DRAFT COMPREHENSIVE TECHNICAL REPORT

FNFNES

First Nations Food, Nutrition & Environment Study

FINAL REPORT FOR EIGHT ASSEMBLY OF FIRST NATIONS REGIONS

ASSEMBLY of FIRST NATIONS • ASSEMBLÉE des PREMIÈRES NATIONS

uOttawa

Université de Montréal

DRAFT: NOT FOR CIRCULATION

FNFNES Final Report for Eight Assembly of First Nations Regions: Draft Comprehensive Technical Report

November 2019

Assembly of First Nations
University of Ottawa
Université de Montréal

Report prepared by: Laurie Chan, Malek Batal, Tonio Sadik, Constantine Tikhonov, Harold Schwartz, Karen Fediuk, Amy Ing, Lesya Marushka, Kathleen Lindhorst, Lynn Barwin, Peter Berti, Kavita Singh and Olivier Receveur.

FNFNES
University of Ottawa
30 Marie Curie, Ottawa, Ontario K1N 6N5
tel: 613-562-5800 ext. 7214
email: fnfnes@uottawa.ca
fnfnes.ca

Submitted to First Nations and Inuit Health Branch, Department of Indigenous Services Canada, September 13, 2019

Suggested citation:

Chan, Laurie, Malek Batal, Tonio Sadik, Constantine Tikhonov, Harold Schwartz, Karen Fediuk, Amy Ing, Lesya Marushka, Kathleen Lindhorst, Lynn Barwin, Peter Berti, Kavita Singh and Olivier Receveur. 2019. *FNFNES Final Report for Eight Assembly of First Nations Regions: Draft Comprehensive Technical Report*. Assembly of First Nations, University of Ottawa, Université de Montréal.

COVER PHOTO: CRABAPPLE, WOODSTOCK FIRST NATION, BY STEPHANIE LEVESQUE
GRAPHIC DESIGN AND COPYEDIT: NADENE REHNBY, HANDS ON PUBLICATIONS

Contents

Acknowledgements

We would like to extend our gratitude again to all of the participants, partners, community members and staff from various partner organizations who carried this work forward on its journey over the last 11 years including:

Assembly of First Nations National and Regional Organizations; Chiefs and Councils of 92 participating First Nations; hundreds of community members who worked as community coordinators, research assistants and helped with water sampling; First Nation and Inuit Health Branch Environmental Public Health Officers; Statistics Canada statisticians, ALS Global, Research staff at University of Montreal, University of Ottawa, University of Northern BC, First Nations and Inuit Health Branch Laboratory.

The First Nations and Inuit Health Branch of Health Canada and, currently, Indigenous Services Canada, was instrumental in the initiation, conceptual development and logistical, as well as financial support of the study implementation throughout the lifespan of this study.

The names of individuals and partners are included in the seven FNFNES regional reports published (www.fnfnes.ca).

Investigators

Principal Investigators

Laurie Chan, Ph.D., Professor and Canada Research Chair in Toxicology and Environmental Health, Centre for Advanced Research in Environmental Genomics, University of Ottawa

Olivier Receveur, Ph.D., M.P.H., Dt. P., Professor, Department of Nutrition, Faculty of Medicine, Université de Montréal

Malek Batal, Ph.D., Associate Professor, Department of Nutrition, Faculty of Medicine, Université de Montréal

Tonio Sadik, Ph.D., Director of Environment, Assembly of First Nations

Co-Investigators

Harold Schwartz, Ph.D., Manager, Chemical Safety of Traditional Foods, Environmental Public Health Division, Office of Population and Public Health, Population Health and Primary Care Directorate, First Nations and Inuit Health Branch, Department of Indigenous Services Canada

Constantine Tikhonov, MD, MHA
Section Head, Safe Food Environments, Environmental Public Health Division, Population Health and Primary Care Directorate, First Nations and Inuit Health Branch, Department of Indigenous Services Canada

Executive Summary

THE FIRST NATIONS FOOD, NUTRITION AND ENVIRONMENT STUDY (FNFNES) was implemented in the eight Assembly of First Nations (AFN) regions situated south of the 60th parallel over a 10-year period from 2008 to 2018. The study originated from concerns about the impacts of environmental pollution on the quality and safety of the ecosystems and traditional foods harvested by First Nations. The goal of FNFNES was to fill knowledge gaps about the nutritional adequacy, quality and chemical safety of traditional foods consumed in the current diets, as well as the overall well-being and food security of First Nations. To ensure that the study assessed and represented the diversity of First Nations' diets, the study adopted a random sampling strategy based on an ecosystem framework comprised of 11 ecozones.

FNFNES is a community-based participatory research project. Respective First Nations were involved in the planning and the implementation of data collection for the five principal study components: household interviews; tap water sampling for metals (of human health concern and for aesthetic objectives); surface water sampling for pharmaceuticals; hair sampling for mercury; and traditional food sampling for contaminants. Data collection occurred during the fall months of 2008 to 2016. Results were reviewed and verified at the community level and feedback was integrated into both the final community and regional report. Each community also received a copy of the raw data and workshops were held where representatives were provided training on how to read and interpret their data as well as perform data analyses. Regional reports are available at www.fnfnes.ca.

The intent of this final report is to present summary findings for all ecozones/regions combined for diet quality and current traditional food use, food security, water quality, and current exposure to chemical contaminants in traditional food and water for First Nations living on-reserve lands south of the 60th parallel. Results obtained through the household interview component can be considered to be representative at the regional and ecozone level for all First Nations adults and/or households living on reserve south of the 60th parallel. As data were collected over a 10-year time span, an adjustment factor was created to account for population changes over the time period.

Ninety-two First Nations, located in 11 ecozones, completed the five general study components. Sixty percent of participating First Nations were located more than 50 km away from a service centre while 18% had no year-round road access. With an average household size of five, 69% of households contained dependents under the age of 18. Overall, 55% of participants identified that they had a high school equivalency diploma or higher. Employment earnings were the most commonly reported source of income (52%), followed by social assistance (28%), pension (11%), worker's compensation (6%) and other sources (3%).

LAC LA RONGE, TRADITIONAL PLANTS, PHOTO BY REBECCA HARE

Diverse patterns of traditional food use were seen across the regions and ecozones. Higher intakes were seen in the western and northernmost ecozones. While most households across the regions (between 62% and 79%) were actively engaged in harvesting, there were substantive differences in the number of days that traditional food was reported to be eaten: traditional food appeared more often on the table in BC and was significantly lower in Ontario, the Atlantic, Alberta and Manitoba. Traditional food use was associated with location, household participation in traditional food harvesting activities, age group, gender and education. Structural level barriers to harvesting were industrial activities and government regulations while household level barriers included insufficient resources to purchase/operate equipment, a lack of a hunter and time.

The goal of FNFNES was to fill knowledge gaps about the nutritional adequacy, quality and chemical safety of traditional foods consumed in the current diets, as well as the overall well-being and food security of First Nations.

The diet of adult First Nations adults across Canada does not meet nutrition recommendations. There are inadequate intakes for vitamins A, D, and C, folate, calcium, and magnesium. On days when traditional food is present, recommendations for several nutrients are more likely to be met.

The prevalence of food insecurity is very high in First Nations communities (48%). The highest rates of food insecurity were found in Alberta (60%) and in remote communities. By ecozone, the lowest rate of food insecurity (23.7%) was found in the Boreal Cordillera (northern BC). Food insecurity was lower in households with two or more individuals working full-time, among older adults (71+), in males and in those with self-reported good health and non-smokers.

Rates of obesity and diabetes are higher than reported for the general Canadian population. Eighty-two percent of all adults were considered overweight or obese. The age-standardized diabetes rate was 19% for all adults.

The likelihood of reporting good health varied by location, gender, education, income, weight and diabetic status of participants, and between households reporting traditional food activities. There were significantly lower rates of self-reported good health in three regions (Manitoba, Saskatchewan and Ontario), in one ecozone (the Boreal Shield), and in households reporting no traditional food activity. Self-reported health was also significantly lower among adults who were male, obese and had finished less than nine years of education.

Although almost all households have tap water (99.5%), only 73.9% using it for drinking while 92.5% reported using tap water for cooking purposes. Tap water avoidance is mainly due to concerns about the taste and colour of the water. Exceedances for metals with operational guidance values and aesthetic objectives was 30% (453/1,516).

Of the 1,516 households that participated in testing for metals in drinking water, exceedances of metals of public health concern were found in 29 homes or 1.9%. Three households had elevated arsenic in the first draw sample with one exceedance in the flushed sample. Sixty-nine households (4.6%) had elevated lead in the first draw with three exceedances in the flushed samples and the duplicates. One of those households was resampled and the follow up sample was below the guideline value. One household had elevated selenium in the first draw sample and a selenium exceedance in the flushed sample. Lastly, 24 households had elevated levels of uranium in the first draw sample and exceedances in the flushed sample: three duplicate uranium samples also exceeded the Canadian guideline.

Pharmaceuticals were found in surface water bodies nearby 79 of the 95 (83.2%) participating communities. Among the 302 sites where testing occurred, pharmaceuticals were present at 193 of the 285 surface water sites (67.7%), in 4/11 drinking water sites, and in all (6/6) wastewater sites sampled. In some communities, there are as many as 21 different pharmaceuticals in the surface water. In total, 35 of the 43 pharmaceuticals tested for were found in at least one community. Currently, the concentrations of the pharmaceuticals found in the FNFNES study should not pose a threat to human health, however, the potential health effects from drinking the water from these surface water sites over a prolonged period are unknown.

Generally, contaminant concentrations found in traditional foods were within the normal ranges that are typically found in Canada with no health concern associated with the current consumption rate. Higher concentrations of cadmium were found in organ meats compared to muscle tissue. Some samples had higher concentrations of lead, likely as a result of contamination from lead-containing ammunition. Higher concentrations of arsenic and mercury were found in fish and seafood. Between one and five percent of consumers exceeded the provisional tolerable daily intakes for metals of human health concern. For lead, the provisional daily intake was exceeded by 4% of all consumers and 3% of women of childbearing age. Two percent of women of childbearing age exceeded the provisional tolerable daily intake for mercury. There were no exceedances for persistent organic pollutants.

A total of 3,404 First Nations adults or 52.5% of respondents volunteered to have their hair sampled and tested for mercury. Higher hair mercury concentrations were observed among adults living in the AFN region of Quebec and in northern ecozones of most regions. The lowest level of hair mercury was observed for First Nations living in the Atlantic region. At the ecozone level, a greater frequency of higher exposures was seen in northern ecozones. Overall, mercury body burden is below the established Health Canada's mercury guidelines of 6 µg/g in hair (ranging from 0.16 µg/g to 3.3 µg/g across age and sex groups) in all regions except Quebec. Mercury exposure is reasonably comparable to the general population. The results suggest that mercury exposure is not a significant health issue in the First Nations population south of 60th parallel across Canada. Nevertheless, there were observed exceedances of the acceptable level guidelines for the general population and women of childbearing age. First Nations women of childbearing age living in northern ecozones in Saskatchewan, Manitoba, Ontario and particularly Quebec would benefit from sustained public health risk-benefit communication efforts aiming to promote the importance of continued reliance on fish as a food source, while decreasing exposure to environmental mercury.

The diet of First Nation adults across Canada does not meet nutrition recommendations. There are inadequate intakes for vitamins A, D, and C, folate, calcium, and magnesium. On days when traditional food is present, recommendations for several nutrients are more likely to be met.

Summary of Key Findings and Recommendations

1. This study offers for the first time a body of coherent evidence on the human dimension of the ongoing environmental degradation affecting First Nation citizens and communities.
2. Traditional food systems remain foundational to First Nations.
3. Traditional food has multiple core values for First Nations. These include cultural, spiritual, and traditional values, along with enhanced nutrition and health, food security, ways of knowing, and an ongoing connection to land and water.
4. Traditional food access does not meet current needs. Over half of all adults reported that harvesting traditional food is impacted by industry-related activities, as well as climate change.
5. Traditional food is generally preferred to store-bought food, is of superior nutritional quality, and its inclusion significantly improves diet quality.
6. While there are two primary exceptions, traditional food is safe for consumption. Exceptions include:
    a. Large predatory fish (such as walleye and northern pike) in some areas have higher levels of mercury, and some women of childbearing age have elevated levels of mercury exposure, particularly in the northern parts of Saskatchewan, Manitoba, Ontario and Quebec.
    b. The use of lead-based ammunition resulted in very high levels of lead in many harvested mammal and bird samples. As a result, there is an elevated risk of exposure to lead for some adults and women of childbearing age. The use of other forms of ammunition can eliminate this exposure to lead.
7. Many First Nations face the challenge of extremely high rates of food insecurity. Overall, almost half of all First Nation families have difficulty putting enough food on the table. Families with children are affected to an even greater degree.
8. The price of healthy foods in many First Nation communities is much higher than in urban centres, and is therefore beyond the reach of many families.
9. The current diet of many First Nation adults is nutritionally inadequate, which is strongly tied to food insecurity and limited access to healthy food options.
10. The health of many First Nation adults is compromised with very high rates of smoking, obesity (double the obesity rate among Canadians), and with one-fifth of the adult population suffering from diabetes (more than double the national average).
11. There continue to be issues with water treatment systems in many communities, particularly exceedances for metals that affect colour and taste, which limit the acceptability and use of tap water for drinking.
12. Pharmaceutical residues were found in surface waters in and around many communities, indicating potential sewage contamination.

The authors of this study urge governments and decision-makers to urgently address systemic problems relating to food, nutrition and the environment affecting First Nations, and to do so in a manner that supports First Nations-led leadership and solutions.

Beyond addressing individual and household barriers to accessing high quality foods from both the market and traditional food systems, it is imperative to reduce threats to the health of ecosystems and the quality and availability of traditional food. Over half of all adults reported that harvesting was impacted by industry-related activities, and climate change. First Nations reported that they have a limited ability to affect decisions relating to natural resource management and the foods available for purchase within a community.

These findings highlight the need to continue to build upon current efforts at the community, regional, provincial and national levels to improve food security and nutrition in First Nations through a social determinants of health approach.

Indigenous priorities and values need to be recognized and included within relevant frameworks that affect decisions around land use, conservation, habitat protection and access to high quality and sufficient traditional food.

New mechanisms need to be co-developed with First Nations to address weaknesses in current policy and program approaches in order to:

Close gaps in nutrition and food insecurity

- Improve access to the traditional food system through a combination of subsidies that support harvesting, growing, sharing, and preservation.
- Improve local availability and access to healthier foods independent of imports (gardens, greenhouses, hydroponic units, agricultural activity and animal husbandry when appropriate).
- Reduce food price differences between major urban centres and First Nations by increasing community eligibility for subsidy programs (such as Nutrition North) and providing financial support to increase First Nation operated and owned food production and distribution businesses/organizations.
- Improve families' financial ability to purchase healthy market food options and engage in local harvesting and food production activities.
- Continue monitoring nutrition and food insecurity, and create appropriate mechanisms to establish accountabilities in progress and reporting.
- Monitor the effectiveness of food access programs for First Nations in curbing food insecurity.

SHAYNE PAPATIE, LA NATION ANISHNABE DU LAC SIMON, PHOTO BY MARIE PIER BOLDUC

Support sustainable and healthy lifestyles

- The high levels of smoking, obesity and diabetes reflect inequities in access to health-oriented food and built environments (e.g., walkability, recreational opportunities), and sufficient community prevention and health service delivery options.
- Additional investments are needed for communities to provide a healthier environment and culturally appropriate and safe primary prevention, and acute and chronic disease management.
- Develop region and ecozone specific advisories and guidance for fish consumption that would promote the importance of fish in diets, but would also inform sensitive populations such as women of childbearing age (WCBA), about decreasing exposure to mercury.
- First Nations WCBA living in northern ecozones in Saskatchewan, Manitoba, Ontario and particularly Quebec would benefit from sustained public health risk-benefit communication efforts aiming to promote the importance of continued reliance on fish as a food source, while decreasing exposure to environmental mercury.

The authors of this study urge governments and decision-makers to urgently address systemic problems relating to food, nutrition and the environment affecting First Nations, and to do so in a manner that supports First Nations-led leadership and solutions.

Support communities to increase their reliance on traditional food systems

- Recognize and include Indigenous values and priorities in all federal, provincial and local government decisions with respect to land use, development, conservation, habitat protection, with an intention to maintain or enhance access to and availability of high quality traditional food.
- Recognize First Nations priority rights to harvest in preferred areas to meet their food needs, and minimize and compensate any potential infringements on these priority rights to harvest.
- Support is needed by all levels of government to monitor, protect and ensure that local ecosystems are healthy and can support First Nations ability to access sufficient traditional food.
- Develop a long-term nation-wide traditional food contaminant monitoring program.
- Develop a pan-Canadian programming for the safe and affordable replacement of lead-containing ammunition and fishing weights
- Develop region and ecozone specific advisories and guidance for fish consumption that would promote the importance of fish in diets, but would also inform sensitive populations such as women of childbearing age (WCBA), about decreasing exposure to mercury. First Nations WCBA living in northern ecozones in Saskatchewan, Manitoba, Ontario and particularly Quebec would benefit from sustained public health risk-benefit communication efforts aiming to promote the importance of continued reliance on fish as a food source, while decreasing exposure to environmental mercury.

Ensure good drinking water quality and trust in safety of public water systems

- In order to promote the use of tap water over sugar-sweetened beverages, concerns about the taste and/or appearance of drinking water need to be addressed. Regular maintenance and inspection programs of water treatment and/or delivery systems need to be adequately resourced to improve the quality of the drinking water supply.
- Lead pipes need to be replaced in communities with elevated lead levels in drinking water.

Ensure that pharmaceuticals are not present in levels potentially harmful to humans or animals

- Develop pan-Canadian guidelines and a monitoring program for the protection of aquatic, land and human health to avoid unnecessary exposure to pharmaceuticals and other contaminants.
- Develop detailed planning for appropriate sewage waste treatment and disposal.
- Further support is needed to ensure the return or proper disposal of unused or expired prescription drugs and medications as an alternative to flushing them down the toilet or throwing them into the regular garbage.

In the fall of 2019, a workshop with representatives from participating communities will meet to discuss the results and provide feedback on study recommendations.

