creel survey more commonly eat fish from the Peace River system more than once a month than do participants in the MLIB and BRFN baseline fish consumption surveys.

Table 1. Frequency with which participants in MMP baseline fish consumption surveys eat fish

	Creel Survey	McLeod Lake Indian Band	Blueberry River First Nations
Sample size	94	33	29
Do not eat fish	7 %	6 %	29 %
Eat fish less than once a month	35 %	15 %	34 %
Eat fish 1 to 3 times a month	42 %	67 %	38 %
Eat fish once a week or more	16 %	12 %	0 %

Table 2. Frequency with which participants in MMP baseline fish consumption surveys eat fish from the Peace River system

	Creel Survey	McLeod Lake Indian Band	Blueberry River First Nations
Sample size	56	33	11
Eat fish once a month or less	39 %	88 %	82 %
Eat fish more than once a month	61 %	12 %	18 %

About 60 % of participants in the creel survey baseline fish consumption questionnaire eat fish from the Peace River system once a month or more, and about 15 % eat fish from the Peace River system once a week or more. A smaller, but not insignificant, proportion of participants in the BRFN and MLIB baseline fish consumption surveys regularly eat fish from the Peace River. About 18 % of participants in the baseline BRFN and 12 % of participants in MLIB baseline fish consumption eat fish from the Peace River system once a month or more.

Depending on the species and size of fish that they eat, and where the fish was caught, people who eat fish from the Site C reservoir and the Peace River from Site C to Many Islands, Alberta once a month or more could experience an increase in their intake of methylmercury as a result of temporary increases in concentrations of methylmercury in fish from the construction of the Site C reservoir. The percentage of the provisional tolerable daily intake of methylmercury associated with eating one serving a month of fish from Sections 1 or 3 of the Peace River (the future location of the Site C reservoir), is listed in **Table 3**. Information is provided for baseline and predicted peak concentrations¹⁹ of methylmercury in a 13" (330 mm) long Rainbow Trout and a 22" (560 mm) Bull Trout (Azimuth 2024, BC Hydro 2013). For a child under 12 years old, eating one serving a month of a 22" Bull Trout under baseline conditions represents about 10 % of their provisional tolerable daily intake of methylmercury. At predicted peak concentrations of methylmercury, this will increase to about 40 %.

¹⁹ Peak levels of methylmercury in fish that inhabit the Site C reservoir are expected to be, on average, three to four times above baseline.

Table 3. Percentage of provisional tolerable daily intake of methylmercury associated with eating one serving a month of fish from Sections 1 or 3 of the Peace River (location of future Site C reservoir)

Baseline	Mercury (ppm)	Children¹	Pregnant²	Others
13" Rainbow Trout	0.03	2.0%	1.2%	0.5%
22" Bull Trout	0.15	10.2%	5.8%	2.5%
Peak³				
13" Rainbow Trout	0.12	8.1%	4.6%	2.0%
22" Bull Trout	0.6	40.7%	23.1%	9.8%

notes

1. Children less than 12 years old

2. People who are pregnant or could be pregnant

3. Peak concentrations of methylmercury were assumed to be four times higher than baseline

Participants in the BRFN baseline fish consumption survey eat fish less frequently than participants in the creel survey and MLIB baseline fish consumption surveys. For example, 62 % of participants in the BRFN baseline fish consumption survey either do not eat fish or rarely eat fish (i.e., they eat fish less than once a month), compared to 45 % of people who completed the creel survey baseline fish consumption survey and 21 % of participants in the MLIB baseline fish consumption survey.

We don't know why participants in the BRFN baseline fish consumption survey eat less fish than participants in the creel survey and MLIB surveys. It is possible that members of the BRFN have a lower preference for fish as a food source than members of the MLIB and people who participated in the creel survey. Another possibility is that the differences in consumption frequency reflect the lower percentage of male participants in the BRFN survey (24 %) than the creel survey (45 %) and MLIB (48 %) surveys. Other studies of both Indigenous and non-Indigenous populations have reported that males tend to eat more wild-caught fish than females (Burger 2000, Marushka et al. 2022), although there does not appear to be a difference in the frequency of fish consumption between males and females among the general Canadian population (Hu and Chan 2021).

4.3 What Species of Fish Do People Eat?

The baseline fish consumption data indicate that participants in the studies who eat fish tend to eat a variety of fish species, including a mix of some species that have relatively low levels of methylmercury and some species that have higher levels of methylmercury. Rainbow Trout and whitefish species were the most commonly eaten species of fish that have relatively low levels of methylmercury, and Walleye and Northern Pike were the most commonly eaten species of fish that have higher levels of methylmercury. The baseline fish consumption data also suggest that many participants in the MMP baseline fish consumption surveys are exposed to methylmercury from eating fish from sources other than the Peace River.

4.3.1 People Tend to Eat More than One Species of Fish

The results from the surveys consistently showed that participants were more likely to eat more than one species of fish than exclusively eat only one species of fish. And it was not uncommon for participants to eat four or more species of fish. More than 70 % of participants who completed the creel survey baseline fish consumption questionnaire who regularly eat fish from the Peace River eat more than one species of fish; more than 50 % eat four or more species of fish. More than 50 % of participants in the MLIB baseline fish consumption survey who regularly eat fish from the Peace River eat more than one species of fish, and 100 % of participants in the BRFN baseline fish consumption survey who regularly eat fish from the Peace River eat four or more species of fish.

Tabular fish consumption guidance, such as the format of the fish consumption guidance in the MMP annual report, provides limited value for people who eat more than one species of fish. This is because, for people who regularly eat more than one species of fish, the tabular guidance cannot account for the possible combinations of fish they might eat.