Detailed Table of Contents

Acronyms and Abbreviations

AI: Adequate Intake

AFN: Assembly of First Nations

AMDR: Acceptable Macronutrient Distribution Ranges

AO: Aesthetic Objective

BMI: Body Mass Index

BW: Body weight

CALA: Canadian Association for Laboratory Accreditation

CCHS: Canadian Community Health Survey

CI: Confidence Interval

CIHR: Canadian Institutes of Health Research

CWS: Community Water System

DDE: Dichlorodiphenyldichloroethylene

DRI: Dietary Reference Intakes

EAR: Estimated Average Requirements

EHO: Environmental Health Officer

FFQ: Food Frequency Questionnaire

FNFNES: First Nations Food, Nutrition and Environment Study

FNIHB: First Nations and Inuit Health Branch (Indigenous Services Canada)

HH: Household

ISC: Indigenous Services Canada

MAC: Maximum acceptable concentration

Max: Maximum or highest value

Min: Minimum or lowest value

mM: Molar Concentration-one thousandth of a mole

n: Number of participants surveyed or number of food, water or hair samples analyzed

PAH: Polycyclic aromatic hydrocarbons

PBDE: Polybrominated diphenyl ethers

PCB: Polychlorinated biphenyls

PFC: Perfluorinated compounds

PFOS: Perfluorooctanesulfonic acid or perfluorooctane sulfonate

PI: Principal Investigator

POP: Persistent Organic Pollutant

PPCP: Pharmaceuticals and personal care products

PPM: Parts per million

PSU: Primary Sampling Unit

PWS: Public Water System

QA/QC: Quality Insurance/Quality Control program

RDA: Recommended Dietary Allowance

SAS: Statistical Analysis System: software developed by SAS institute

SIDE: Software for Intake Distribution Estimation

SCC Standards Council of Canada

SE: Standard error (see Glossary)

SHL: Socio/Health/Lifestyle Questionnaire

SSU: Secondary Sampling Unit

TDI/PTDI: Tolerable Daily Intake/ Provisional Tolerable Daily Intake

TDS: Total Diet Studies

TF: Traditional food

TSU: Tertiary Sampling Unit

TWS: Trucked Water System

TPWS: Trucked Public Water System

UL: Tolerable Upper Intake Level

USDA: United States Department of Agriculture

Glossary

Aesthetic objective (AO): The level of substances in drinking water or characteristics of drinking water (such as taste, odour, or colour) that can affect its acceptance by consumers. Aesthetic objective levels are below levels considered to be harmful to health.

Acceptable Macronutrient Distribution Ranges (AMDR): Expressed as a percentage of energy intake (total calories), the AMDRs are the range of intake for protein (10-35%), fat (20-35%), and carbohydrates (45-65%), associated with a reduced risk of chronic disease and provide adequate amounts of these nutrients.

Adequate Intake (AI): An AI is derived for a nutrient if there is inadequate evidence to establish an Estimated Average Requirement (EAR).

Arithmetic mean: See mean.

Average: See mean.

Background level: The level of chemical (or other substances) that are normally found in the environment.

Body burden: This refers to the total amount of any chemicals currently present in the human body at any given time. Some chemicals only stay present in the body for a short period of time while others remain within the body for 50 years or more.

Body Mass Index (BMI): Calculated by dividing the weight (in kilograms) by the square of the height (in metres), this index is used to define normal weight (range of 18.5-24.9), overweight (25-29.9) and obesity (30 and over). Overweight and obesity are degrees of excess body weight carrying increasing risks of developing health problems such as diabetes and heart disease.

Bootstrapping: A computer-based statistical method used to estimate a statistical parameter (e.g., standard error) by random sampling with replacement from the original dataset.

Cistern: A water holding tank that provides storage for treated drinking water.

Coefficient of variation (CV): A measure of the relative magnitude of the standard deviation. The standard deviation is the typical or average distance a value is to the mean. CV=standard deviation/mean. Data that is more spread out will have a higher CV. CVs over 33% are often considered unreliable

Confidence Interval: A range or interval of scores that reflects the margin of error (due to sampling and measurement errors) associated with the mean value of the parameter (characteristic of a population) under study. A 95% CI means that the true mean value falls within this interval 95% of the time.

Dietary Reference Intakes (DRI): A set of nutrient-based reference values that are used to assess and plan the diets of healthy individuals and groups. The DRIs include the Estimated Average Requirements (EARs), the Recommended Dietary Allowance (RDA), the Adequate Intake (AI) and the Tolerable Upper Intake Level (UL).

Ecozone: Regions/areas identified based on the distribution patterns of plants, animals, geographical characteristics and climate.

Estimated Average Requirement (EAR): The estimated median daily nutrient intake level necessary to meet the nutrient needs of half of the healthy individuals in a gender or age group. It is a primary reference point used to assess the nutrient adequacy of groups

Food security: Physical and economic access by all people to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Household food security can be estimated by a questionnaire.

Guideline value: In Canada, guideline values are set for the protection of environmental and human health. For example, there are guidelines for human tissues (such as blood and hair), animal tissues (fish, mammals and birds), drinking water, recreational water, soil, as well as for the protection of aquatic life. These values are based on the most current scientific data available for the parameter of interest.

Groundwater: Water located beneath the ground surface such as in porous soil spaces and fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water.

Groundwater under the direct influence of surface water (GUDI): groundwater that shows surface water characteristics. This can include water from a well that is not a drilled well or does not have a watertight casing and is up to 6 m in depth below ground level.

Hazard Quotient (HQ): The HQ approach is used in contaminant exposure analyses to estimate risks of adverse health effects to any chemicals of potential concern (COPC) such as metals (arsenic, lead, cadmium, mercury) or persistent organic pollutants. An HQ is calculated by dividing the estimated exposure to a COPC (µg/kg body weight/day) by the TDI. If the HQ is ≤ 1, the risk of an adverse health effect is not likely. If HQ is >1, there can be an increased health risk exposure from the contaminant.

Individual Water System (IWS): A system serving individual homes that each have their own pressurized water supply (e.g., a well), or is connected to a piped distribution system that has less than five housing units and does not include any public access buildings.

Interquartile range (IQR): A statistical term used to describe the distribution around the median (25% above and below the median).

Maximum Acceptable Concentration (MAC): The concentration or level of a particular substance at which exposure to may cause harmful effects on health.

Mean (arithmetic): A statistical term used to describe the value obtained by adding up all the values in a dataset and dividing by the number of observations. Also known as 'average'.

Mean, geometric (GM): To calculate a geometric mean, all observations (i.e., values) are multiplied together, and the nth root of the product is taken, where n is the number of observations. A geometric mean of skewed distribution such as hair mercury concentrations usually produces an estimate which is much closer to the true center of the distribution than would an arithmetic mean.

Median: A statistical term used to describe the middle value obtained when all values in a dataset are placed in numerical order; at most half the observations in a dataset are below the median and at most half are above the median.

Reserve: A tract of land, held in trust by the Crown, for the exclusive use of Indian people. Reserves are regulated under the Indian Act.

Organochlorines: A group of organic compounds with a similar chemical structure. There are naturally occurring and man-made organochlorines. Organochlorine compounds have been used for a variety of purposes including pesticides (DDT, chlordane, toxaphene, solvents, material purposes (PVC pipes) insulators (PCB). Some organochlorines have been banned or their use restricted due to their harmful impacts and classification as a POP.

Oral Slope Factor: An upper bound, approximating a 95% confidence limit, on the increased cancer risk from a lifetime oral exposure to an agent. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg-day, is generally reserved for use in the low-dose region of the dose-response relationship, that is, for exposures corresponding to risks less than 1 in 100.

Persistent Organic Pollutant (POP): Groups of chemicals that persist in the environment and in the bodies of humans and other animals long after their use.

Public Water System (PWS): A community water system with five or more connections that has a distribution system (piped) and may also have a truck fill station.

Recommended Dietary Allowance (RDA): The estimated average daily nutrient intake level that meets the needs of nearly all (98%) healthy individuals in an age or gender group.

Semi Public Water System (SPWS): A well or cistern serving a public building(s) or where the public has a reasonable expectation of access and has less than five connections.

Significant difference: Determination through statistical testing of differences between two numbers or groups. There are three aspects to these tests—the estimates of the averages, the variability of the observations, and the sample size. A difference is more likely to be significant when: a.) the difference in the estimates of the averages are large; b.) the variability in the observations is small; and c.) the sample size is large. When a difference is not considered significant, it could be because of any one of those three aspects: the difference in the averages is small, the observations vary widely between individuals, and there are not many observations. If the survey was repeated some of the differences that are considered significant in this report would no longer be significant, and vice-versa, but we would expect that general tendencies would be the same.

Standard deviation (SD): A measure of the usual distance or spread of the data values about the mean value (the average of a set of numbers) in a data set. The SD is higher when the data have greater variability.

Standard error (SE): A measure of variation to be expected from sampling strategy, measurement error, and natural variability in the calculated parameter (The parameter can be a percentage or a mean (average) for example).

Surface water (SW): All water situated above-ground (for example, rivers, lakes, ponds, reservoirs, streams, seas).

Tolerable Daily Intake (TDI) or Provisional Tolerable Daily Intake (PTDI): The amount of a substance in air, food or drinking water that can be taken in daily over a lifetime without adverse health effects. TDIs or PTDIs are calculated on the basis of laboratory toxicity data to which uncertainty factors are applied. TDIs are presented as daily dose rates in units of mass of a particular chemical per kilogram of body weight of a person per day.

Tolerable Upper Intake Level (UL): An estimate of the highest average daily nutrient intake level that is likely to pose no adverse health effects.

Wastewater (WW): used water, including greywater (used water kitchen, laundry), blackwater (used water from bathroom containing human waste), or surface runoff or used water from an industrial, commercial or institutional facility that is mixed with blackwater).

Water treatment plant (WTP): The facility that treats water so that it is clean and safe to drink.

Water treatment system (WTS): Includes all water delivery components such as the raw water intake, water treatment plant, distribution system, hydrants, etc.

µg/g: Micrograms (1 millionth or 1/1,000,000 of a gram) per gram; in the case of the mercury in hair results, this measurement represents the weight of mercury measured per gram of hair. In the food contaminant results, this represents the weight of contaminant per gram of food.

µg/L: Micrograms (1 millionth or 1/1,000,000 of a gram) per litre; found in the drinking water results, this measurement represents the weight of trace metals measured per litre of water.

ng/g: Nanograms (1 billionth or 1/1,000,000,000 of a gram) per gram; found in the food contaminant results, this measurement represents the weight of a contaminant measured per gram of food.

ppm: Parts per million; A common unit typically used to describe the concentration of contaminants in food or environment. This is approximately equivalent to one drop of water diluted into 50 liters (roughly the fuel tank capacity of a small car).

ppb: Parts per billion; this is approximately equivalent to one drop of water diluted into 250- 55-gallon containers.

pg/kg/day: Pico grams (1 trillionth or 1/1,000,000,000,000 of a gram) per kilogram per day; in the food contaminant results, this represents the weight of contaminants per kilogram body weight that is being consumed per day. This value is used for risk assessment.

CHAPTER 1

Introduction

IN CANADA, THERE REMAIN LARGE GAPS in health between First Nations and the non-Indigenous population. The well-being of individuals and communities is determined by a broad range of factors including the social determinants of health, diet and lifestyle, genetics, and the state of the environment. The social determinants of health (social and economic factors including income, education, employment, early childhood development, social networks, food security, gender, ethnicity, and disability that can result in inequities and exclusion) play a key role in health inequities: those who have more advantages tend to have better health (Frohlich, Ross and Richmond 2006; Mikkonen and Raphael 2010). For First Nations peoples, the history of colonization and the loss of jurisdiction over traditional territories is an additional dimension of the determinants of health (Egeland and Harrison 2013; Reading and Wein 2009).

For thousands of years, First Nations have relied on ecozone-adapted traditional food systems and diverse resource management and food production technologies from hunting and foraging to intensive food production (e.g., clam gardens, berry patches, species domestication) (Deur and Turner 2005; Waldram, Herring and Young 1995). First Nations are experiencing a dietary transition away from traditional foods that has been attributed to a multitude of factors including: a decline in the availability, quality, safety and access to traditional food due to development, pollution, and climate change; government regulations that impact harvesting; financial and time constraints that influence participation in harvesting; and cultural losses from the breakdown of social systems and intergenerational learning due to colonial assimilation policies and the legacy of the residential school system (Kuhnlein, Erasmus et al. 2013; Kuhnlein and Receveur 1996; Turner, Plotkin and Kuhnlein 2013). Traditional food has key nutritional, cultural, spiritual, and economic values for First Nations peoples and is often more nutrient dense than commercially available 'market' or store-bought food replacements. As the proportion of traditional food decreases in the diet of First Nations, there is a risk of a decrease in the nutritional quality of the diet and rise in nutrition-related health problems such as anemia, heart disease, obesity, osteoporosis, cancer, infections, diabetes, and tooth decay (Kuhnlein and Receveur 1996). The health and nutrition of First Nations peoples are strongly affected by social disparities, the erosion of a traditional lifestyle, and the resulting high food insecurity and poor quality diet (Adelson 2005; Kuhnlein and Receveur 1996; Power 2008; Willows, Veugelers et al. 2011; Willows 2005).

Increasing industrialization in the last century has led to varying degrees of pollution in all ecosystems. It has been suggested that major health problems (e.g., cancer, diabetes, low infant weight) may be related to the amount of chemical contaminants in the environment (Hectors et al. 2011; Lee et al. 2011; Li et al. 2006; Institute of Medicine 2007).

UNAMEN SHIPU, PHOTO BY LARA STEINHOUSE

Over the past 50 years, the Government of Canada has conducted three national nutrition surveys (1970-1972 Nutrition Canada National Survey (NCNS), 2004 and 2015 Canadian Community Health Survey–Nutrition) and six Total Diet Studies (TDS) to understand the eating patterns, diet quality and the environmental safety of store-bought foods of the general population's diet. These studies however, have been of limited value for First Nations communities. First Nations living on-reserve were not included in the 2004 and 2015 CCHS–Nutrition surveys (Statistics Canada 2017) and only store-bought foods have been examined in the TDS (Health Canada 2009a). The 1970-1972 NCNS included 29 First Nation communities (27 communities south of the 60th parallel and two communities in the Northwest Territories); however, the participation rate was 30% and only one report was published containing aggregated nutrient intake results without food quality and consumption patterns (Health Canada 1975). Two decades later, fish and game consumption estimates, combined for First Nations and Inuit, were derived from unpublished anonymized 24-hour recalls from the NCNS with no distinction by geographic region or cultural identity (Richardson 1997); these estimates have been incorporated into human health risk assessment guidance for use where no dietary studies on traditional food use exist (Health Canada 2010). Therefore, there is a need to have a better understanding of the diet, particularly the variety and amount traditional foods harvested locally, of First Nations living on-reserve.

First Nations in different geographical areas face their own unique environmental problems due to the nature of the point sources of environmental pollution and the degree to which their diet is obtained from the local environment. Unfortunately, there has been a knowledge gap about the nutritional composition of the average diet of most First Nations and the levels of contaminants in their traditional foods. Prior to this study, the only comprehensive regional level dietary data available for First Nations, including the nutritive value of traditional food and the food pathways of exposure to chemicals of potential concern, was from dietary studies conducted in the 1990s in the Yukon and Northwest Territories with funding support from the Northern Contaminants Program (Kuhnlein, Receveur and Chan 2001). Diets have been consistently shown to be of greater nutritional quality when traditional food is consumed compared to when only store-bought food is consumed. Furthermore, the nutritional, as well as cultural benefits of traditional food have been repeatedly shown to outweigh the risks from chemical contamination (Kuhnlein, Receveur and Chan 2001; Donaldson et al. 2010; Laird et al. 2013; Canada Crown-Indigenous Relations and Northern Affairs (CIRNAC) 2018).

For thousands of years, First Nations have relied on ecozone-adapted traditional food systems and diverse resource management and food production technologies from hunting and foraging to intensive food production.

PHOTO BY STÉPHANE DECELLES

The First Nations Food, Nutrition and Environment Study (FNFNES) is the first study developed to provide reliable information on the diet of First Nations and chemical exposure through the consumption of locally-harvested foods in the 10 Canadian provinces and eight Assembly of First Nations (AFN) regions south of the 60th parallel. The goal of FNFNES was to obtain representative baseline data on food use patterns and exposure to contaminants in order to provide information needed for the promotion of healthy environments and healthy foods for healthy First Nations.

The goal of FNFNES was to obtain representative baseline data on food use patterns and exposure to contaminants in order to provide information needed for the promotion of healthy environments and healthy foods for healthy First Nations.

FNFNES has been jointly led by the Assembly of First Nations (AFN), the University of Ottawa (2013-2019), the Université de Montréal, and the University of Northern British Columbia (2008-2013). Initiated through a resolution passed by the Chiefs-in-Assembly at the Assembly of First Nations' (AFN) Annual General Assembly in Halifax, Nova Scotia on July 12, 2007, FNFNES was implemented sequentially in eight AFN regions over a 10-year period (2008 to 2018) with 92 First Nation partners. A total of 92 community reports that include the community-specific results were disseminated to the participating First Nations. Each First Nation has governance or control on how to use the information collected. Results from each region were integrated and reported in the seven Regional Reports that are available online (www.fnfnes.ca). Funding has been provided from First Nations and Inuit Health Branch, Health Canada/Indigenous Services Canada.

The primary objectives of FNFNES were:

- To determine consumption patterns of traditional and store-bought foods on-reserve within each AFN region.
- To collect traditional foods and drinking water to determine the dietary intake of selected chemical contaminants within each AFN region.
- To estimate nutrient intake for macronutrients (carbohydrates, fat and protein) and selected vitamins and minerals.
- To document food security within each AFN region.

The secondary objectives of FNFNES were:

- To describe self-reported health status and lifestyle habits within each AFN region.
- To identify factors which affect the availability and accessibility of traditional and store-bought foods within each AFN region.
- To describe whether pharmaceutical products are in the environment within each region.
- To describe the body burden of mercury among First Nations people on the basis of hair analysis.

The study sought to integrate information on diet (food intake, nutrient composition of food, nutrient requirements and dietary adequacy, food availability and accessibility), local and traditional ecological knowledge, cultural and socioeconomic factors and exposure to chemicals of potential concern in various foods and drinking water. Traditional food samples were analyzed for four metals (arsenic, cadmium, lead, mercury) and persistent organic pollutants including: polycyclic aromatic hydrocarbons, perfluorinated compounds, organochlorine compounds (organochlorine pesticides, polychlorinated biphenyls, dioxins and furans) and polybrominated fire retardants. Usual household drinking water sources were tested for metals of human health and aesthetic concern. In addition, as pharmaceuticals are emerging contaminants, this study tested for the presence of various pharmaceutically-active compounds that may find their way into surface waters that are used for fishing, swimming or as a source for drinking water.

The intent of this report is to present key findings about diet quality and current traditional food use, food security, water quality, health, and exposure to chemical contaminants in traditional food and water among First Nations across the eight AFN regions south of the 60th parallel. Results of this study will be useful for the development of community-level food programming including improved access to traditional food and food guidance for First Nations. The information on background exposures to POPs, toxic metals and pharmaceutical products is also essential for First Nations as an enabling foundation for any future food monitoring at the community level.

Methodology

Study Design

The study was designed with the intent that First Nations involved would have an equal and participatory role at all levels of the research. Research was conducted following the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans* and in particular Chapter 9 research involving the First Nations, Inuit and Métis peoples of Canada (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada 2010), and the document entitled: *Indigenous Peoples & Participatory Health Research: Planning & Management, Preparing Research Agreements* published by the World Health Organization (2010). Its protocol was accepted by the Ethical Review Boards at Health Canada, the University of Northern British Columbia, the University of Ottawa and the Université de Montréal. The FNFNES also follows the First Nations principles of Ownership, Control, Access and Possession (OCAP®) of data (Schnarch 2004). Individual participation in the project was voluntary and based on informed written consent following an oral and written explanation of each project component. Project direction followed agreed-upon guiding principles (see www.fnfnes.ca), which were jointly established by the Steering Committee and consultation with Statistics Canada for the sampling methodology and random sample selection. The AFN has played an active role in all aspects of providing initial and ongoing direction to the FNFNES as an equal partner in the research and regularly reports on progress to First Nations.

At the regional level, prior to implementation, First Nations Provincial organizations were contacted to ask: 1) whether they would like the study to take place in their region, 2) if the randomized sample of communities is representative of the diversity of their region, and 3) information on logistics. In a few instances, specific communities known to have local

AMANDA THOMAS, PELICAN LAKE FIRST NATION, PHOTO BY LINDSAY KRAITBERG

environmental issues or concerns, or unique ecosystems were invited to participate. Such information has helped the study to ensure the best "snapshot" of regional representation at the time of data collection.

First Nations randomly selected to participate were initially contacted by the AFN and invited to attend a methodology workshop to review the study design and refine the data collection tools. FNFNES was then introduced to leadership and the wider community. Community Research Agreements were signed by the Chief and FNFNES Principal Investigators (PIs) marking the formal beginning of research activities. First Nation partners took the lead role in data collection and coordination, including; prioritization and collection of traditional food for chemical contaminant testing; identification and prioritization of surface water sampling sites for pharmaceutical testing; recruitment of community research assistants to conduct the household survey and collection of tap water samples and hair for mercury analyses.

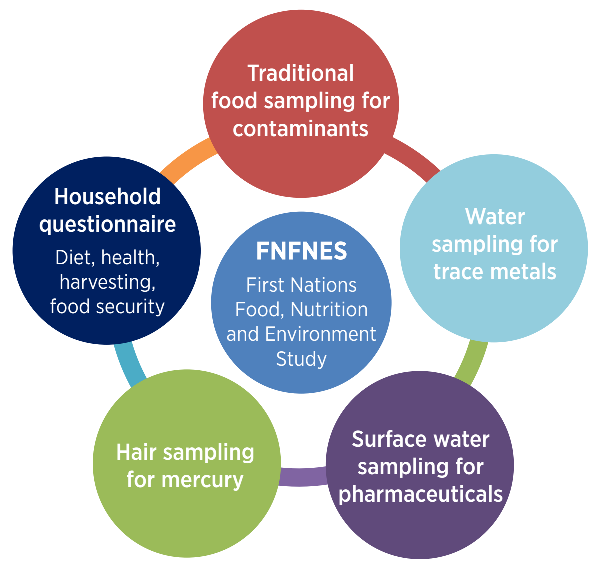
FNFNES used a single approach, with identical tools and methodology to conduct a regional level survey of First Nations adults living on-reserve in the eight AFN regions south of the 60th parallel in Canada. To ensure that the study assessed and represented the diversity of diets of First Nations, a random sampling strategy was adopted, based on an ecosystem framework that included 11 ecozones. Data collection occurred during the fall months (September to mid-December) from 2008 to 2016.

Upon completion of community data analyses, draft reports were submitted to each First Nation partner for initial review. Verification meetings were undertaken in each community and feedback was incorporated into the community and regional reports. Regional data training workshops were also delivered to both officially transfer community level results to the First Nation and provide representatives with training on how to access and run some basic data analyses. Regional level report findings were then released at an all-Chief's meeting in each region.

The findings of this study are representative at the regional and ecozone level for all First Nations adults living on-reserve south of the 60th parallel.

Principal Study Components

The following chart illustrates the five components of the FNFNES:



1. **Household interviews:** In each community, up to 100 adults (one person per household), aged 19 years or older who self-identified as a First Nations person living on-reserve were invited to participate. Each participant was asked a series of questions that focused on foods consumed (both traditional and store-bought food), health, lifestyle and socio-economic issues, household composition and food security.

2. **Tap water sampling for trace metals[1]:** The drinking water component aimed to collect tap water samples from 20 participating households in every community. Selection of sampling sites was based on what would be considered representative of the water distribution system, i.e., at the ends of pipelines and at miscellaneous points within the system. Maps were used to help in the selection. In addition, if a household in the community was accessing a source of drinking water that was not part of the community water supply system, such as a well, nearby spring, or a trucked water source, these were also sampled. Two water samples were collected at the household level: a first draw sample that had stagnated in the plumbing pipes for a minimum of four hours and a second draw sample which was taken after running the water for five minutes, or until it ran cold (i.e., in homes where water was trucked in, shorter times were often used) to flush out the water that had been sitting in the pipes. These are analyzed for trace metals.

3. **Surface water sampling for pharmaceuticals:** Water samples are collected from three separate sites chosen by the participating community to analyze for the presence and amount of agricultural, veterinary and human pharmaceuticals and their metabolites.

1 This study determines the chemical safety of the community water supplies. Environmental Public Health Services, FNIHB, Department of Indigenous Services Canada monitors drinking water in First Nations Communities which includes weekly microbiologic monitoring, annual basic chemical monitoring and a comprehensive chemical and radiological monitoring on a five-year cycle. Regions maintain a database with complete and historic records on community drinking water quality and water system profiles for all the communities.

BRENDAN ABITONG, ALLEN TOULOUSE, SAGAMOK FIRST NATION, PHOTO BY KATHLEEN LINDHORST

4. **Hair sampling to estimate mercury exposure:** In each community, all participating adults were invited to provide a hair sample. Hair analysis for mercury allowed for estimation of exposure to mercury and verification of the estimate of mercury exposure from traditional food consumption analyses. About 20 pieces of hair were requested from each participant.

5. **Traditional food sampling for contaminant[2] content:** Each community identified and collected up to 30 traditional foods (with up to five replicates of each food) which were analyzed for the same suite of environmental contaminants and nutrient analyses as needed.

Additional details of each of the five study components is available within each of the Regional reports published and available at www.fnfnes.ca

2 FNFNES studied the chemical safety of traditional food. Bacteriological safety is monitored by the community's EPHO.

Sampling Strategy

For FNFNES, the population of interest was adults living on Indian Reserves (IR) in any of the 10 provinces and eight AFN regions. FNFNES followed a 3-stage sampling plan: the regions, the communities and the households (participants). The sampling frame of the study design was to recruit up to 10,000 participants (100 participants in 100 First Nations).

The first stratum of interest were the eight AFN regions (British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec-Labrador, New Brunswick-Newfoundland and Nova Scotia-Prince Edward Island). The final sampling framework was created with an allocation of 92 randomly selected First Nations in the eight AFN regions: the number of communities allocated to each region was proportional to the square root of the number of communities within it that had a population on-reserve at the time of the initial sampling (Appendix A). The survey design allowed for eight communities to be directly invited and included in the study. These communities were invited due to: 1) contamination concerns (Mikisew Cree First Nation, Onion Lake, Grassy Narrow, Aamjiwnaang); 2) availability of previously published data (Nuxalk Nation); and to enhance cultural and ecosystem diversity (Skidegate, Unamen Shipu).

For FNFNES, the population of interest was adults living on Indian Reserves in any of the 10 provinces and eight AFN regions.

In each AFN region, First Nations were further stratified into ecozones to ensure the diversity of diets of First Nations was represented. The sample was proportionally allocated between the ecozone strata, except in ecozones with a very small number of communities, in which case all the communities were chosen. The selection of communities was made independently for each stratum. Communities were randomly selected with probability proportional to the size of communities, which ensured that the most populated communities were more likely to be chosen in the sample.

Within each selected community, random sampling of 125 households was undertaken. For communities with fewer than 125 households, every household in the community was selected. A larger sample of households than desired (100) was selected to adjust for expected non-response (20%). At the household level, random selection of one adult took place (if there was more than one eligible adult, the research assistant was requested to select the person living in the household whose birthday was next). Participants had to be 19 years of age and older, able to provide written informed consent and self-identify as a First Nations person living on the reserve.

Over the course of FNFNES, 117 communities were approached to participate (Table 1.1): 82 were randomly selected, nine were pre-selected with certainty either due to population size or if they were the sole community

LAC LA RONGE, SMOKING FISH, PHOTO BY REBECCA HARE within an ecozone and eight were invited. Twenty-one communities declined to participate after the initial consultation. Where communities elected not to participate, replacement communities were approached. Eighteen alternate communities were approached and 17 agreed to participate. Two communities selected with certainty did not have an alternate (one community did not have an ecozone alternate and one community did not have an alternate because of its population size). One invited community chose not to participate. Three communities withdrew part-way through data collection and were dropped from the analyses for the region; however, these communities completed the pharmaceutical component and their results are included in the chapter on water quality. For logistical reasons, data collection took place over two years in the region of British Columbia and Ontario.

A total of seven regional reports have been published and are available for all eight AFN regions: results from the two AFN Atlantic regions were combined into one report.

Weighting Adjustment

For each regional report, estimation weights were calculated to ensure that the data reflected the whole population from which they were drawn. The data were weighted to adjust for non-response at three levels: community, households and individuals. Further details can be found in the regional reports and in Appendix A.

To prepare summary statistics for this summative all-regions report from FNFNES survey data that was collected over a period of several years, an adjustment factor was created to account for population changes between 2008 and 2017. A ratio of populations was calculated by dividing the 2017 population by the reference year population used in the weighting estimate documents for a particular AFN region (British Columbia 2009, Manitoba 2010, Ontario 2012, Alberta 2013, Atlantic AFN regions [NS-NF and NB-PEI] 2014, Saskatchewan 2015, Quebec 2016). Year-end population data were obtained from Indigenous and Northern Affairs Canada (INAC) Indian Registry System, for 2017 and each of the reference years (Statistical Consultation Group 2018). Adjustment factors were calculated individually for each community or band, and applied to the 501 weight variables of each FNFNES record (the estimation weight and the 500 replication or bootstrap weights) for that community (See Appendix A). This adjustment factor does not address other potential demographic or socio-economic changes that may have occurred, which does bring some uncertainty to the results described in this report. Notwithstanding, this serves to present a baseline of the diet of First Nations living on-reserve. Many of the results presented below are in line with results from the only other major study occurring on reserve, the First Nations Regional Health Survey (First Nations Information Governance Centre (FNIGC) 2018b).

Presentation of Results Values

All results in this report are weighted, unless stated otherwise. Their corresponding standard errors are reported unless it is greater than 33.3% of the estimated parameter, in which case the estimates parameter is identified as (-) for being unreliable. To improve readability, many of the numbers have been rounded up to the nearest whole number. For nutrients and contaminants information, numbers are rounded to the first decimal place. As a result, some totals do not add up to 100%.

While ecozone level results were presented in the regional reports, information from some communities could not be included if it was the sole community in an ecozone so as not to be identifiable: this was the case for the regional reports for Alberta, Saskatchewan, Quebec, and the Atlantic. For this summative report, results from all communities have been included in the region and ecozone level tables and figures.

Table 1.1 Communities approached and participation

Characteristic	Total	British Columbia	Alberta	Saskatchewan	Manitoba	Ontario	Quebec	Atlantic (NB-NL, NS-PE)
Year(s) of data collection	2008 to 2016	2008 & 2009	2013	2015	2010	2011 & 2012	2016	2014
# of First Nations with on-reserve population in 2008	583	198	46	70	63	137	40	31
Population on-reserve (2008)	413,205	58,876	63,707	61,564	78,415	82,952	49,597	18,454 (8,930, 9,524)
Original sample allocation	92	20	10	12	12	18	9	12
Communities approached	117	23	16	19	12	19	13	15
Selected with certainty due to population/ecozone	9	0	1	1	3	0	2	2
Random selection	82	19	9	11	9	16	8	10
Alternates	18	2	4	6	0	1	2	3
Invited	8	2	2	1	0	2	1	0
Refusals	22	2	6	6	0	1	3	4
Selected with certainty	2	0	0	0	0	0	1	1
Randomly selected	18	2	4	6	0	1	2	3
Alternate	1	0	1	0	0	0	0	0
Invited	1	0	1	0	0	0	0	0
Withdrew during study	3	0	0	0	3	0	0	0
Participating communities	92	21	10	13*	9	18	10	11
Selected with certainty due to population/ecozone	6	0	1	1	3	0	0	1
Randomly selected	62	17	5	5	6	15	7	7
Alternate	17	2	3	6	0	1	2	3
Invited	7	2	1	1	0	2	1	0

*One community randomly selected was split into two separate communities due to the location of communities in two ecozones.
In regional reports, therefore, there is a count of 14 communities from Saskatchewan.

CHAPTER 2

Overview of Community and Participants

IN SUMMARY, 92 FIRST NATIONS located in 11 ecozones completed the five general study components of FNFNES (Table 2.1). As one First Nation in the Saskatchewan AFN region had occupied reserves in two ecozones (Boreal Plains and Boreal Shield), a decision was made to split the First Nation into two sites by an ecozone boundary. Therefore, many tables describe a total of 93 First Nation communities at the AFN region and ecozone level.

Figure 2.1 and Table 2.2 summarize the location of communities by AFN region and ecozone. Most ecozones include communities in two or more regions, such as the Boreal Plains and Boreal Shield. Communities in three ecozones (Pacific Maritime, Boreal Cordillera and Montane Cordillera) are only in the AFN British Columbia region.

As the distance from major service centres can impact the cost and ability of individual's and communities to access services, communities were classified according to the Geographic Zone index used by Indigenous and Northern Affairs Canada (2000). The Indigenous and Northern Affairs Canada Remoteness Index Zone (INACRIZ) groups First Nations into four zones according to the presence of year-round roads (i.e., roads that are paved or gravelled such as forest roads and can include ferry services), distance to the nearest service centre, and climatic factors. Zone 1 represents First Nations that are connected by road to a service centre within 50 kilometres and are not considered remote. Zone 2 represents First Nations communities with year-round road access to services centres 50 and 350 km away. Zone 3 represents First Nations communities with year-round road access to services centres more than 350 km away); First Nations communities located in Zone 4 have no year-round road access to a service centre (i.e., are fly-in communities). Overall, 56 (60%) of the participating communities were located more than 50 km away from a service centre while 17 (18%) had no year-round road access. INACRIZ classification was used for some food security analyses in Chapter 4.

Table 2.3 contains information on the participation and characteristics (age, gender, household size) of participants by region. Overall, a total of 6,487 or 78% of adults contacted for this study completed the household questionnaire component of FNFNES. Although the randomization process ensured that there would be an equal chance of either gender being selected to participate, a higher percentage of females (66%) participated than males (34%). The average age of both males and females was similar (44 and 45). Sixty-nine percent of households contained dependents under the age of 18 years, and the average household size across the regions was five. At the regional level, the average number of people living in households ranged between four and six while the percentages of households with children were: 58% in British Columbia, 68% in Alberta, 69% in Saskatchewan; 74% in Manitoba; 48% in Ontario, 55% in Quebec and 48% in the Atlantic.

Overall, 55% of participants identified that they had a high school equivalency diploma or higher, while 14% reported that having some post-secondary education (Figure 2.2). Post-secondary education was more commonly reported by participating adults residing in Saskatchewan (15%), Ontario (25%), Quebec (17%) and the Atlantic (27%), and, at the ecozone level, in the Mixedwood Plains (40%), Atlantic Maritime (28%) and the Hudson Plains (18%) (Figure 2.3 and Figure 2.4). Just over half (52%) of all participants (Figure 2.4 and Figure 2.5), indicated that employment was their primary source of income, followed by social assistance (28%), pension (11%), worker's compensation (6%) and other sources (3%). At the ecozone level, employment as the main source of income appeared to be higher in the Pacific Maritime (57%), Boreal Cordillera (73%), Montane Cordillera (61%), Taiga Shield (69%), Hudson Plains (59%) and the Mixedwood Plains (64%). Higher levels of social assistance were found in the Taiga Plains (32%), Boreal Plains (34%), Prairies (46%) and the Atlantic Maritime (31%).

DEE DEE WAPASS, ONION LAKE FIRST NATION, PHOTO BY LINDSAY KRAITBERG

Table 2.1 Summary table of participating communities, remoteness and year of data collection

Characteristic	Total	British Columbia	Alberta	Saskatchewan	Manitoba	Ontario	Quebec and Labrador	Atlantic (NB-NL, NS-PE)
Year(s) of data collection	2008 to 2016	2008 & 2009	2013	2015	2010	2011 & 2012	2016	2014
Number of participating communities	92*	21	10	13	9	18	10	11
INACRIZ*								
1	37	7	6	1	0	8	5	10
2	35	12	2	12	7	3	0	1
3	3	2	0	0	0	0	1	0
4	17	0	2	2	2	7	4	0

*INACRIZ=Indigenous and Northern Affairs Canada Remoteness Index Zone classifies First Nations into one of four geographic zones based on the presence of year-round access roads (roads can be either paved and/or gravelled main or forest roads and may include ferry services), distance to the nearest service centre, and climatic factors. Zone 1 (year-round road access and within 50 km to the nearest service centre); Zone 2 (year-round road access and between 50 and 350 km to the nearest service centre); Zone 3 (year-round road access and > 350 km to the nearest service centre); Zone 4 (no year-round road access to a service centre, i.e., fly-in communities).

Figure 2.1 Map of participating communities, AFN regions and ecozones

Table 2.2 First Nations located in each ecozone and participation in FNFNES

Ecozone	First Nations in each ecozone	Participating communities in FNFNES by ecozone in each AFN region							
		Total	British Columbia	Alberta	Saskatchewan	Manitoba	Ontario	Quebec	Atlantic (NB-NL, NS-PE)
			2008/2009	2013	2015	2010	2011 /2012	2016	2014
Pacific Maritime	112	9	9	-	-	-	-	-	-
Boreal Cordillera	5	2	2	-	-	-	-	-	-
Montane Cordillera	75	6	6	-	-	-	-	-	-
Taiga Plains	3	3	2	1	-	-	-	-	-
Boreal Plains	92	17	2	7	7	2	-	-	-
Prairies	56	8	-	2	4	2	-	-	-
Boreal Shield	147	19*	-		2	3	10	3	1
Taiga Shield	9	5	-	-	1	2		2	-
Hudson Plains	9	5	-	-	-	-	4	1	-
Mixedwood Plains	31	6	-	-	-	-	4	2	-
Atlantic Maritime	32	12	-	-	-	-		2	10

*Three communities in the Boreal Shield completed the pharmaceutical component but withdrew from the other components.