Among participants in the creel survey baseline fish consumption questionnaire, the most commonly consumed fish from the Peace River were Rainbow Trout (91 %), Lake Trout (57 %), Walleye (49 %), Northern Pike (43 %), Arctic Grayling (37 %), and Bull Trout (37 %). Not enough participants in the BRFN and MLIB baseline fish consumption surveys provided information to support meaningful conclusions about the relative popularity of different species of fish from the Peace River.

Fifty seven percent of participants in the creel survey baseline fish consumption questionnaire reported that they eat Lake Trout caught in “the Peace River, or lakes or rivers connected to the Peace River”. Lake Trout are scarce in the mainstem of the Peace River downstream of the Peace Canyon dam, but they are relatively abundant in Dinosaur and Williston reservoirs. These data indicate that some participants may have included fish from the Peace River watershed upstream of the Peace Canyon dam in their responses about fish consumption from the Peace River system.

4.3.2 People Commonly Eat Some Fish Species that Have Low Levels of Methylmercury

The most commonly eaten freshwater fish that have low levels of methylmercury were Rainbow Trout and whitefish species. There appeared to be some regional variation, with Rainbow Trout more popular in the western region of the areas studied and white fish species more popular in the eastern region. Findings that support these conclusions include:

- Rainbow Trout was the most commonly eaten freshwater fish in the FNFNES data for the Montane Cordillera ecozone and the most commonly eaten species of fish from the Peace River system among participants in the 2022/23 creel survey MMP baseline fish consumption survey;
- Rainbow Trout and whitefish species were among the most commonly caught species among participants in the 2017 McLeod Lake Indian Band 2017 Environmental Livelihoods Survey;
- Rainbow Trout and whitefish species were among the most important species of fish among Saulteau First Nations participants in the 2018 FWCP information gathering project;
- From 23 to 26 % of participants in the 2022/23 creel survey MMP baseline fish consumption survey ate whitefish species from the Peace River system;
- Lake Whitefish was the most commonly eaten fish in the FNFNES data for the Boreal Plains ecozone and second most commonly eaten fish in the Taiga Plains ecozone. Whitefish species were also among the most commonly eaten fish among participants in the Duncan's First Nation and Horse Lake First Nation Country Food Harvest Questionnaires.

The baseline fish consumption data on the popularity of Rainbow Trout are consistent with the results of the 2022/23 Peace River Recreational Angling Creel Survey (Robichaud et al. 2024). Rainbow Trout was, by far, the most frequently targeted and harvested species of fish in the 2022/23 Peace River Recreational Angling Creel Survey. Most Rainbow Trout were caught by shore-based angling between Peace Canyon Dam and Hudson's Hope during July and August, and the estimated annual catch was 4,621 fish per year. Estimates of catch per unit effort ranged from 0.025 to 0.776 fish per angling hour. About 1 % of the Rainbow Trout that were caught were harvested (275 fish per year, SE 49).

Only 3 % of participants in the 2024 MMP McLeod Lake Indian Band baseline fish consumption survey reported eating Rainbow Trout (**Figure 33**). On the other hand, Rainbow Trout was among the most commonly caught species among participants in the 2017 McLeod Lake Indian Band Environmental Livelihoods Survey. We are not sure of the reason for these disparate results, but it may reflect differences in the demographics of the sample populations; for example, the 2017 McLeod Lake Indian Band Environmental Livelihoods Survey included many participants from Prince George whereas the 2024 MMP McLeod Lake Indian Band baseline fish consumption survey was focused on participants that live in McLeod Lake.

Mountain Whitefish are the most abundant fish species in the Peace River (Robichaud et al. 2024). The baseline fish consumption information indicated that whitefish species were relatively popular. These results, however, are at odds with the results from the 2022/23 Peace River Recreational Angling Creel Survey, which reported that only 2 % of anglers were fishing for Mountain Whitefish, and no Mountain Whitefish were harvested. We are not sure of the reason for this inconsistency. It perhaps reflects a difference between Indigenous and non-Indigenous fishers in their preferences for whitefish.

4.3.3 People Commonly Eat Some Fish Species that Have Higher Levels of Methylmercury

Northern Pike, Walleye, Bull Trout, and Lake Trout were among the most commonly eaten species of fish. These species of fish are long-lived piscivores and generally have higher levels of methylmercury. There appeared to be some regional variation, with Lake Trout more popular in the western region of the areas studied and Northern Pike and Walleye more popular in the eastern region. Findings that support these conclusions include:

- Northern Pike, Walleye, and Bull Trout were among the top four most commonly eaten freshwater fish in the FNFNES data for the Taiga Plains and Boreal Plains ecozones;
- Lake Trout and Bull Trout were among the top four most commonly eaten freshwater fish in the FNFNES data for the Montane Cordillera ecozone;
- Northern Pike and Walleye were among the top three most commonly eaten fish among Duncan's First Nation and Horse Lake First Nation participants in the 2010/11 Country Food Harvest Questionnaires;
- Bull Trout and Lake Trout were the top two most commonly harvested species among participants in the 2017 McLeod Lake Indian Band Environmental Livelihoods Study;
- Bull Trout were the most important species of fish among McLeod Lake Indian Band participants in the 2018 FWCP information gathering project;
- Northern Pike, Bull Trout, and Lake Trout were among the most important species of fish among Saulteau First Nations participants in the 2018 FWCP information gathering project;

- Lake Trout, Walleye, Northern Pike, and Bull Trout were among the top six most commonly eaten fish from the Peace River system²⁰ among participants in the 2022/23 creel survey MMP baseline fish consumption survey; and,
- Lake Trout was the commonly eaten fish from sources other than the Peace River system among participants in the 2024 McLeod Lake Indian Band MMP baseline fish consumption survey.