Table 2.3 Participation rate and description of participants

Characteristic		All regions	BC	AB	SK	MB	ON	QC	AT
Participation rate of household questionnaire		78%	68%	70%	84%	82%	79%	71%	90%
Number of participants		6,487	1,103	609	1,042	706	1,429	573	1,025
Females		4,277	706	387	721	477	896	420	670
Males		2,210	397	222	321	229	533	153	355
Mean age (SE)	Females	44 (0.5)	45 (1.7)	42 (1.1)	43 (1.3)	43 (1.0)	45 (0.7)	42 (0.4)	43 (0.5)
	Males	45 (0.9)	46 (1.7)	42 (3.0)	44 (1.3)	44 (3.5)	46 (1.9)	48 (0.5)	43 (0.8)
Mean years of education (SE)		11 (0.1)	11 (0.3)	10 (0.3)	11 (0.1)	10 (0.2)	12 (0.3)	10 (0.4)	12 (0.2)
Mean household size (SE)		5 (0.1)	4 (0.2)	6 (0.3)	5 (0.3)	6 (0.4)	4 (0.1)	5 (0.3)	4 (0.1)
Percentage of households with children under the age of 18 years		69%	58%	68%	69%	74%	48%	55%	48%

Figure 2.2 Highest level of education obtained by participants across regions

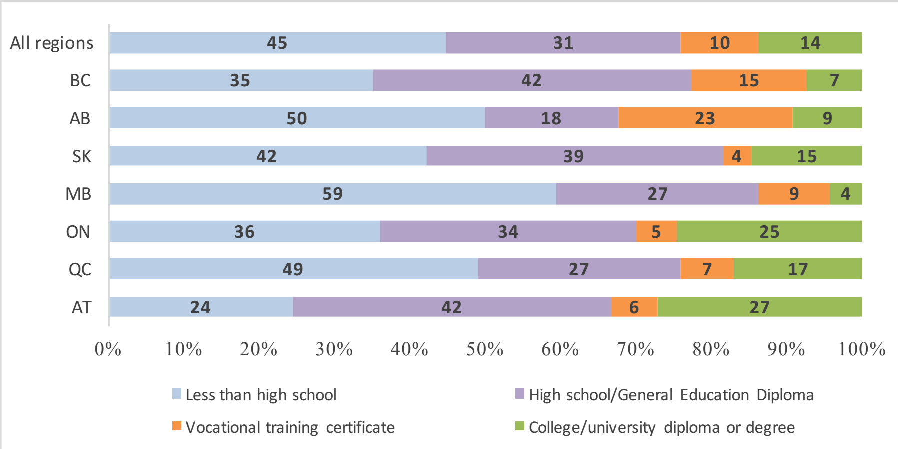
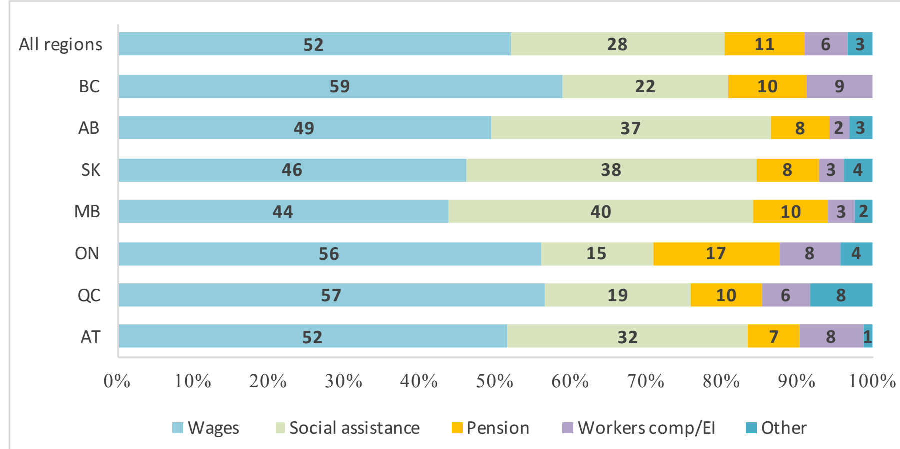
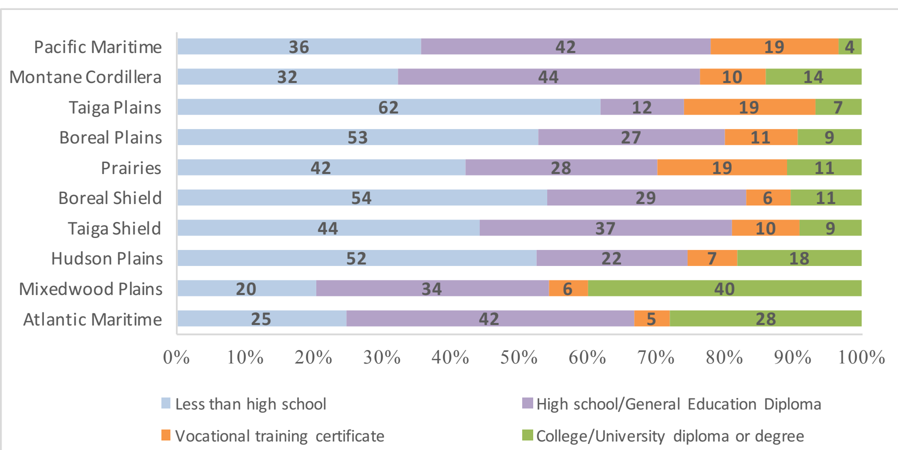


Figure 2.4 Main source of income of participants by AFN region



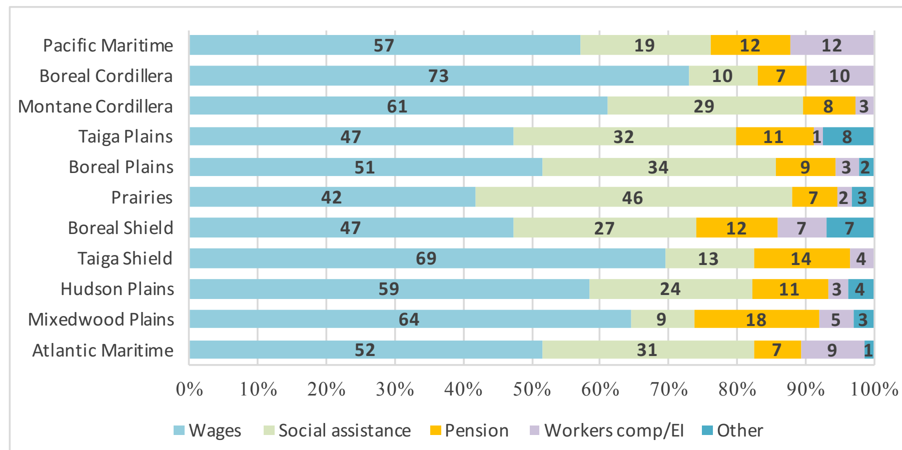
Note: EI = Employment insurance. Other includes foster parent compensation, student/training allowance, spousal support, none, refused to say.

Figure 2.3 Highest level of education obtained by participants across ecozones*



*No data available for year one in terms of the highest degree of education, therefore results for the Boreal Cordillera are not available.

Figure 2.5 Main income source of participants by ecozone



Note: EI = Employment insurance. Other includes foster parent compensation, student/training allowance, spousal support, residential school compensation, none.

CHAPTER 3

Traditional Food Systems

FIRST NATIONS PEOPLE IN CANADA have sustained themselves for millennia through diverse resource management and food production technologies. An ecosystem framework was used in this study to capture the various traditional use patterns. Within each region, traditional food use questions were initially drafted based on a literature review and finalized after a review was completed by community representatives. In each of the AFN regions, participating community members were asked a series of questions in the household interview that captured information about:

- Traditional food harvesting and production activities including fishing, hunting, collecting plants, berries, seafood, and growing a garden;
- Traditional food consumption (a region-specific food frequency questionnaire (FFQ) was used to estimate yearly/seasonal use of 150-200 traditional foods while a 24-hour recall was undertaken to establish usual portion sizes of traditional food, and nutrient contribution of traditional food in the diet in the fall season relative to store-bought foods and beverages)
- Adequacy of their traditional food supplies;
- Barriers related to traditional food use;
- Benefits of foods from the land and the store; and
- Impacts of climate change on traditional food availability.

Across the ecozones, 67% of households reported engagement in food harvesting and production activities, with a greater reporting of fishing and hunting (Figure 3.1 and Figure 3.2). To note, the percentage of households engaged in plant harvesting seems rather low compared to the other activities. This could be a design fault of the question which did not specifically ask about berry picking.

Within each ecozone, almost all adults reported eating traditional food. Traditional food types were broadly categorized as animal-based and plant-based and further classified into seven categories (fish, seafood, game, birds, plants, cultivated plants and mushrooms). In ecozones in BC (Pacific Maritime, Montane Cordillera, Boreal Cordillera, Taiga Plains) and the Taiga Shield, the average types of traditional food that adults ate over a year ranged between 10-15 (13 to 17 types at the 95^{th} percentile) compared to a range of 6-8 (7 to 15 at the 95^{th} percentile) among adults in the Prairies, Boreal Plains, Boreal Shield, Hudson Plains, Mixedwood Plains and the Atlantic Maritime (Figure 3.3). With the exception of the Prairies, the Mixedwood Plains and the Atlantic Maritime, there was both a high number of and a greater proportion of animal-based traditional foods. When analyzed in terms of the number of days that traditional food appeared in the diet (TF days), animal-based foods from the marine environment are only predominant in the Pacific Maritime.

The average number of days per year that traditional food appeared in the diet (TF days) ranged from 66 days in the Atlantic Maritime to daily in the Taiga Plains (Figure 3.4). More frequent use was reported in the westernmost and northern ecozones (Taiga Plains, Boreal Cordillera, Montane Cordillera, Pacific Maritime and Taiga Shield, Hudson Plains) in both the food frequency (FFQ) results (Figure 3.4) and 24-hour recall data (Figure 3.5). The percentage of 24-hour recalls that contained any traditional food ranged from 6% (Mixedwood Plains) to 52% (Boreal Cordillera).

The more widely available traditional foods in each ecozone are presented in a series of pie charts (Figure 3.6 to 3.16). In the Pacific Maritime (Figure 3.6), three types of fish (salmon, eulachon and halibut) were the most commonly eaten traditional foods. In seven of the ecozones, moose meat was reported most frequently followed by: salmon and trout in the Boreal Cordillera (Figure 3.7); deer and salmon in Montane Cordillera (Figure 3.8); ducks and grouse in the Taiga Plains (Figure 3.9); mint and deer in the Boreal Plains (Figure 3.10); deer and elk in the Prairies (Figure 3.11); walleye and blueberries in the Boreal Shield (Figure 3.12); and blueberries and strawberries in the Atlantic Maritime (Figure 3.16). In contrast, Labrador tea and caribou were the most frequently consumed foods in the Taiga Shield (Figure 3.13) while cultivated plants (corn, beans and squash) appeared most frequently in the Mixedwood Plains (Figure 3.15). In the Hudson Plains, geese and moose were the most heavily reported foods (Figure 3.14).

Additional summary tables of the most frequently eaten foods by ecozones and within major traditional food categories (fish, seafood, land animals, birds, plants, cultivated foods, mushrooms) for all adults are found in Appendix B and C.

The average daily grams of traditional food for the total population was estimated from both the 12-month FFQ data (Figure 3.17) and the fall 24-hour recall data (Figure 3.18). Estimates were calculated using results from both methods as only 19% of all participants[3] reported a traditional food on their fall 24-hour recall and as the FFQ contained a much longer list of items.

3 Among the 6,485 participants who provided a 24-hour recall, at least one traditional food was reported by 1,243 adults.

LAC LA RONGE CULTURE CAMP, PHOTO BY REBECCA HARE

Results from the 24-hour recall data are also presented for consumers only (Figure 3.19). As the FFQ data only estimated the number of days a food was eaten for each participant over the last year, this information was multiplied by the average regional food category portion size estimated for each gender and age group to calculate the average grams of intake. A density conversion of .96 g/ml was used for traditional food where 250 ml is equal to 240 grams (FAO 2012). The average traditional food portion weight by region can be found in Appendix D. The grams of traditional food from the 24-hour recall data was estimated from food and portion size data from participants who reported consuming any traditional food on the day prior to the interview.

Overall, results from both of the methods indicate that traditional food intake appears to be higher in western (Pacific Maritime, Boreal Cordillera, Montane Cordillera) and northern (Hudson Plains, Taiga Plains, Taiga Shield, Boreal Cordillera) ecozones.

When participants without traditional food on their 24h recall[4] were removed from the analysis, the average daily traditional food intake increased from 61 grams (Figure 3.18) to 338 grams or about 1 1/3 cup (Figure 3.19). The average daily intake ranged from 210 grams (or over 3/4 of a cup) in the Mixedwood Plains to 504 grams (or 2 cups) in the Hudson Plains. Among adults at the 95th percentile of the distribution of reported intake in the sample, the amount of traditional food consumed was 981 grams (or almost 4 cups) (Figure 3.20). Traditional food intakes were over 1,000 grams a day among consumers at the 95th percentile in the Montane Cordillera (1,443 grams), Taiga Plains (1,099 grams), Hudson Plains (1,393 grams) and the Atlantic Maritime (1,106 grams).

Figures 3.21 and 3.22 display the intake of traditional food from each of the major food categories, calculated from both the FFQ and 24-hour recall data for all adults. When the intakes by traditional food category are averaged across all ecozones, land animals are the largest contributor (mean of 18 grams from the FFQ and 38 grams from the 24-hour recall data), followed by fish (14 grams from the FFQ and 13 grams from the 24-hour recall), birds (4 grams from the FFQ and 3 grams from the 24-hour recall), plants (combined wild and cultivated) and seafood.

The relative contribution of each traditional food category to the overall gram intake among consumers, as per analyses of the 24-hour recall data is presented in Figure 3.23. Except for adults in the Pacific Maritime and the Mixedwood Plains, the largest proportion of traditional food is from land animals. In the Pacific Maritime, fish (47%) and seafood (30%) contribute a greater share to the overall gram intake than land animals (18%). In the Mixedwood Plains, plants (41% combined for wild and cultivated) were the largest contributor.

4 For this analysis, the 5,242 adults who did not report a traditional food on the day of the recall (81% of all participants) were removed.

While the majority of adults (Figure 3.24 and Figure 3.25) said that they would like to have more traditional food in their household, 71% identified one or more barriers to traditional food intake on an open-ended question (Figure 3.26). Overall, the three barriers mentioned most frequently at the regional level and in 8 of the 11 ecozones, were a lack of: hunter, resources (i.e., money and equipment/transportation); and time. In three of the ecozones, other key barriers were a lack of availability (reported by 15.8% in the Pacific Maritime) and a lack of knowledge (reported by 11.2% in the Mixedwood Plains and 10.6% in the Atlantic Maritime). Appendix E contains the top ten barriers reported at the ecozone level. Participants were also asked if government regulations and natural resource industries (mining, forestry, oil and gas, hydro, farming) impacted or limited where they could harvest: overall, 54.7% of participants said natural resource activities affected harvesting practices while 42% identified government regulations as a barrier (Figure 3.27). In the Boreal Cordillera, Montane Cordillera and Taiga Plains, over 80% of adults identified that mining, forestry or oil and gas negatively impacted their engagement in harvesting.

The average number of days per year that traditional food appeared in the diet ranged from 66 days in the Atlantic Maritime to daily in the Taiga Plains. More frequent use was reported in the westernmost and northern ecozones

As climate change has been recognized as having an impact on food production, participants in this study were asked to describe any significant changes in their territory and impacts on traditional food specifically. In all ecozones, most adults said that they had noticed changes that they attributed to climate change (Figure 3.28). Climate change was considered to impact both the overall amount of traditional food and the ability to access traditional food (Figure 3.29). Some adults reported that seasonal growth and harvesting were shorter and less predictable. Changes to overall availability were mentioned more frequently by adults residing in the Pacific Maritime, Boreal Cordillera, Montane Cordillera, and the Mixedwood Plains (Figure 3.30) whereas, access challenges seemed to be more pronounced in the Hudson Plains and Taiga Shield.

Predictors of Traditional Food Intake

A multivariable regression was performed to assess whether location (region, ecozone) road access, participant characteristics (age group, income source, education level, self-reported health, BMI status, participation in traditional food harvesting activities), household characteristics (number of adults working) could predict the number of days traditional food was eaten (Figure 3.31). The distribution of "Traditional food – days" (TFD) is right-skewed, therefore the square root of TFD (TFDsr), which is approximately normally distributed, was used as the dependent variable (see Appendix F for detailed results). The number of days that traditional food was eaten was affected by location, household participation in traditional food harvesting activities, age (participants younger than 51 ate traditional food less often), and gender (females ate less). Traditional food intake was the highest in BC and significantly lower in Ontario, the Atlantic, Alberta and Manitoba. At the ecozone level, traditional food intake was highest in the Taiga Plains and significantly lower in eight ecozones. Traditional food intake in the Taiga Shield and Montane Cordillera was not significantly different from use in the Taiga Plains. Any relationship between education level and traditional food consumption is unclear and needs to be further explored. Previous studies have reported that traditional food use by Indigenous peoples in Canada is influenced by a multitude of factors (Chan et al. 2006; Kuhnlein and Receveur 1996; Laberge et al. 2015; Turner, Plotkin and Kuhnlein 2013) including: environmental factors (ecosystem quality and natural resource management, government regulations, development) community factors (location, land access, community programs), interpersonal factors (extended family, social network, sharing, intergenerational influence and learning) and individual factors (preferences, cost, time, skills, convenience).

Figure 3.1 Types of food harvesting and production practices reported at the household level by total and region

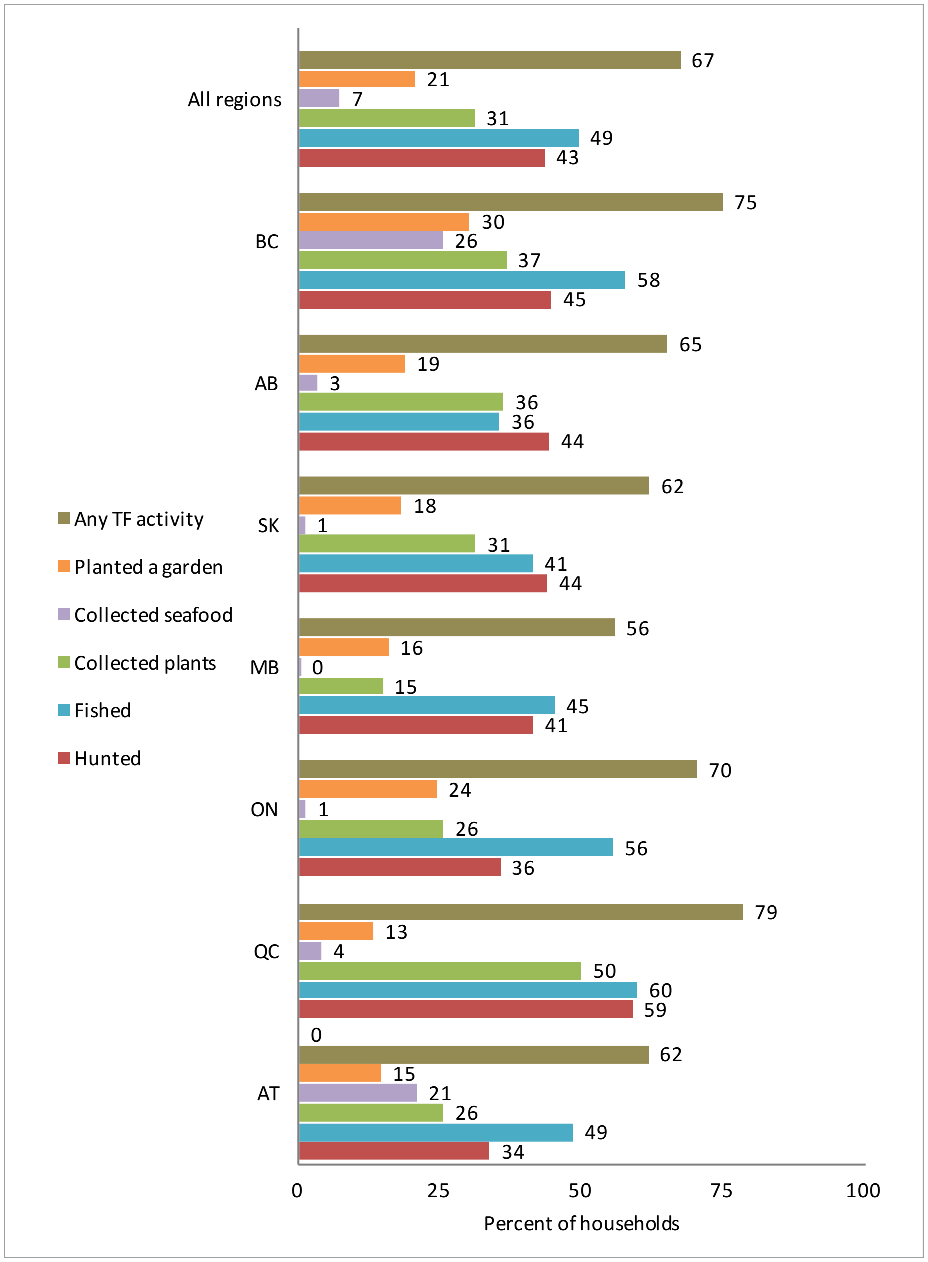


Figure 3.2 Types of food harvesting and production practices reported at the household level by ecozone

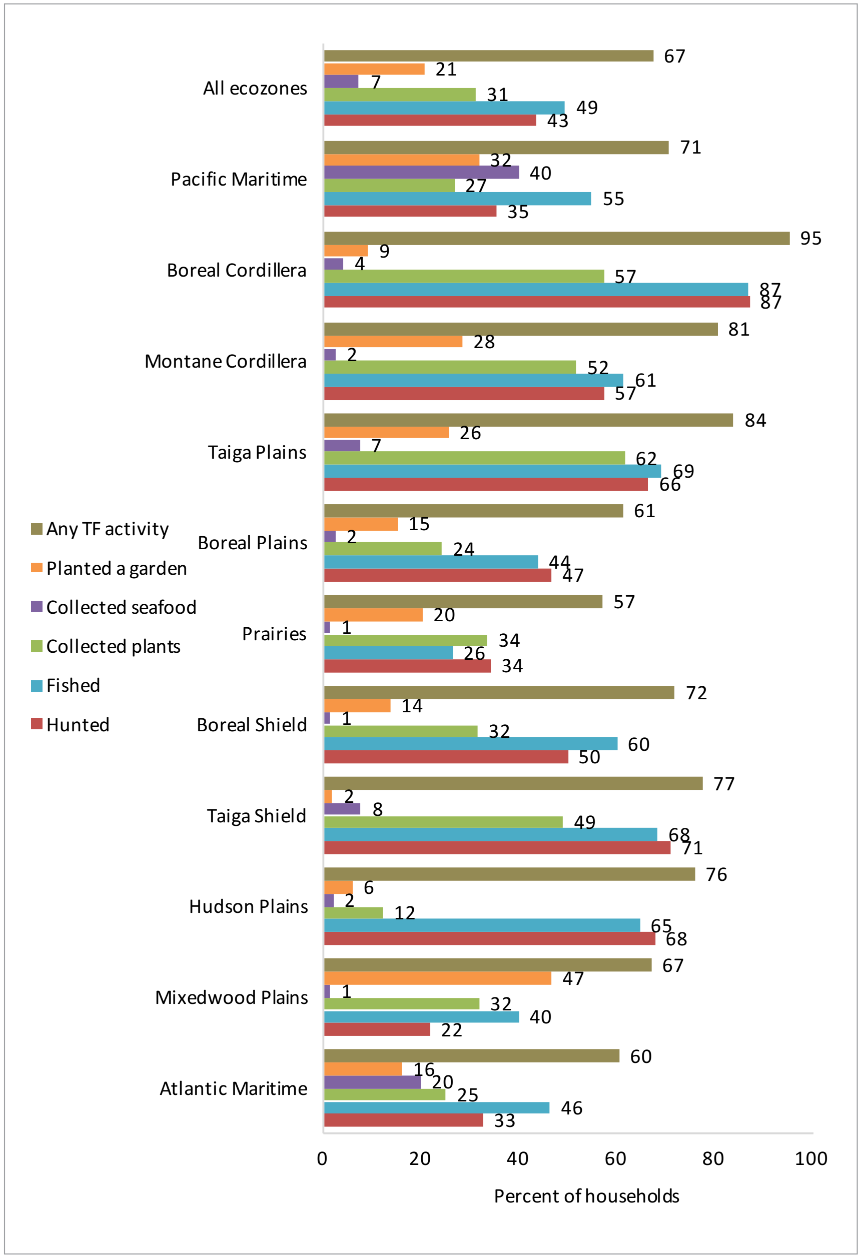


Figure 3.3 Diversity of animal and plant-based traditional foods consumed in each ecozone, based on the food frequency data

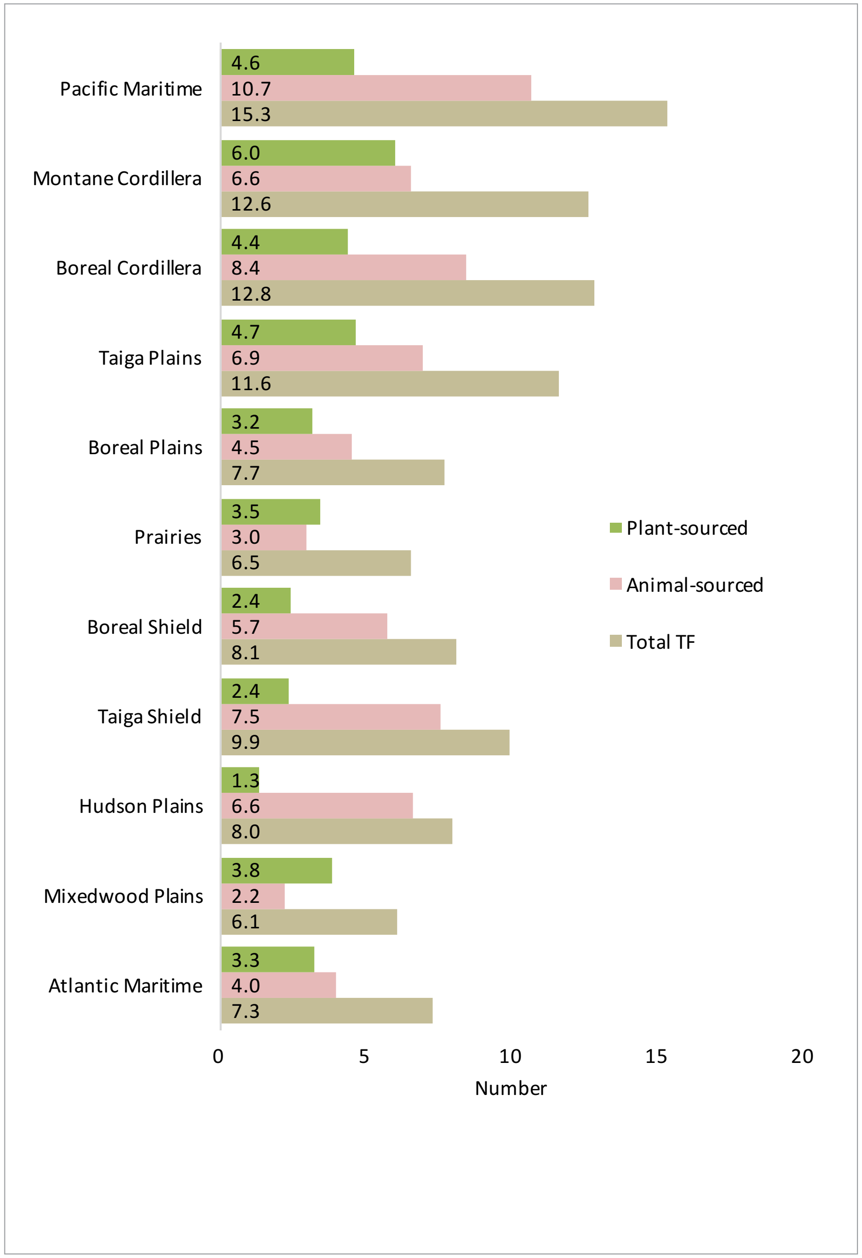
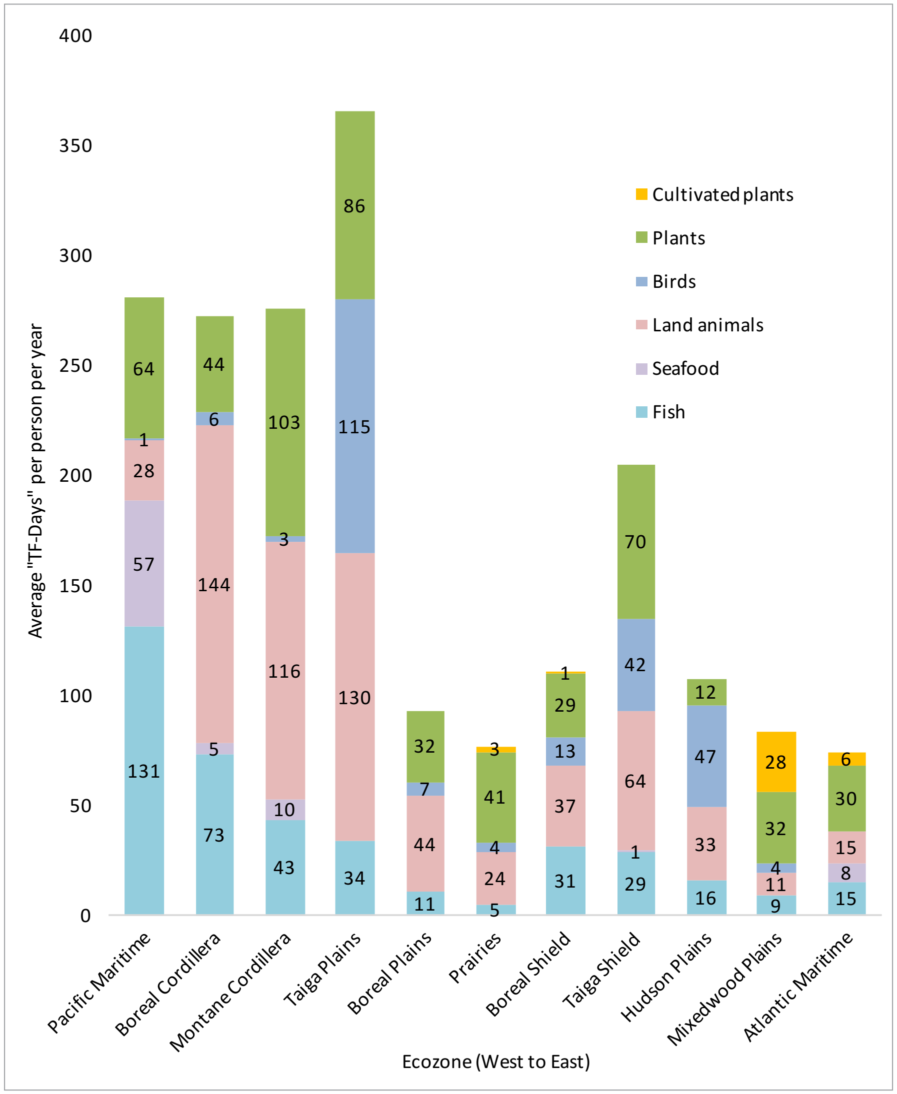


Figure 3.4 Average number of “traditional food days”*, by type and ecozone



*The average “Traditional Food – Days” per person per year in each ecozone, for each of the six categories, was calculated as the sum of days on which each type of TF was reported consumed on the food frequency questionnaire.

Cultivated plants refer to plant species grown in plots by Indigenous peoples including beans, tomatoes, potatoes, squash.

Figure 3.5 Percentage of 24-hour recalls with traditional food by ecozone

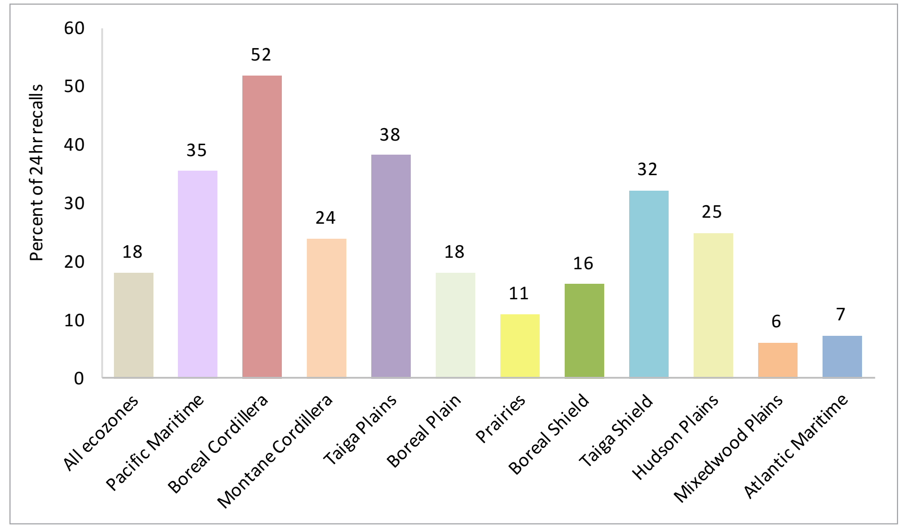


Figure 3.6 Top 10 most frequently consumed traditional foods by number of days in the Pacific Maritime ecozone

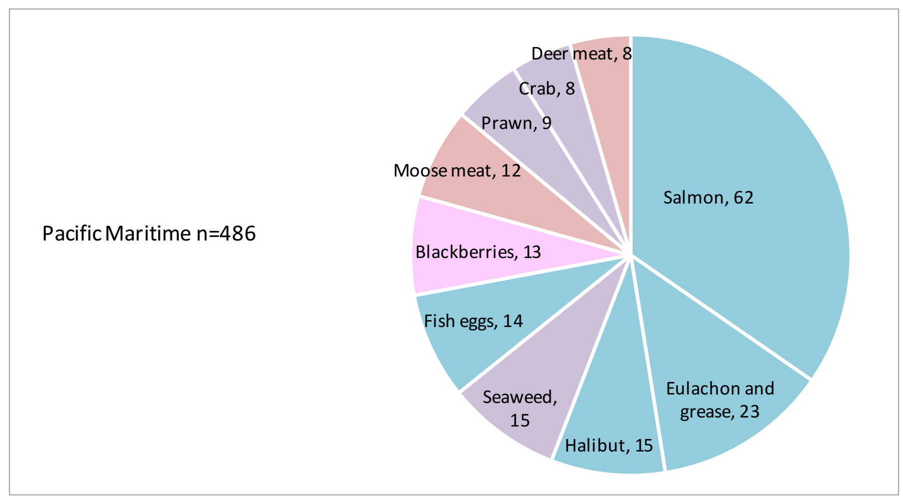


Figure 3.7 Top 10 most frequently consumed traditional foods by number of days in the Boreal Cordillera ecozone

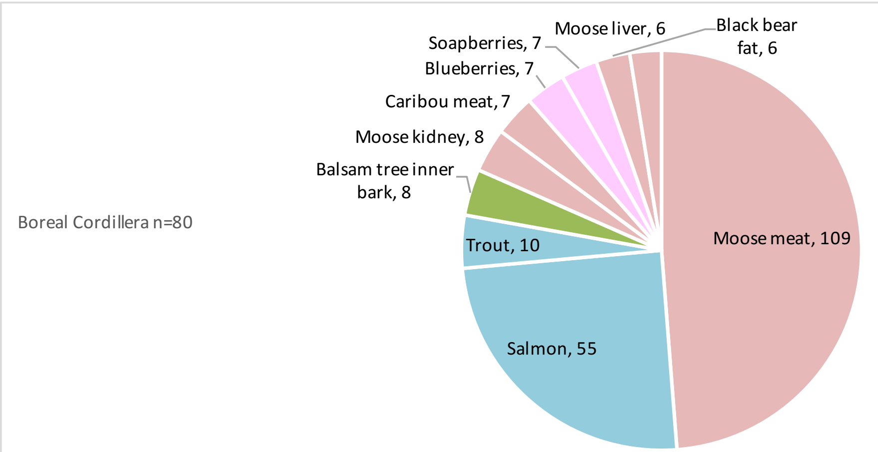


Figure 3.9 Top 10 most frequently consumed traditional foods by number of days in the Taiga Plains ecozone

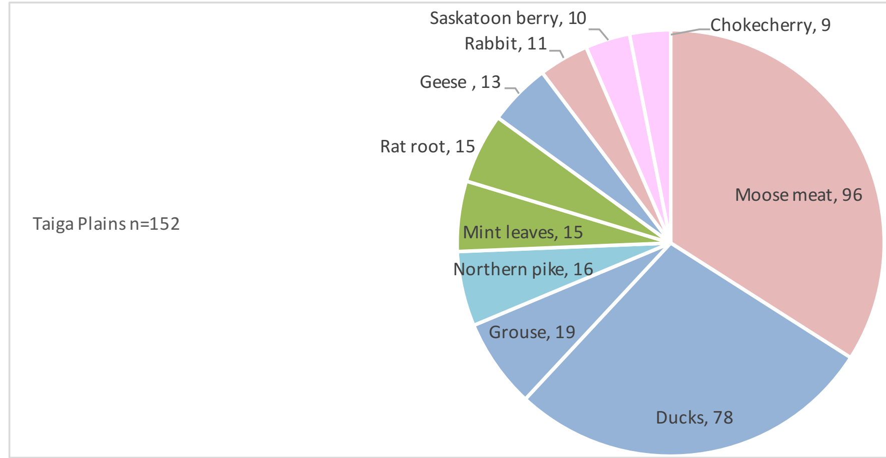


Figure 3.8 Top 10 most frequently consumed traditional foods by number of days in the Montane Cordillera ecozone