The baseline fish consumption data on the popularity of Bull Trout, Walleye, and Northern Pike are generally consistent with the results of the 2022/23 Peace River Recreational Angling Creel Survey (Robichaud et al. 2024). Bull Trout was the second most frequently targeted species, and Northern Pike, Walleye, and Bull Trout were three of the top five most frequently harvested species. An important exception is Lake Trout. The 2022/23 Peace River Recreational Angling Creel Survey reported that “few” Lake Trout were caught and Lake Trout harvest was “negligible” (Robichaud et al. 2024). The popularity of Lake Trout among fish consumed from the Peace River system indicates that participants may have included fish harvested from the Peace River watershed above the Peace Canyon dam, and outside of the area where levels of methylmercury in fish will be affected by the Site C Project, in this category. The authors of the 2022/23 Peace River Recreational Angling Creel Survey also noted evidence of angler misidentification of Bull Trout vs Lake Trout (Robichaud et al. 2024). This further complicates interpretation of the Bull Trout and Lake Trout data from both the MMP baseline fish consumption questionnaires and the 2022/23 Peace River Recreational Angling Creel Survey.

More than 35 % of participants in the creel survey baseline fish consumption questionnaire ate long-lived, piscivorous fish species, such as Lake Trout, Walleye, Northern Pike, and Bull Trout from the Peace River system once a month or more. These species have relatively high levels of methylmercury, and increased levels have greater potential to put people who eat them at risk for exceeding their provisional Tolerable Daily Intake (pTDI) for methylmercury. This risk can be mitigated by encouraging people who regularly eat long-lived, piscivorous fish species from the Peace River to substitute some meals of these fish with insectivore species, such as Rainbow Trout, Arctic Grayling, or Whitefish, which have lower levels of methylmercury. It is encouraging to note that the 2022/23 Peace River Recreational Angling Creel Survey reported that more Rainbow Trout and fewer Bull Trout, Walleye, Mountain Whitefish, Arctic Grayling, and Goldeye were caught in 2023-24, compared to the 2008-09 creel survey (Robichaud et al. 2024), indicating a general trend toward increasing the proportion of lower mercury fish that anglers are targeting.

4.3.4 People Eat Fish from Sources Other than the Peace River

Creel survey and MLIB baseline fish consumption surveys. Participants in these surveys reported consuming the following species from non-Peace sources most commonly: Salmon, Halibut, Tuna (Light, Albacore, or Ahi), Rainbow Trout, and Lake Trout.

BRFN baseline fish consumption survey. Not enough participants in this survey provided information to support meaningful conclusions about the relative popularity of different species of fish from sources other than the Peace River.

The most frequently eaten fish from non-Peace sources from the baseline fish consumption surveys were consistent with data for the general Canadian population, except for Halibut. The most frequently consumed fish among the general Canadian population in the 2015 Canadian Community Health Survey were, in descending order: Salmon, Tuna, Cod, Trout, Sardine, and Herring (Hu and Chan 2021). Concentrations of methylmercury in Salmon, Light Tuna, Rainbow Trout, Sardine, and Herring are very low.

The baseline fish consumption data indicate that a proportion of people who regularly eat fish from the Peace River may also have significant exposure to methylmercury from eating fish from other sources. For example, 42 % of people who completed the creel survey baseline fish consumption survey regularly eat one meal a month of Albacore Tuna, and 31 % regularly eat one or two meals a month of Walleye. These species have moderate to high levels of methylmercury. For example, the median concentration of methylmercury in Canadian Walleye is approximately 0.4 ppm (Depew et al. 2013). At this concentration, a 30-year-old female eating two 163 g meals of Walleye a month would be exposed to approximately 30 % of her pTDI for methylmercury, and a child under 12 years old eating two 100 g meals of Walleye a month would be exposed to approximately 50 % of their pTDI for methylmercury. People who regularly eat fish with moderate to high levels of methylmercury from sources other than the Peace River have less “room” in their baseline intake of methylmercury to safely absorb increases in their total exposure to methylmercury associated with Project-related increases in methylmercury in fish.

4.4 How Much Fish Do People Eat?

4.4.1 Mass of Fish Per Meal

The baseline fish consumption surveys collected information on the average amount, or mass, of fish participants consume in a meal of fish. Considering the average amount of fish consumed in a meal of fish, participants in the creel survey consumed more than double that of participants in the MLIB survey and more than the average amount reported in other regional and national studies and assumed in MMP baseline fish consumption guidance. These findings and the implications for the MMP are discussed in more detail below.

Summary of Results

- **Creel survey.** Fifty-five participants in the creel survey provided information on the average mass of fish consumed per meal, which ranged from 85 to 680 g (equivalent to 1 to 8 portions), with an arithmetic mean and standard deviation of $262 \pm 165 \text{ g}^{21}$.
- **MLIB survey.** Thirty-one participants in the MLIB survey provided information on the average number of portions of fish they eat per meal, which ranged from 85 to 170 g (equivalent to 1 to 2 portions), with a mean and standard deviation of $118 \pm 42 \text{ g}$.
- **Creel and MLIB survey average.** The average mass of fish per meal in both the creel survey and MLIB surveys was similar among the participants from different gender groups and population categories.
- **BRFN survey.** Only two participants in the BRFN survey provided information on the mass of fish in a meal, and the results will not be discussed further here.