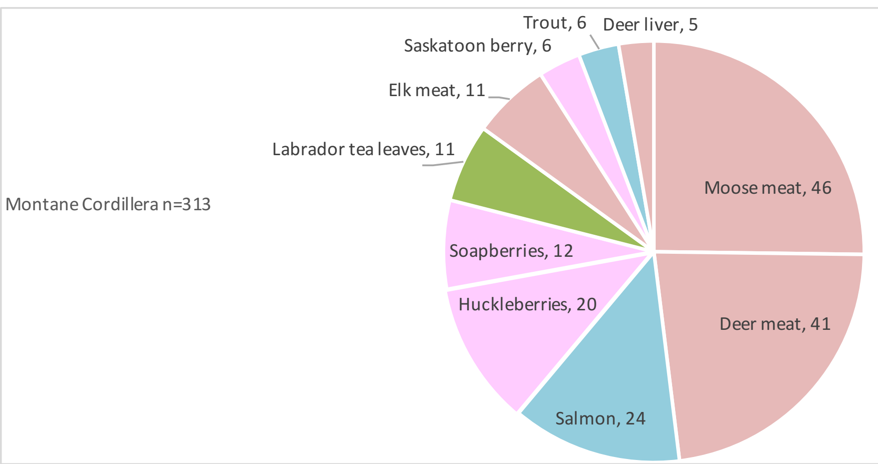


Figure 3.10 Top 10 most frequently consumed traditional foods by number of days in the Boreal Plains ecozone

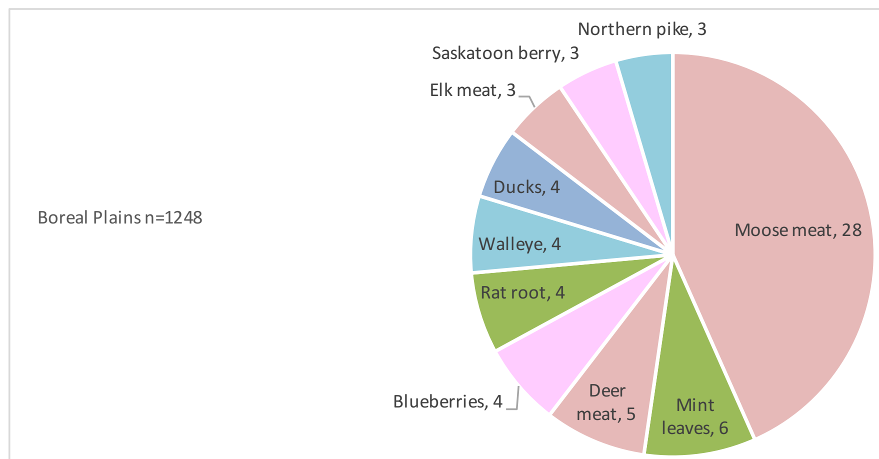


Figure 3.11 Top 10 most frequently consumed traditional foods by number of days in the Prairies ecozone

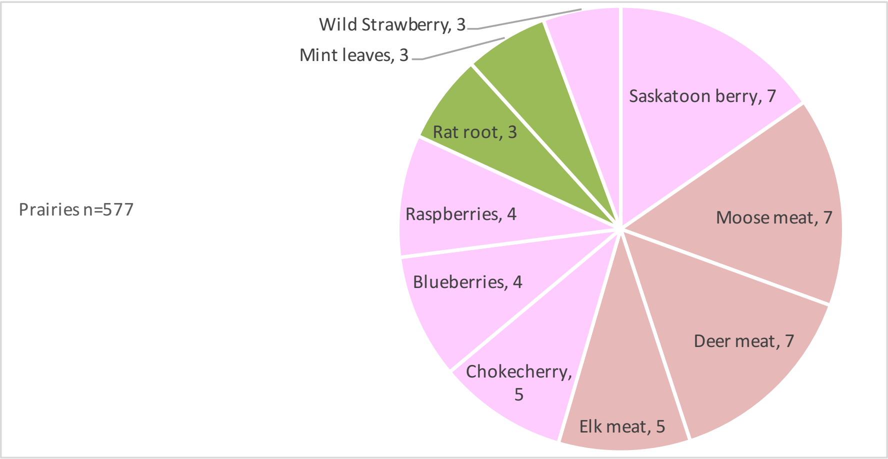


Figure 3.13 Top 10 most frequently consumed traditional foods by number of days in the Taiga Shield ecozone

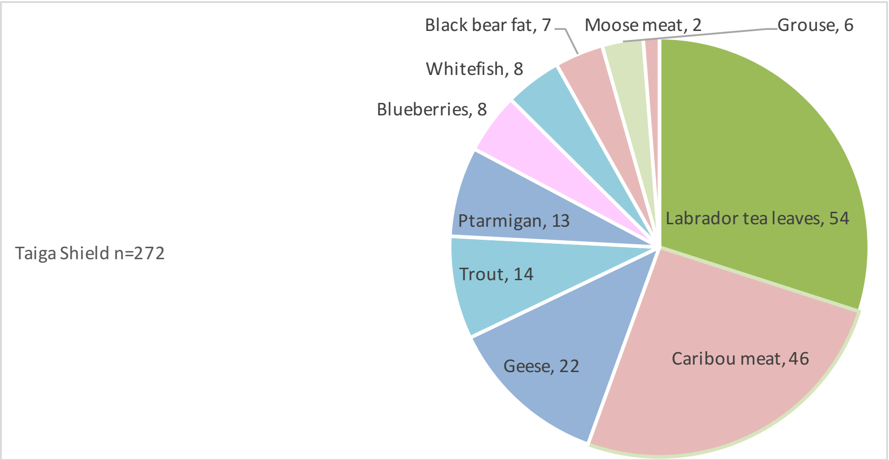


Figure 3.12 Top 10 most frequently consumed traditional foods by number of days in the Boreal Shield ecozone

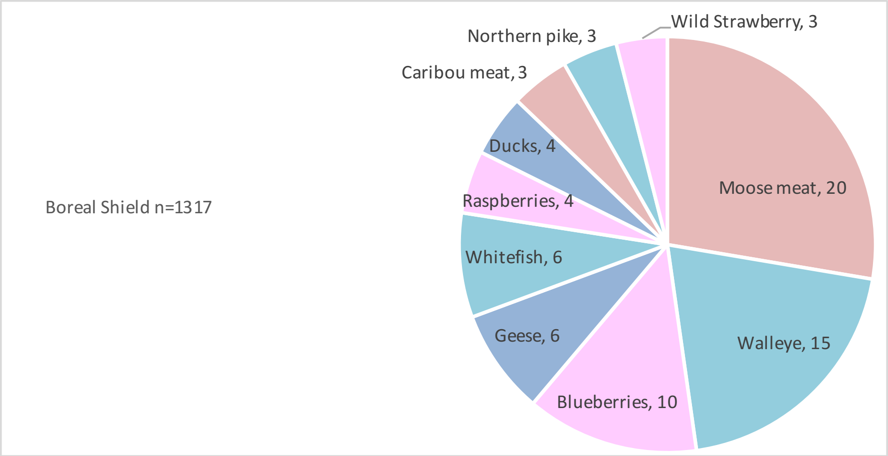


Figure 3.14 Top 10 most frequently consumed traditional foods by number of days in the Hudson Plains ecozone

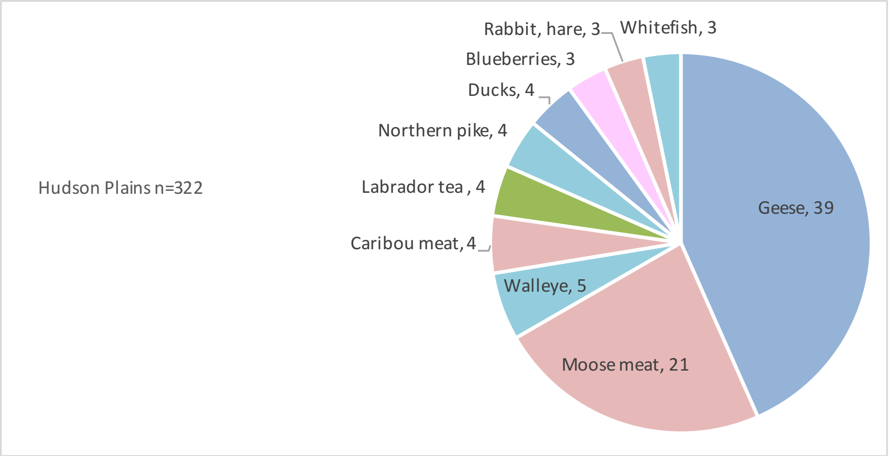


Figure 3.15 Top 10 most frequently consumed traditional foods by number of days in the Mixedwood Plains ecozone

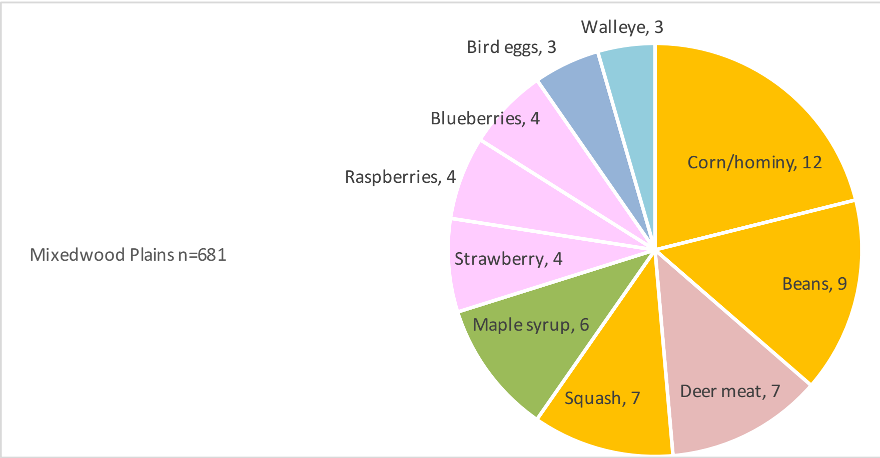


Figure 3.16 Top 10 most frequently consumed traditional foods by number of days in the Atlantic Maritime ecozone

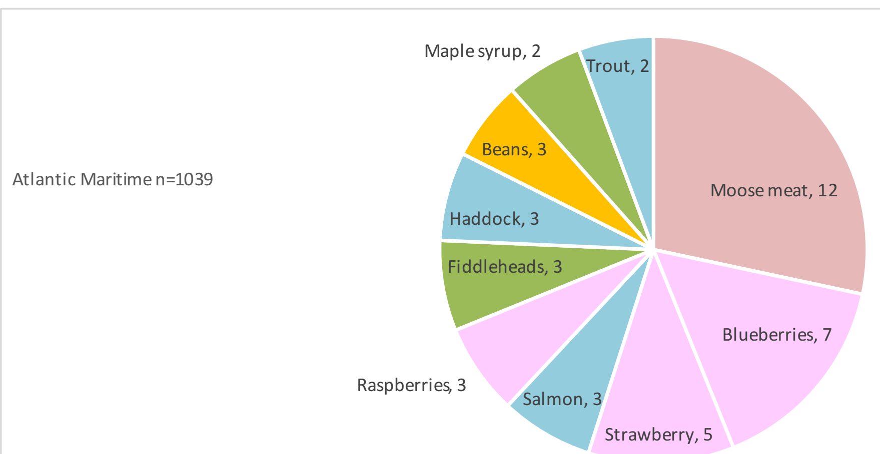


Figure 3.17 Average grams of traditional food consumed daily (consumers and non-consumers) by ecozone, based on the 12-month food frequency data

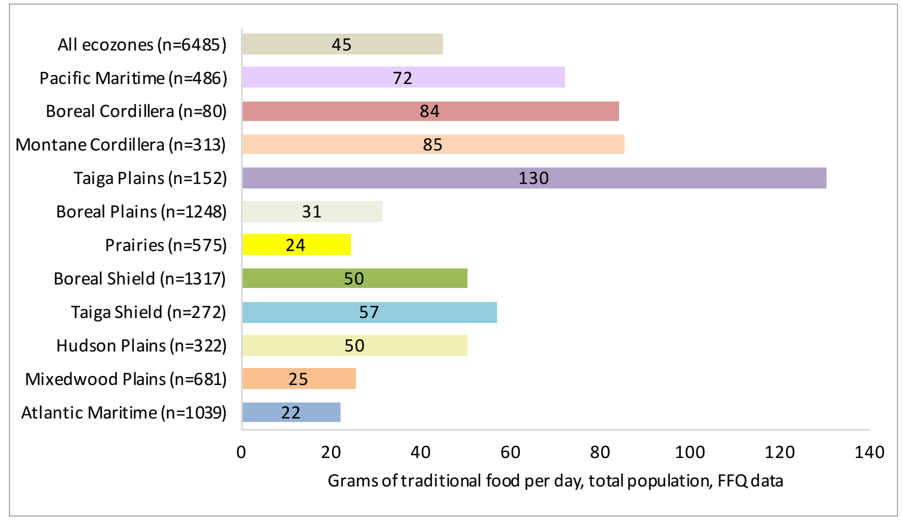


Figure 3.18 Average grams of TF consumed daily (consumers and non-consumers) by ecozone in the fall season from the 24-hour recall data

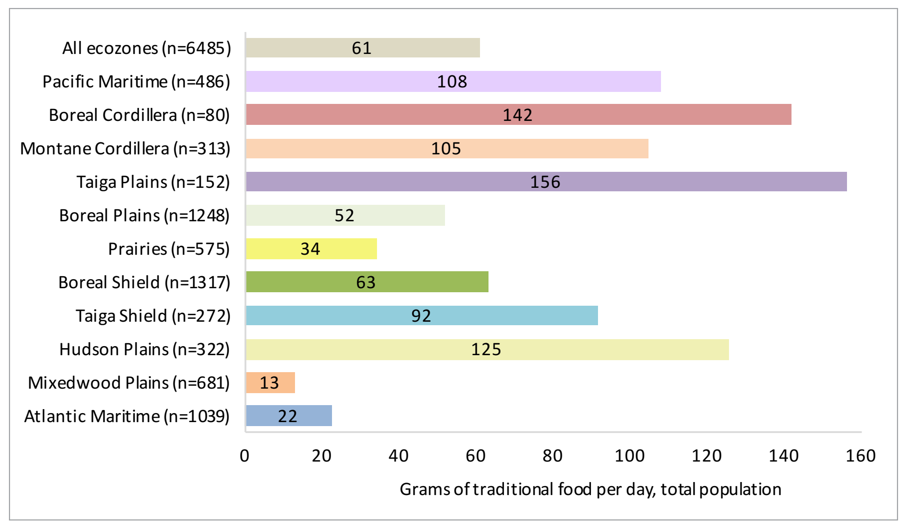


Figure 3.19 Average grams of TF consumed daily by consumers only by ecozone in the fall season from the 24-hour recall data

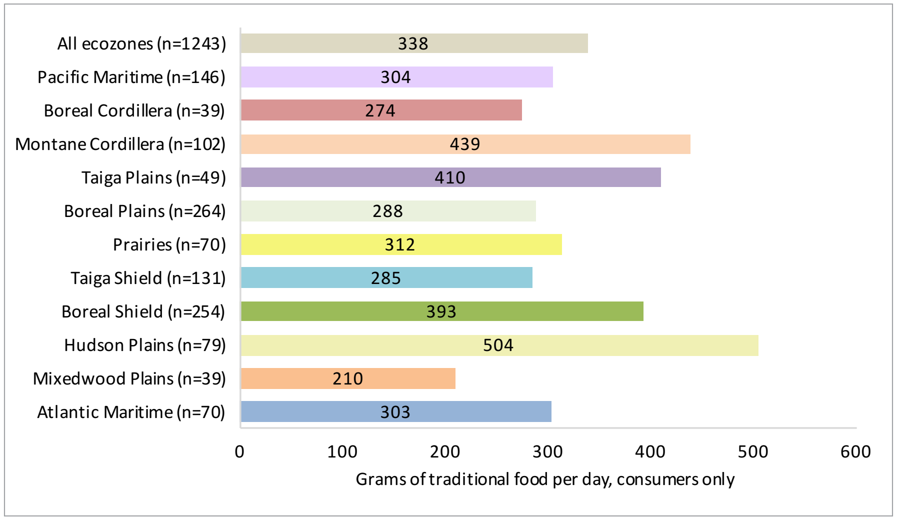


Figure 3.20 High consumers (95th percentile) daily intake of traditional food from the 24-hour recall data

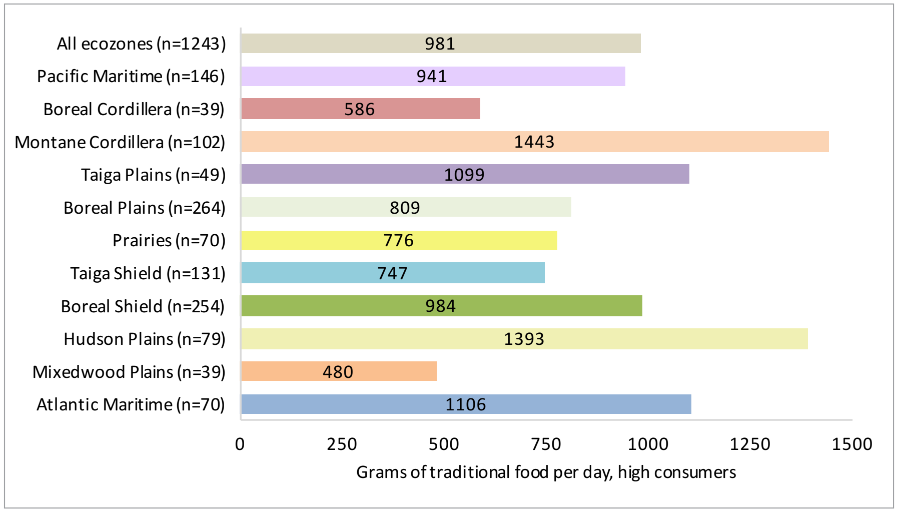


Figure 3.21 Average grams of traditional food by category (consumers and non-consumers) by ecozone, based on the food frequency data

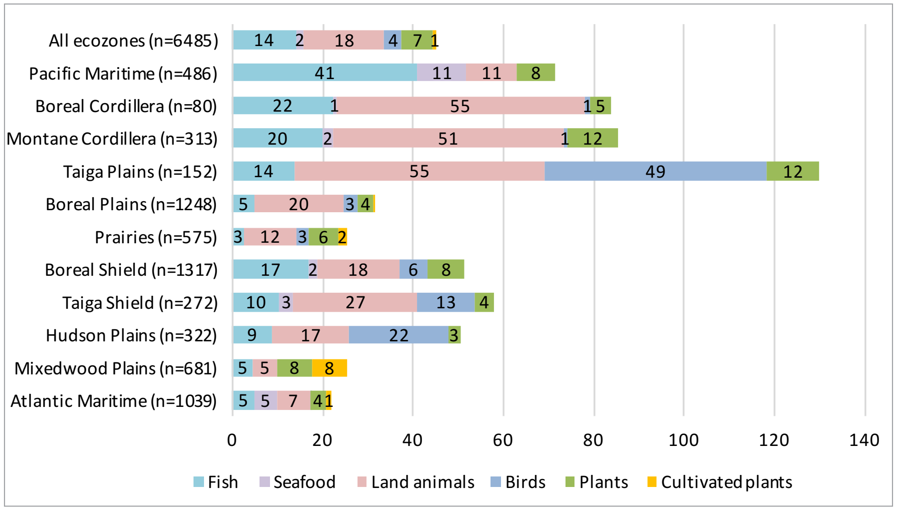


Figure 3.22 Average grams of traditional food by category (consumers and non-consumers), by ecozone, based on the fall 24-hour recall data

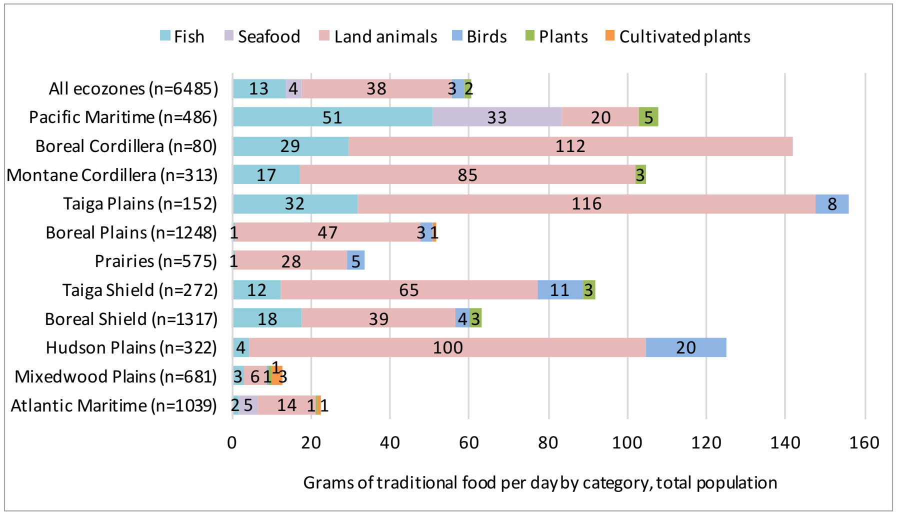


Figure 3.23 Average grams of traditional food by category, consumers only, by ecozone, from the fall 24-hour recall data

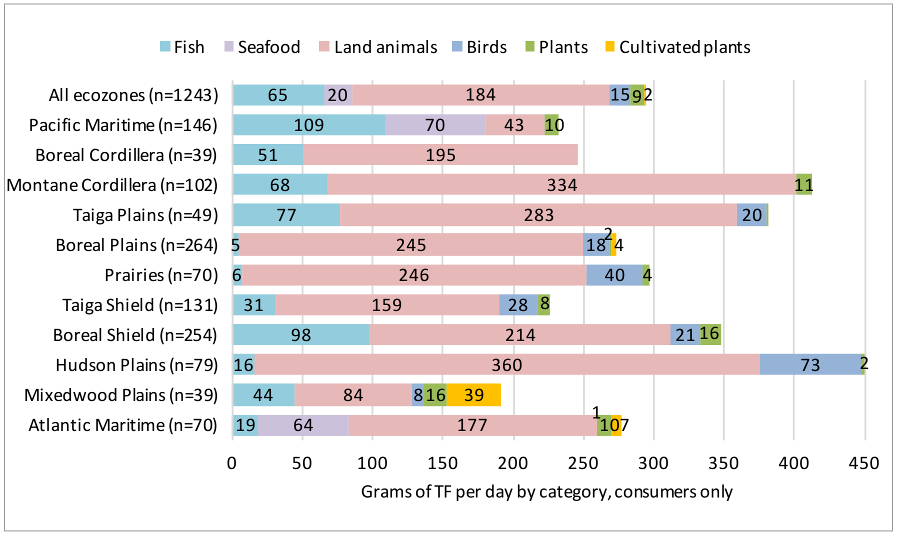


Figure 3.25 Percent of First Nations adults who would like more traditional food in their household, by ecozone

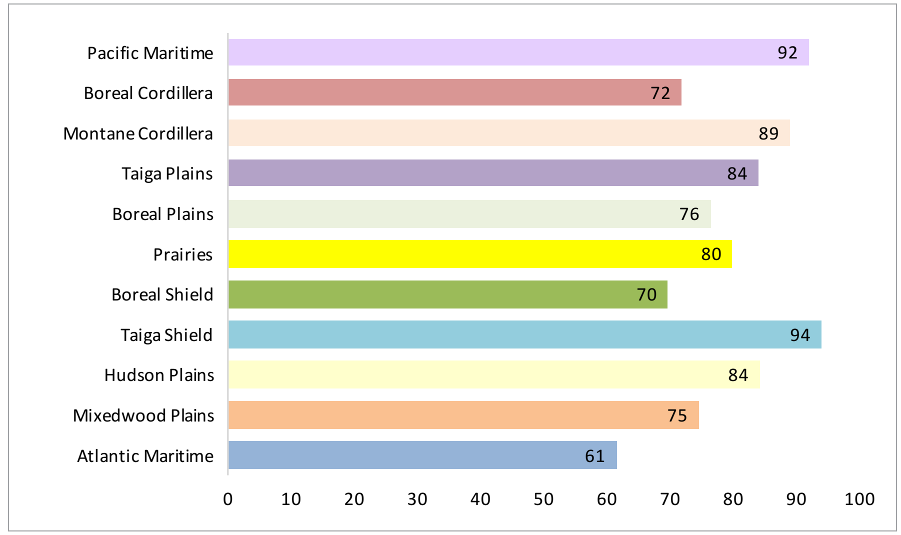


Figure 3.24 Percent of First Nations adults who would like more traditional food in their household, by region

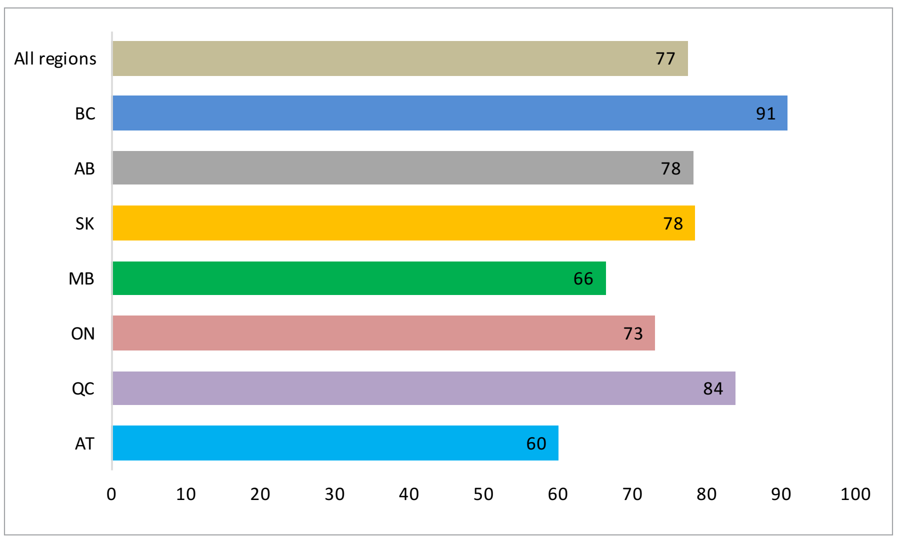


Figure 3.26 Barriers to traditional food intake, based on percentage of responses (n=5,643)

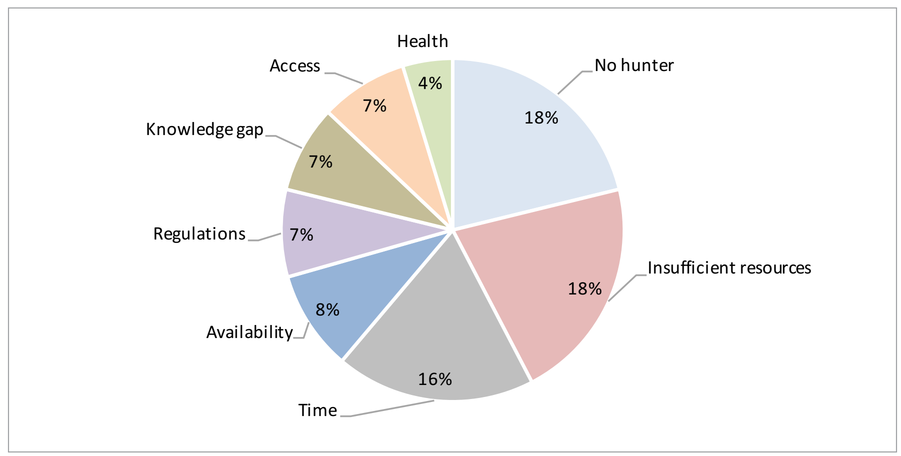
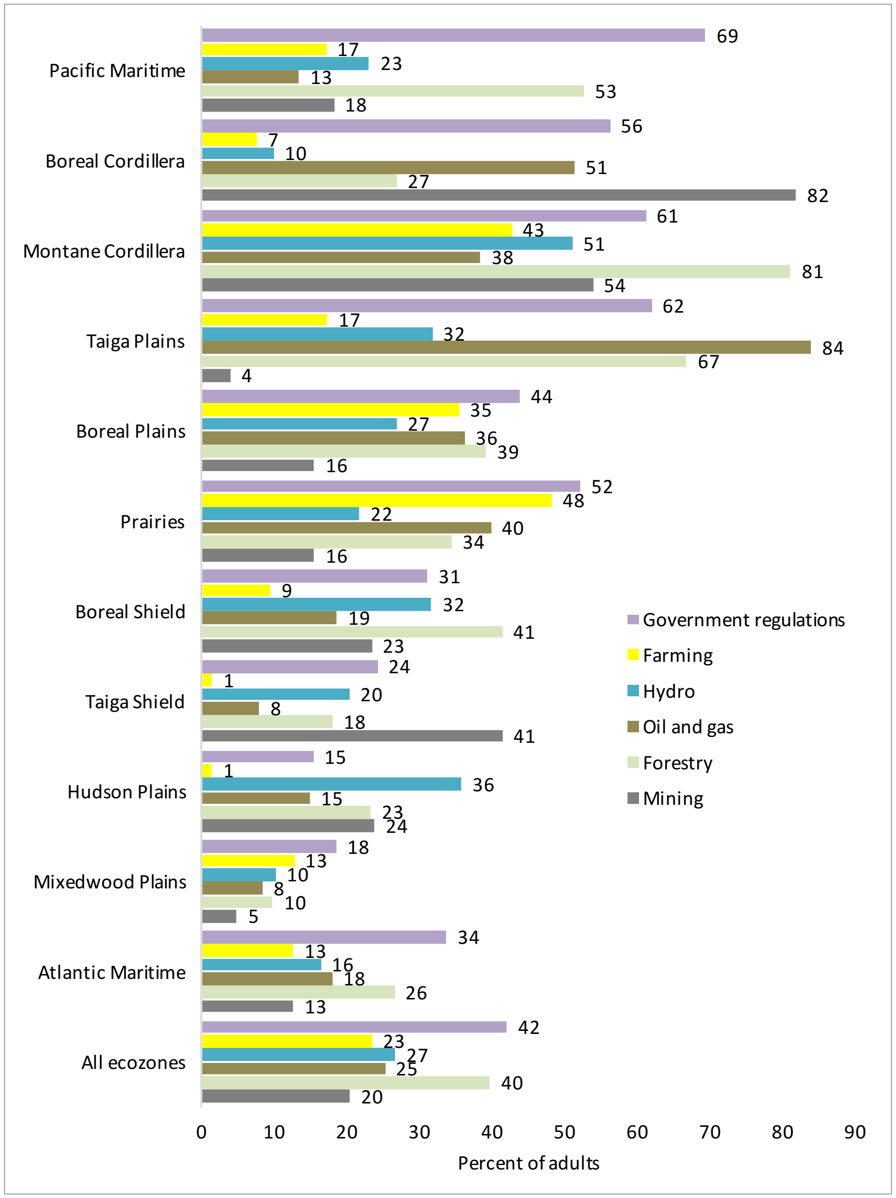


Figure 3.27 Percent of First Nations adults who reported that the following affect where they could hunt, fish or collect berries (n=6,476)*



*Combined, 54.7% of participants reported natural resource activities affected harvesting practices while 42% identified government regulations as a barrier.

Figure 3.28: Percent of First Nations adults who reported that they noticed significant climate change, by ecozone

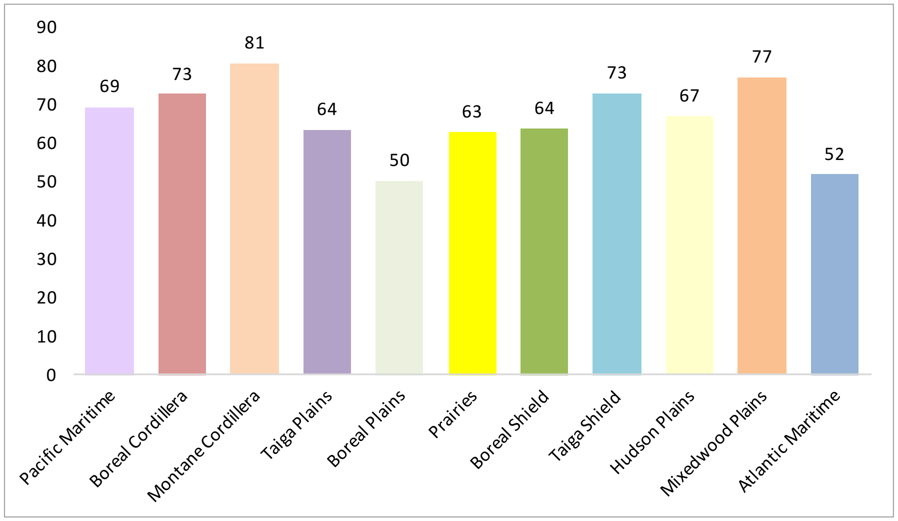


Figure 3.29 Top 5 responses of how climate change has affected traditional food availability

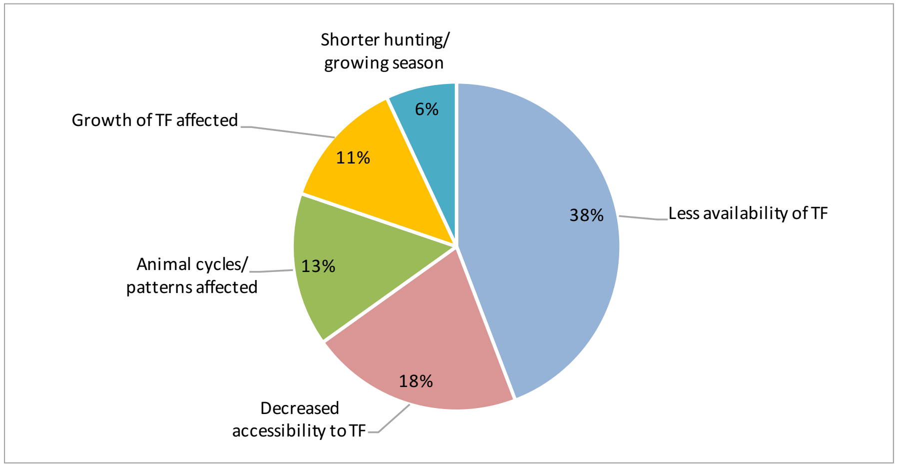
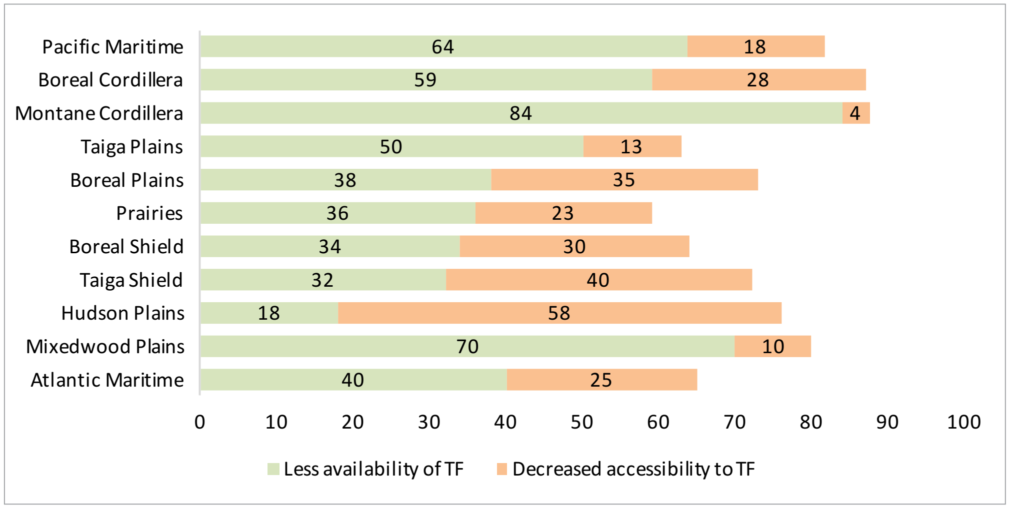


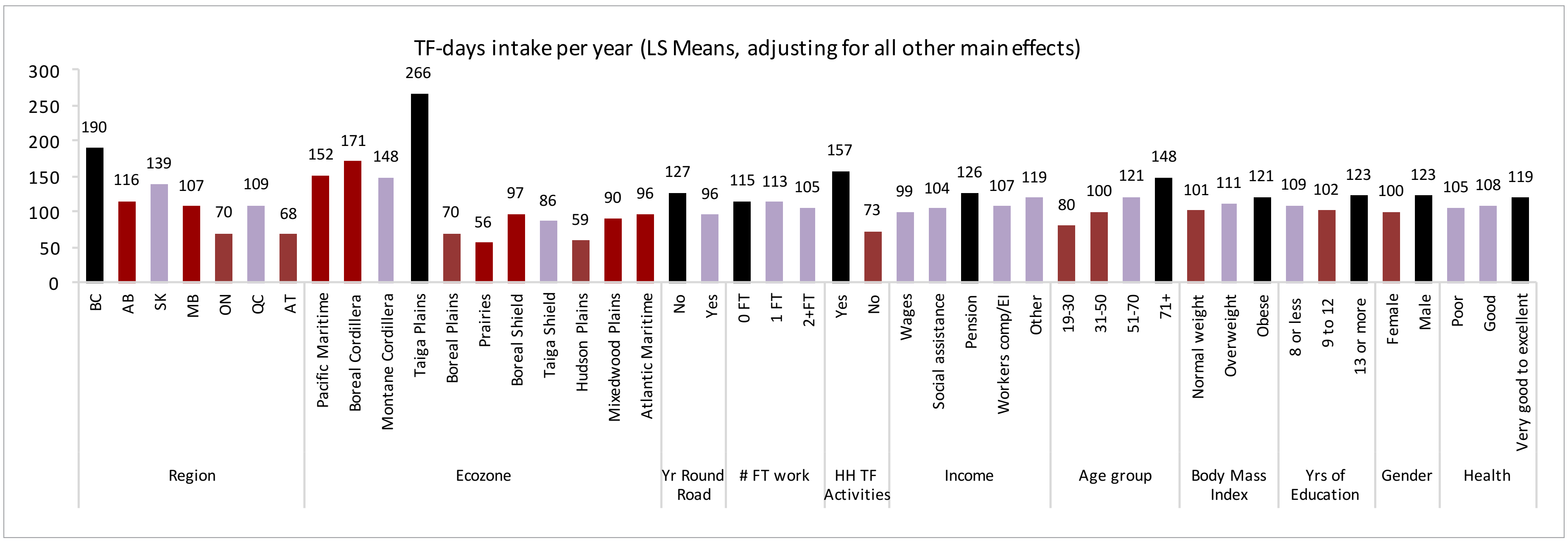
Figure 3.30 Most commonly reported effects of climate change on traditional food, by ecozone



Note: Displaying percentages of top two answers when analyzed by total.