The average mass of fish per meal reported in the creel survey was relatively high. It was more than double that reported in the MLIB survey and about 60 % higher than estimates of the average mass of fish per meal reported in other regional and national studies. It is uncertain to what extent these differences are because participants in the creel survey truly eat larger portions of fish or due to differences in survey methods.

Estimates of Fish Mass per Meal for the General Canadian Population

Information on the average mass of fish in a meal of fish for the general Canadian population is available from a Health Canada analysis of a Market Facts study and from the most recent round of the Canadian Community Health Survey (CCHS) to include data on food and nutrition.

²¹ For comparison, a 170 g can of light tuna contains approximately 120 g of fish (the rest being water or oil) (Health Canada 2007).

Health Canada and Market Facts Study

Health Canada (2007) conducted a review of Canadian data on fish consumption and concluded that the best estimate of the long-term average mass of fish²² per meal for the general Canadian population was 150 g for adults, 125 g for children 5 to 11 years old, and 75 g for children 1 to 4 years old. Health Canada (2007) considered these values to be conservative estimates (i.e., more likely over-estimates than underestimates) of the average mass of fish per meal consumed by the general Canadian population.

Health Canada (2007) based their estimates of the average mass of fish per meal for adults on a study commissioned by Health and Welfare Canada in the early 1990s called the Market Facts study. The Market Facts study was a nationwide, one-month food diary of 3,815 Canadians over 1 year old between December 1990 and February 1991. The estimates of the average mass of fish per meal for children that Health Canada (2007) used was based on a linear regression model of the relationship between average mass of fish per meal and body weight developed from the data in the Market Facts study.

2015 Canadian Community Health Survey

The average mass of fish consumed in a day by participants in the 2015 CCHS who reported eating fish the previous day was approximately 100 g and ranged from 53 g to 146 g, depending on the gender of the respondent and the species of fish eaten (Hu and Chan 2021). Diet and nutrition data for the 2015 CCHS were based on 24-hour dietary recall with two-dimensional images provided to aid participants in estimating amounts eaten. The CCHS was a nationally representative survey of the general Canadian population 2 years of age and older, but it did not include Indigenous people living on reserves or in Indigenous settlements.

²² The values for average mass of fish per meal recommended by Health Canada (2007) were for finfish (i.e., did not include shellfish).

Estimates of Fish Mass per Meal for First Nations in British Columbia

The B.C. First Nations Food, Nutrition and Environment Study (FNFNES) reported higher values for average mass of fish per meal for First Nations adults living in B.C. than the value adopted by Health Canada, but the values are not as high as the value from the creel survey fish consumption questionnaire. The B.C. FNFNES was a study of traditional food consumption among 1,103 self-identified First Nations members aged 19 years and older living on reserve in 21 randomly selected communities in B.C. (Chan et al. 2011). Ninety-five percent of participants in the B.C. FNFNES reported consuming fish in the year prior to the study, and the average meal size for fish ranged from 87–163 g, depending on age and gender. The average fish meal size for adult women of childbearing age (19–50 years) was 109 g, and the average fish portion size for adult men was 163 g. Data on the average mass of fish per meal from the B.C. FNFNES were based on 24-hour dietary recall. In this method, the participants described, in as much detail as possible, the types and amounts of each food and beverage item that they ate the previous day using a multi-pass approach and aided by three-dimensional food models.

The B.C. FNFNES estimates of the average mass of fish in a meal were higher than those from the 2015 CCHS. This may be because the 2015 CCHS included children, whereas the B.C. FNFNES was based on adults only.

Discussion

The average mass of fish in a meal from the creel survey fish consumption questionnaire (262 g) was higher than other regional and national estimates of the average mass of fish per meal. Health Canada (2007) recommended a default value for adults in the general Canadian population of 150 g. This value is similar to the upper end of the ranges of average mass of fish per meal from the 2015 CCHS (53 g to 146 g) and the B.C. FNFNES (109 to 163 g).

The B.C. FNFNES and 2015 CCHS estimates of the average mass of fish in a meal were lower than those from the creel survey fish consumption questionnaire. This may reflect true differences among the sample populations. It is plausible that people fishing on the Peace River tend to eat larger portions of fish than the general Canadian population or Indigenous adults living on reserve in B.C. The differences might also be due to different study methods. Estimates of the average mass of fish per meal from the B.C. FNFNES and 2015 CCHS were both based on 24-hour dietary recall with visual models to aid respondents estimate the mass of fish they ate. Estimates of the average mass of fish per meal from the creel survey fish consumption questionnaire were based on a general question about the average mass of fish per meal, regardless of when it was last eaten. Food frequency questionnaires are more prone to recall bias than 24-hour dietary recall (Naska et al. 2017). This difference in methods may have increased the amount of recall bias in the responses to the creel survey fish consumption questionnaire. Although the creel survey fish consumption questionnaire included a conceptual reference to help estimate the average mass of fish per meal (one portion of fish is equal in size to a deck of playing cards), this method may not have been as accurate as using visual models.

For the MLIB baseline fish consumption survey, estimates of the average mass of fish in a meal were lower than those from the creel survey fish consumption questionnaire. Both surveys used the same method and survey form. So, the difference in results either reflects true differences in mass per meal between the two survey populations, or a difference in how the interviewers asked the question and explained the conceptual reference to interviewees.

Implications for MMP Fish Consumption Guidance

The baseline MMP fish consumption guidance was calculated based on assumed average fish serving sizes of 163 g for adults and 100 g for children. The results from the baseline fish consumption surveys suggest that the average mass of fish some groups of people consume per meal may be higher than that assumed in the baseline MMP fish consumption guidance. For example, the average mass of fish per meal from the creel survey baseline fish consumption questionnaire was 262 g/meal. If the average mass of fish per meal is truly higher than assumed when calculating the MMP baseline fish consumption guidance, then the guidance is inaccurate and the number of meals of fish that a person can eat without exceeding their pTDI for methylmercury will be less than indicated in the guidance.

4.4.2 Rates of Fish Consumption

Estimates of baseline fish consumption rates varied considerably among the sources of data. Estimates of the average and 95th percentile baseline fish consumption rates from existing data and MMP baseline fish consumption surveys are summarized in **Table 4**. Estimates of average baseline fish consumption rates varied by approximately an order of magnitude and ranged from 7 to 81 g/day. Estimates of 95th percentile fish consumption rates varied by about the same margin and ranged from 31 to 244 g/day.

Table 4. Summary of average and 95th percentile baseline fish consumption rates (grams per day)

Study	Sample Size	Average	95 th Percentile	Type of Fish
2010/11 Country Food Harvest Questionnaires				
Duncan's First Nation	47	27	67	Wild-caught freshwater fish
Horse Lake First Nation	92	13	45	Wild-caught freshwater fish
2009-2013 First Nation Food, Nutrition, and Environment Study				
Taiga Plains	152	20	97	Wild-caught freshwater fish
Boreal Plains	548	7	32	Wild-caught freshwater fish
Montaine Cordillera	313	9	35	Wild-caught freshwater fish
2023-2024 MMP Baseline Fish Consumption Surveys				
Creel Survey - Peace	35	41	119	Wild-caught Peace River fish
Creel Survey - Total	35	81	244	All fish
MLIB - Peace	3	22	31	Wild-caught Peace River fish
MLIB - Total	30	23	79	All fish

To help put the findings on fish consumption rates into context, we looked at the baseline fish consumption guidance expressed as grams per day, rather than meals per month. The baseline MMP fish consumption guidance for a 500 mm (22") Bull Trout from Section 1/3 of the Peace River (location of the future Site C reservoir) is 9 meals a month for children less than 12 years old, 17 meals a month for people who are or could be pregnant, and 40 meals a month for others²³. Based on assumed fish meal sizes of 163 g for adults and 100 g for children, this guidance translates to 30 g/d for children less than 12 years old, 92 g/d for people who are or could be pregnant, and 217 g/d for others.

It is uncertain to what extent the differences in baseline fish consumption rates among studies reflect true differences in fish consumption rates among the different study populations or are a result of differences between study methods. The data collection periods for the studies differ by up to 15 years. The Country Food Harvest Questionnaires and the FNFNES measured fish consumption rates for a subset of wild-caught freshwater fish, whereas the MMP baseline fish consumption surveys measured fish consumption rates for wild-caught fish from the Peace River system and total fish consumption from all sources.

Given the apples-to-oranges nature of comparisons among the studies, we can look to support inferences by making comparisons among studies that used the same or similar methods. There was a two-to-three-fold variation in average and 95th percentile fish consumption rates between the two Indigenous Nations that participated in the Country Foods Harvest Questionnaires and the three ecozones that participated in the FNFNES. There was also roughly the same margin of difference in the rates of consumption between the MLIB and Creel Survey MMP baseline fish consumption surveys.

The differences in fish consumption rates among studies that used the same or similar methods suggest that there could be significant differences between groups of people (i.e., different Indigenous groups) in their rates of fish consumption. If this is true, the lack of baseline fish consumption data for seven of the 13 specified Indigenous groups represents an important knowledge gap.

Health Canada (2007) reviewed fish consumption rates for the general Canadian population in 1997 and concluded that 22 g/day was a reasonable estimate of the average consumption rate for retail finfish, and 40 g/day was a reasonable estimate of the average rate of total finfish consumption for sport fishers and subsistence consumers. These values are generally consistent with the MMP average rates of baseline fish consumption for wild-caught freshwater fish, which ranged from 7 to 41 g/day.

²³ See Figure 6-1 in the 2022 MMP annual report (Azimuth, 2024). The estimated concentration of methylmercury in a 500 mm (22") Bull Trout from Section 1/3 of the Peace River was 0.15 ppm.

The 2004 and 2015 CCHSs included nationally representative cross-sectional 24-hour dietary recall data for non-Indigenous Canadians. An analysis of the 2015 CCHS data reported that the average daily intakes of seafood for people 2 to 13 years old ranged from 53 to 70 g/day, and average daily intakes of seafood for people older than 13 years old ranged from 91 to 110 g/day (Hu and Chan 2021). The MMP average baseline fish consumption rates were somewhat lower, but the Canadian Community Health Survey data were for seafood, which includes both finfish and shellfish, and were based on 24-hour dietary recall methods, which tend to produce higher estimates of long-term average food intake rates than food frequency questionnaires.

4.4.3 Relationships Between Body Weight and Fish Consumption Rates

The MMP baseline fish consumption surveys collected data on participants' body weight and how much fish they eat. We used linear regressions to investigate relationships between participants' body weight and their fish consumption rates (g/day), as well as between their body weight and the average mass of fish consumed per meal (g). These analyses were done for data from participants in the creel survey and MLIB baseline fish consumption surveys, with the following findings:

- There was no consistent trend in the data and no statistically significant relationship between body weights and fish consumption rates; and,
- There appeared to be an increase in the average amount of fish consumed per meal as body weight of participants increased, but the relationship was not statistically significant.

There were insufficient data from the BRFN baseline fish consumption survey to do these analyses.

Health Canada (2007) analyzed fish consumption data for the general Canadian population and concluded that there was a positive relationship between body weight and the average amount of fish consumed per meal, or portion size. Data from the creel survey and MLIB baseline fish consumption surveys also suggest that there is a positive relationship between the average amount of fish consumed per meal and the body weight of participants. These relationships were not statistically significant, but that may simply be due to the relatively small sample sizes in the surveys.

The presence of a positive relationship between the amount of fish consumed per meal and body weight has important implications for MMP fish consumption guidance. Body weight and the amount of fish consumed per meal are both input variables in a formula that is used to calculate the average number of servings of fish that can be consumed per month without exceeding Health Canada's provisional Tolerable Daily Intakes (pTDI) for methylmercury (see Equation 1 in Appendix B of the MMP; BC Hydro 2023). Body weight is in the numerator of the formula, and the amount of fish consumed per meal is in the denominator. Therefore, the correlation between the two variables must be accounted for when selecting the corresponding input variables. If the input value for body weight is based on the average body weight for a receptor group, the input value for the average amount of fish consumed per meal should also be based on the average for that receptor group, otherwise the output of the calculation will be inaccurate and will either over- or underestimate the number of servings of fish that can be consumed per month without exceeding Health Canada's pTD for methylmercury.

4.5 How Frequently do Children Eat Fish?

None of the existing sources provided information on baseline fish consumption by children. The MMP baseline fish consumption questionnaires collected information on fish consumption of people that lived with the participants, including children under 12 years old. The baseline fish consumption questionnaires asked participants whether children under 12 years old that live in the same house as the participant eat fish more or less frequently or about the same frequency as the participant. Information from the baseline fish consumption surveys on the frequency of fish consumption by children under 12 years old is summarized below:

- Participants in the creel survey baseline fish consumption survey provided information on fish consumption for 41 household members who were children under 12 years old: 34 % ate fish less frequently than the participant, 63 % ate fish about equally as frequently, and 2 % ate fish more frequently.
- Participants in the MLIB baseline fish consumption survey provided information on fish consumption for two household members who were children under 12 years old; both ate fish less frequently than the participant.
- Participants in the BRFN baseline fish consumption survey provided information on fish consumption for 5 household members who were children under 12 years old: 40 % ate fish less frequently than the participant and 60 % ate fish about as frequently.

The results from the baseline fish consumption surveys indicate, in general, that children under 12 years old eat fish about as frequently as adults or less frequently than adults in the same household.

Information from the baseline fish consumption surveys on fish consumption by children was consistent with other studies. There is evidence that children generally do not eat as much fish as adults, but the differences may be narrowing. A recent analysis of CCHS nutritional data by Hu and Chan (2021) showed that among the general non-Indigenous Canadian population:

- The prevalence of seafood consumption was lowest in children 4 to 18 years old, highest in adults 51 to 70 years old, and intermediate in other age groups (children 2 to 3 years old, adults 31 to 50 years old, and adults greater than 70 years old); and,
- The prevalence of seafood consumption and seafood consumption rates among children increased between 2005 and 2015.

4.6 Limitations to Information on Baseline Fish Consumption

Dietary intake is difficult to measure and can change over time. Therefore, the results of the baseline fish consumption task should be interpreted with caution.

4.6.1 The Study Methods Have Limitations

The food frequency questionnaire, which was used to measure baseline fish consumption, is a relatively blunt instrument. The questionnaire is a relatively simple, cost-effective, and time-efficient method for assessing long-term dietary intakes. However, compared to other methods, the accuracy of food frequency questionnaires is low (Shim et al. 2014). For example:

- Correlations between estimates of dietary intake from food frequency questionnaires and more objective measures of dietary intake, such as biomarkers, are typically in the range of 0.01 and 0.5 (Kristal et al. 2005, Jackson et al. 2011, Patterson et al. 2012, Stråvik et al. 2023);
- Fish consumption rates measured using a weighed food record were about seven-fold lower than fish consumption rates estimated from a food frequency questionnaire, and measured fish consumption frequencies were about four-fold lower than estimated fish consumption frequencies in a study of fish consumption among Ojibwe in the Upper Great Lakes Region of the United States (Dellinger, 2004);
- A study of 2,224 Greenland Inuit found no association between fish intake estimated from a food frequency questionnaire and concentrations of mercury in the blood of participants (Jeppesen et al. 2012); and
- Hair mercury levels predicted from a food frequency questionnaire for fish were greater than measured hair mercury levels by an average factor of about six in a study of recreational anglers in James Bay, Quebec (Loranger et al. 2002).

In addition to the general limitations of food frequency questionnaires, some of the studies on baseline fish consumption were based on non-random sampling and had relatively small sample sizes.

4.6.2 The Amount and Species of Fish People Eat Can Change Over Time

There are many reasons why the amount and species of fish people eat can change over time:

- Price and availability of retail fish;
- Quality, quantity, and relative abundance of fish available for harvest;
- Quantity and quality of other traditional foods (e.g., moose);
- Access to fishing locations; and
- Access to knowledge about fishing and preserving and preparing fish.

4.6.3 People May Not Eat as Much Fish as They Would Like To

Participants in the studies that provided data for the baseline fish consumption task may not eat as much fish as they would like to. One of the reasons that actual fish consumption may be lower than desired fish consumption is concern about mercury in fish. Ten percent of participants in the 2017 McLeod Lake Indian Band Environmental Livelihoods Survey reported that they were concerned about mercury in fish. They spent fewer days fishing and caught fewer fish than participants who were not concerned about mercury in fish. The 2018 Peace Region Fish and Wildlife Compensation Program Information Gathering on Kokanee, Bull Trout, and Arctic Grayling project found that members of the McLeod Lake Indian Band are concerned about mercury levels in all fish, are uncertain what fish are safe to eat, and have shifted fishing away from the Parsnip River to other waterbodies that are not connected to Williston reservoir due, in part, to concern over mercury in fish. The same study found that members of the Sauteau First Nations are concerned about mercury levels in all fish and believe that some fish, especially those in Moberly Lake and tributaries to the Peace River and Williston Reservoir, are contaminated with mercury and not suitable to eat.

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APPENDICES

APPENDIX A:

BASELINE FISH CONSUMPTION QUESTIONNAIRES

Appendix A1:
Initial Creel Survey Fish Consumption Questionnaire, June 30,
2022 Version

Appendix A2:
Creel Survey Fish Consumption Questionnaire, August 31, 2022
Version

Appendix A3:
Creel Survey Fish Consumption Questionnaire, February 2,
2023 Version

Appendix A4:
BRFN Baseline Fish Consumption Questionnaire

BRFN Baseline Fish Consumption Questionnaire

Introduction

This survey is about how much fish you, and people you live with, eat. There are 10 questions.

Methylmercury levels in fish from the Site C Reservoir and Peace River downstream to Many Islands AB, are expected to temporarily increase after the Site C Reservoir is created. Information on how much fish people eat will help us understand if the increases in methylmercury levels in fish are a health concern.

Information collected through this survey is anonymous. The questionnaire will not ask for your name and does not collect any personal identifying information. The information collected in the survey is owned by Blueberry River First Nations and Blueberry River First Nations will be involved in interpreting the information collected.

If you would like to receive more information on methylmercury in fish or why BC Hydro is doing this survey, please contact Norm Healey at Azimuth Consulting Group, email nhealey@azimuthgroup.ca or call or text 250-213-7236.

BRFN Baseline Fish Consumption Questionnaire

1. How often to you eat fish? Choose one.

- I don't eat fish If selected, go to question #6
- Less than once a month If selected, go to question #6
- 1 to 3 times a month If selected, go to question #2
- Once a week or more If selected, go to question #2

2. Do you eat fish caught in the Pace River, or lakes or rivers or streams connected to the Peace River, once a month or more? Choose one.

- Yes If selected, go to question #3
- No If selected, go to question #6

3. What is the average amount of fish you eat in a meal, in portions? A portion is 3 oz, or a piece of raw fish about the size of a deck of cards.

portions.

BRFN Baseline Fish Consumption Questionnaire

4. How many meals a month on average, do you eat the following kind of fish?

This first list is for fish from the Peace River or lakes, rivers or streams connected to the Peace River.

Fish from the Peace River or lakes, rivers, or streams connected to the Peace River							
	Number of meals a month, on average, I eat this kind of fish					Number of portions, on average, each time I eat fish (1 portion = 3 oz)	Average length, in inches, of fish eaten?
	Same all year	Winter (Jan-end of March)	Spring (April to June)	Summer (July to Sept)	Fall (Oct to Dec)		
Bull trout						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Lake trout						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Walleye						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Burbot (ling)						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Goldeye						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Northern pike (jackfish)						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Mountain whitefish						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Lake whitefish						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Arctic grayling						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Rainbow trout						<input type="checkbox"/> Same as question 3	Not required
Kokanee						<input type="checkbox"/> Same as question 3	Not required
Northern pikeminnow						<input type="checkbox"/> Same as question 3	Not required
Sucker						<input type="checkbox"/> Same as question 3	Not required
Other						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know

BRFN Baseline Fish Consumption Questionnaire

How many meals a month on average, do you eat the following kind of fish?

This second list is for fish from stores or restaurants or caught in places other than the Peace River

Fish from stores or restaurants or caught in other places							
	Same all year	Winter (Jan-end of March)	Spring (April to June)	Summer (July to Sept)	Fall (Oct to Dec)	Number of portions, on average, each time I eat fish (1 portion = 3 oz)	Average length, in inches, of fish eaten?
Bull trout						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Lake trout						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Rainbow trout						<input type="checkbox"/> Same as question 3	Not required
Walleye						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Burbot (ling)						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Goldeye						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Northern pike (jackfish)						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Mountain whitefish						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Lake whitefish						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Arctic grayling						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Kokanee						<input type="checkbox"/> Same as question 3	Not required
Bigeye or bluefin tuna						<input type="checkbox"/> Same as question 3	Not required
Ahi tuna						<input type="checkbox"/> Same as question 3	Not required
Canned light tuna (skipjack or yellowfin)*						<input type="checkbox"/> Same as question 3	Not required
Albacore tuna (canned, fresh or frozen)						<input type="checkbox"/> Same as question 3	Not required
Shark, swordfish, or marlin						<input type="checkbox"/> Same as question 3	Not required
Halibut						<input type="checkbox"/> Same as question 3	Not required
Salmon						<input type="checkbox"/> Same as question 3	Not required
Other groundfish (cod, snapper, rockfish, greenling, sole)						<input type="checkbox"/> Same as question 3	Not required
Other						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know

*Canned light tuna is usually less expensive than canned albacore, or white, tuna

BRFN Baseline Fish Consumption Questionnaire

5. What is your approximate weight, in pounds? We are collecting this information so we have a better understanding of how portion size varies with body weight. This information is important for figuring out how much methylmercury people are exposed to from eating fish.

 lbs

Prefer not to answer / not sure

6. What is your gender?

Female

Male

I prefer to self-identify (please specify)

Prefer not to answer

7. Does anyone else you live with eat fish once a month or more?

Yes If selected, go to question #8

No If selected, go to question #9

BRFN Baseline Fish Consumption Questionnaire

8. Complete the following table for each person who lives with you that eats fish once a month or more.

Age and gender of the other people that live with you that eat fish once a month or more.	Do they eat fish more or less frequently than you, or about the same?
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less

9. What is your age, in years?

years

Prefer not to answer

10. What community do you live in?

Appendix A5:
MLIB Baseline Fish Consumption Questionnaire

MLIB Baseline Fish Consumption Questionnaire

Introduction

This survey is about how much fish you, and people you live with, eat. There are 10 questions.

Methylmercury levels in fish from the Site C Reservoir and Peace River downstream to Many Islands AB, are expected to temporarily increase after the Site C Reservoir is created. Information on how much fish people eat will help us understand if the increases in methylmercury levels in fish are a health concern.

Information collected through this survey is anonymous. The questionnaire will not ask for your name and does not collect any personal identifying information. The information collected in the survey is owned by McLeod Lake Indian Band and McLeod Lake Indian Band will be involved in interpreting the information collected.

If you would like to receive more information on methylmercury in fish or why BC Hydro is doing this survey, please contact Norm Healey at Azimuth Consulting Group, email nhealey@azimuthgroup.ca or call or text 250-213-7236.

MLIB Baseline Fish Consumption Questionnaire

1. How often to you eat fish? Choose one.

- I don't eat fish If selected, go to question #6
- Less than once a month If selected, go to question #6
- 1 to 3 times a month If selected, go to question #2
- Once a week or more If selected, go to question #2

2. Do you eat fish caught in the Pace River, or lakes or rivers or streams connected to the Peace River, once a month or more? Choose one.

- Yes If selected, go to question #3
- No If selected, go to question #6

3. What is the average amount of fish you eat in a meal, in portions? A portion is 3 oz, or a piece of raw fish about the size of a deck of cards.

portions.

MLIB Baseline Fish Consumption Questionnaire

4. How many meals a month on average, do you eat the following kind of fish?

This first list is for fish from the Peace River or lakes, rivers or streams connected to the Peace River.

Fish from the Peace River or lakes, rivers, or streams connected to the Peace River							
	Number of meals a month, on average, I eat this kind of fish					Number of portions, on average, each time I eat fish (1 portion = 3 oz)	Average length, in inches, of fish eaten?
	Same all year	Winter (Jan-end of March)	Spring (April to June)	Summer (July to Sept)	Fall (Oct to Dec)		
Bull trout						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Lake trout						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Walleye						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Burbot (ling)						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Goldeye						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Northern pike (jackfish)						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Mountain whitefish						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Lake whitefish						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Arctic grayling						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Rainbow trout						<input type="checkbox"/> Same as question 3	Not required
Kokanee						<input type="checkbox"/> Same as question 3	Not required
Northern pikeminnow						<input type="checkbox"/> Same as question 3	Not required
Sucker						<input type="checkbox"/> Same as question 3	Not required
Other						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know

MLIB Baseline Fish Consumption Questionnaire

How many meals a month on average, do you eat the following kind of fish?

This second list is for fish from stores or restaurants or caught in places other than the Peace River

Fish from stores or restaurants or caught in other places							
	Same all year	Winter (Jan-end of March)	Spring (April to June)	Summer (July to Sept)	Fall (Oct to Dec)	Number of portions, on average, each time I eat fish (1 portion = 3 oz)	Average length, in inches, of fish eaten?
Bull trout						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Lake trout						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Rainbow trout						<input type="checkbox"/> Same as question 3	Not required
Walleye						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Burbot (ling)						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Goldeye						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Northern pike (jackfish)						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Mountain whitefish						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Lake whitefish						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Arctic grayling						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
Kokanee						<input type="checkbox"/> Same as question 3	Not required
Bigeye or bluefin tuna						<input type="checkbox"/> Same as question 3	Not required
Ahi tuna						<input type="checkbox"/> Same as question 3	Not required
Canned light tuna (skipjack or yellowfin)*						<input type="checkbox"/> Same as question 3	Not required
Albacore tuna (canned, fresh or frozen)						<input type="checkbox"/> Same as question 3	Not required
Shark, swordfish, or marlin						<input type="checkbox"/> Same as question 3	Not required
Halibut						<input type="checkbox"/> Same as question 3	Not required
Salmon						<input type="checkbox"/> Same as question 3	Not required
Other groundfish (cod, snapper, rockfish, greenling, sole)						<input type="checkbox"/> Same as question 3	Not required
Other						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know
						<input type="checkbox"/> Same as question 3	<input type="checkbox"/> Don't know

*Canned light tuna is usually less expensive than canned albacore, or white, tuna

MLIB Baseline Fish Consumption Questionnaire

5. What is your approximate weight, in pounds? We are collecting this information so we have a better understanding of how portion size varies with body weight. This information is important for figuring out how much methylmercury people are exposed to from eating fish.

 lbs

Prefer not to answer / not sure

6. What is your gender?

Female

Male

I prefer to self-identify (please specify)

Prefer not to answer

7. Does anyone else you live with eat fish once a month or more?

Yes If selected, go to question #8

No If selected, go to question #9

MLIB Baseline Fish Consumption Questionnaire

8. Complete the following table for each person who lives with you that eats fish once a month or more.

Age and gender of the other people that live with you that eat fish once a month or more.	Do they eat fish more or less frequently than you, or about the same?
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less
<input type="checkbox"/> Under 12 yrs old <input type="checkbox"/> Female 12 to 50 yrs old <input type="checkbox"/> Other	<input type="checkbox"/> Same <input type="checkbox"/> More <input type="checkbox"/> Less

9. What is your age, in years?

years

Prefer not to answer

10. What community do you live in?