Figure 3.31 Predictors of traditional food intake

Note to Figure 3.31: The distribution of "Traditional food – days" (TFD) is right-skewed. The square root of TFD (TFDsr) is approximately normal and was used as the dependent variable in a multivariable regression. Values in each independent variable (region, ecozone, year round access, number of people working full-time, TF activities, income, age group, BMI, years of education, gender, smoking, self-reported health) were tested to see whether they predicted the number of days traditional food was eaten. Least square (LS) means are the group means after having controlled for a covariate. The highest prevalence is identified in black. Values with no significant differences are presented in purple. Values in red are significantly different from values in black (p<0.05). Although some non-significantly lower means (such as 109 in QC) appear to be large than significantly lower means (such as 116 in AB), this is a function of the slightly greater variability (and higher standard error) in the QC population. However, these differences are trivial. Although "significant" there is no important difference between 109 and 116.



CHAPTER 4

Diet

Diet Quality and Nutrient Analysis

To assess the quality of the diet of First Nations adults, all participants were asked to describe the types and amounts of food and beverages consumed in the previous 24 hours. The recall used a 3-stage multiple pass method. In the first pass, a quick list of foods and beverages eaten was developed, followed by a more detailed description including the amounts eaten, followed by a final review. Portion sizes were estimated using 3-dimensional food models manufactured for FNFNES and based on models developed by Santé Québec. Alcohol intake data were excluded from all dietary intake analyses.

STEW AND BANNOCK, PHOTO BY MALEK BATAL

For the regional reports, to evaluate nutrient adequacy and overall diet quality, the 24-hour recall data were compared against the Dietary Reference Intakes (DRIs) (Institute of Medicine 2000; 2011 and *Eating Well with Canada's Food Guide — First Nations, Inuit and Métis (EWCFG-FNIM)* (Health Canada 2007a). For this summative report, diet quality was also examined using the Canadian Healthy Eating Index (HEI), a tool adapted from the American HEI to gauge how closely the foods eaten by Canadians follow recommendations outlined in EWCFG (Garriguet 2009).

All 24-hour recall data were entered by research nutritionists at the Université de Montréal, using CANDAT[5], which is a nutrient analysis software that uses foods within the Canadian Nutrient File[6]. To ensure the accuracy of data entry of the 24-hour recalls, a sub-sample of 10% of the records were cross-checked and discrepancies reconciled. Any systematic discrepancies were also corrected throughout. For food groupings, in addition to assigning each food code to only one food group when feasible, a set of 11 multi-food group classifiers was created for complex recipes (see Appendices in FNFNES regional reports for further information). For nutrient intake information, numbers are rounded to the first decimal place. As a result, some totals do not add up to 100%.

5 For more information go to http://www.candat.ca

6 For more information go to the Canadian Nutrient File webpage https://food-nutrition.canada.ca/cnf-fce/index-eng.jsp

Assessment of Usual Intakes from Dietary Sources

There are four types of DRI values: Estimated Average Requirements (EARs); Recommended Dietary Allowance (RDA); Adequate Intake (AI); and Tolerable Upper Intake Levels (UL). The EAR is used to assess whether a group of men or women is likely to be getting enough of a certain nutrient for good health: the EAR is the median daily intake or the amount estimated to meet the needs of 50% of the individuals in a group. The RDA is the amount of a nutrient that would meet the daily needs of up to 97.5% of healthy individuals in the population and is used for individual planning. An AI for some nutrients (such as potassium and sodium), is used when there is currently insufficient evidence to establish an EAR and an RDA. For nutrients with an AI, a prevalence of inadequacy cannot be assessed. The UL is the highest daily nutrient intake that is not likely to pose a risk to health.

The SIDE (Software for Intake Distribution Estimation) SAS sub-routine[7] nutrient analyses were performed on data from a total of 6,201 participants (4,010 women and 2,191 men) to obtain the distributions (percentiles) of usual intake for three age groups: 19-50, 51-70 and 71+. The SIDE SAS sub-routine was used to assess nutrient adequacy, accounting for intra-individual variation, and therefore approximating usual nutrient intakes. When single bootstrap estimates were greater than the observed mean plus four times the standard deviation of the first day intake, they were deleted and resampled until they fell within the margin for inclusion in calculations of the standard error of percentiles. The 95th percent confidence intervals (CI) for the percent of participants with intakes either below the Estimated Average Requirements (EAR), above the Tolerable Upper Intake Level (UL) or below, above and within the Accepted Macronutrient Distribution Range (AMDR), were obtained in a non-parametric fashion by ordering the 500 bootstraps and using the 12th lowest as the lower end estimate and the 12th highest as the upper end estimate.

7 More information about the software is available online: http://www.side.stat.iastate.edu/

Although 6,487 interviews were completed, the nutrient data from 286 individuals were excluded from the analyses: n=245 pregnant and/or lactating women due to higher nutrient requirements and n=27 participants with missing age and age group values. Additionally, 14 participants who reported that they did not eat anything on the day prior to the 24hr recall (resulting in zero kcal intake) were also excluded since these extreme values made the calculation of all percentiles and standard errors very unreliable.

For nutrients with an EAR, values in the '%<EAR' column indicate the percentage of the population with usual intakes less than estimated requirements, that is the proportion at risk of inadequate intake for a specific nutrient. A value of less than 10% below the EAR was used as the cut-off value to define a low prevalence of inadequate intake. This is the same cut-off value used by Health Canada in the development of the 2007 EWCFG (Katamay et al. 2007), and in the assessment of intakes from CCHS 2004 data (Health Canada 2009b). The values reported in the "%>UL" column indicate the proportion of the population at risk of excessive intake for a specific nutrient. For some sex and age groups, the estimate of the percentile value, as well as the level of adequacy, could not be estimated precisely enough due to the high level of variability in nutrient intake between and within individuals. Data that have been suppressed due to extreme sampling variability are indicated in tables in Appendix G by the symbol (-).

Individual nutrient intake tables can be found in Appendix G in Tables G.1 to G.37.

Macronutrient Intakes

Average energy intakes among females were 1,864 kcal/day among those aged 19-50, 1,669 kcal/day among those aged 51-70 and 1,664 kcal/day among females aged 71+ (Appendix Table G.1). In comparison, mean energy intakes reported for females in CCHS 2015 were 1,655 kcal/day (19-30), 1,630 (31-50), 1,578 (51-70) and 1,416 (71+) (Statistics Canada n.d. (a)). Males in this study aged 19-50 had an average energy intake of 2,298 kcal/day while CCHS reported an energy intake of 2,427 kcal/day for males

LAC LA RONGE, FRYING MOOSE LIVER, PHOTO BY REBECCA HARE

aged 19-30 and 2,236 kcal/day among males aged 31-50 years. Males aged 51-70 in this study had a caloric intake of 1,948 kcal/day compared to 2,081 kcal/day in the general population. Males aged 71+ had an intake of 1,761 kcal/day compared to 1,795 kcal/day in the general population.

The percentage of energy in the diet from protein, carbohydrates and fat are provided in Appendix G in Tables G.30 to G32 and compared to the AMDR (Acceptable Macronutrient Distribution Range) which is expressed as a percentage of total energy intake. Intakes within the range described for each column are associated with a reduced risk of chronic disease. While the mean, SE and percentiles were obtained, it was not possible to estimate, for some age groups, the percentage of the group that was within the AMDR. The mean percentage of energy from protein (Table G.30) was within the AMDR for both sexes and all age groups (16.6% to 22.4%). The mean percentage of energy from carbohydrates (Table G.31) was within the recommended range for females and for males aged 19-50 and 51-70; however, 73.6% of males aged 71+ had an intake of carbohydrates below the AMDR. The mean intake of fat was above the recommended range for five of the six age-sex groups. The percentage of energy from saturated fat was above the recommended 10% (Table G.33) for males and for females in the age groups 19-50 and 71+. In the general Canadian population, the percentage of energy from protein (15.8% to 17.9%) (Statistics Canada n.d. (b)) and fat (31.1% to 32.9%) (Statistics Canada n.d. (c)), appears lower while the intake from carbohydrate (46.2% to 50.8%) appears higher (Statistics Canada n.d. (d)).

Nutrients with an EAR, AI and UL

Table 4.1 summarizes by gender and age group, the usual intakes for each nutrient and the adequacy of intake for each of the six age-sex groups relative to the DRIs. Since zero percent of participants had niacin intakes below the EAR, this nutrient appears to be adequate. Among several nutrients with an EAR, adequacy of intake could not be confirmed with certainty for some age-sex groups due to a high coefficient of variance (CV) including: carbohydrate, iron, vitamin B12, thiamin, riboflavin and phosphorous. However, mean intakes for all these aforementioned nutrients were at least 1.5-2 times greater than the EAR, thus intakes are likely adequate for most people. Intakes are inadequate for vitamins A, D, and C, as well as folate, calcium, and magnesium. There were inadequate intakes of vitamin B6 among women as well as males aged 51-70. Among the four nutrients with an AI, intakes were below the AI for fibre, potassium, and linoleic acid. While prevalence of inadequacy cannot be determined, these levels suggest that adults are not meeting recommendations. Females and males aged 19-70 had mean intakes greater than the AI for linolenic acid, suggesting adequate intake. For the seven nutrients with an established UL, there were no exceedances. Previously, the nutrient sodium had a UL. This was recently replaced by a Chronic Disease Risk Reduction Intake (CDRR) level: intake reduction above this amount is expected to reduce chronic disease risk[8]. In this study, sodium intake levels were similar to the general Canadian population. Most adults have intake levels above the AI of 1,500 mg and the CDRR of 2,300 mg. Reductions in sodium intake have the potential to reduce the risk of chronic disease.

8 Previously sodium had a UL, but this was recently removed in the recent Spring 2019 report from the National Academies Press. National Academies of Sciences, Engineering, and Medicine (2019). Dietary Reference Intakes for Sodium and Potassium. Washington, DC: The National Academies Press. https://doi.org/10.17226/25353.

Supplement Use

Twenty-four percent of adults reported taking a supplement: higher usage was reported among adults in BC (33%) and Ontario (34%) (Figure 4.1). Commonly reported supplements were multivitamin/mineral and vitamin D. In the general population, 47% of adults across Canada report using nutritional supplements (Statistics Canada n.d. (e)).

Eating Well with Canada's Food Guide

In the regional reports, diet quality of adults was compared to recommendations within the *Eating Well with Canada's Food Guide – First Nations, Inuit and Métis* (Health Canada 2007a)[9]. EWCFG-FNIM describes the amount and types of food needed on a daily basis to supply adequate amounts of nutrients for good health, and to reduce the risk for both infectious and chronic disease by limiting the consumption of certain elements (saturated fat, salt, sugar and calories).

When compared to EWCFG-FNIM, First Nations did not meet the recommendations for any of the four food groups; Vegetables and Fruit, Grain Products, Milk and Alternatives (mean number of servings per day were below the recommendations), and Meat and Alternatives (above the recommendations) (Table 4.2). Table 4.3 lists the foods that are the five most important contributors to each of the four food groups. The higher use of mixed vegetables relative to potatoes is positive, as is the reliance on a variety of meats, including traditional meats. Table 4.4 shows the top 10 store-bought beverages and foods consumed in the greatest amounts by First Nations adults. By weight, water (tap and bottled combined) and soup were the beverage and food item consumed in the greatest amount. When soft drinks were combined with fruit drinks, iced tea and sports drinks, the intake of sugar-sweetened beverages averaged 339 ml (1 1/3 cup) per person per day.

9 More information and copies can be found at Health Canada's website hc-sc.gc.ca/fn-an/pubs/fnim-pnim/index-eng.php#.

LITTLE RED RIVER CREE NATION, PHOTO BY STÉPHANE DECELLES

Information on the foods that are the most important contributor to each nutrient can be found in Appendix H. Wild meats were the top contributor to both protein and iron intake. About half of the iron in the diet came from wild meat, white bread, cereal, beef and pasta. One-third of vitamin D came from fish, while approximately 41% came from milk, margarine and eggs. Processed meats such as cold cuts and sausages were the top contributor to both total fat and saturated fat, while the main sources of salt were processed food: soup, white bread and processed meats.

Healthy Eating Index

In both the American and Canadian Healthy Eating Index (HEI), foods and beverages recorded in the 24-hour recall data are classified and scored using the concepts of nutrient adequacy and moderation (limiting excess consumption) (Garriguet 2009). The HEI score (maximum total score of 100) is comprised of eight adequacy components (total fruits and vegetables, whole fruits, dark green and orange vegetables, total grain products, whole grains, milk and alternatives, meat and alternatives, unsaturated fats) which combined are scored on 60 points; and three moderation components (saturated fats, sodium, other foods), which are scored on 40 points. The amounts and types of foods recorded in the 24-hour recalls were coded using the methodology developed by Garriguet (Steinhouse 2017).

Points were given based on the EWCFG-FNIM recommendations for respective sex and age categories. Based on the HEI total scores, diet quality was categorized into the following intervals: "low" (<50 points), "average"

(50-80 points), and "high" (> 80 points) (Garriguet 2009). Results from the SIDE analyses of the Healthy Eating Index (HEI) index by sex and age group are presented in Table 4.5. The mean score for both men and women aged 19-50 was "low" while the score for older males and females 51 and older was "average". Less than 1% of First Nations adults had an HEI greater than 80 points (results not shown). In the general Canadian adult population aged 19 years and older, the mean score was "average" while less than 1% had an HEI greater than 80 points (Garriguet 2009).

Traditional Food Attributes and Contributions to Nutrient Intake

Traditional and store-bought food have distinct attributes in the diet. Across ecozones, what adults valued most about traditional food were the health benefits, along with the perception that they were natural or safe and that they tasted good, were cost-effective and had cultural benefits (Figure 4.2), while store bought foods are valued primarily for their convenience (Figure 4.3).

Eighteen percent of all 24-hour recalls collected over the fall season contained at least one traditional food (See Figure 3.5 in Chapter 3) with a wide variation between both regions and ecozones. At the regional level, there was a higher prevalence of traditional food in 24-hour recalls from BC (32%), Saskatchewan (21%) and Quebec (18%), while at the ecozone level, a higher prevalence was seen on recalls from the westernmost ecozones (Pacific Maritime, Montane Cordillera) and northern ecozones (Boreal Cordillera, Taiga Plains, Taiga Shield and Hudson Plains). Among all adults, traditional food provided an average of 4.6% of the daily calories, ranging from 0.9% in the southern ecozone of the Mixedwood Plains to 11.9% in the northwestern ecozone of the Boreal Cordillera (Figure 4.4). Among consumers, 25.4% of calories were from traditional food (Figure 4.5) while those eating at the 95th percentile derived over half their calories (58.4%) from traditional food (data not shown). On days that traditional food was eaten, the intake of almost all nutrients was significantly higher while the intake of saturated fat was lower (Table 4.6).

Health and Lifestyle Measures

Participants were asked a series of health-related questions in order to understand the relationships between diet, lifestyle and health risks. Height and weight measurements were both self-reported and measured for individuals who agreed to have these values recorded. In total, 3,549 individuals provided both measured height and weight while 2,244 individuals provided only self-reported height and/or weight.

Body Mass Index and Obesity

The Body Mass Index (BMI) is a proxy measure of body fat based on a person's weight and height and is an index used to categorize body weights and risk of disease. BMI was calculated using both measured heights and weights when the data were available. In cases where only reported or a combination of reported and measured heights and weights were available, the BMI values were adjusted by the addition of the estimated bias value. The estimated bias value is the mean difference found between the BMIs using measured and reported values using a paired t-test. Based on the BMI categories, 82% of all adults were either overweight or obese (Figures 4.6 and 4.7). In the general Canadian population, based on measured weight and height data from the 2015 CCHS, 61.3% of Canadians aged 18 years and older are either overweight or obese. (Statistics Canada n.d. (f)).

Smoking

Over half (52%) of First Nations adults reported that they smoked cigarettes (Figure 4.8) and this finding is similar to the rate of 53.5% reported for First Nations adults living on-reserve across Canada in the 2015/2016 RHS (First Nations Information Governance Centre (FNIGC) 2018a). Smoking prevalence was lowest in BC (39%) and at the ecozone level in the Pacific Maritime and the Mixedwood Plains ecozone (Figure 4.9). In comparison, 13% of the general population, aged 15 years and older are smokers (Reid et al. 2017).

Physical Activity

Approximately two-thirds of all adults (64%) were classified as 'sedentary' or 'somewhat active' based on an affirmative response to one of the following statements 'I am usually sitting and do not walk around very much, or, 'I stand or walk around quite a lot, but I do not have to carry or lift things often' (Figure 3.9). At the regional level, the rate of physical activity appeared highest in Alberta (45%) and lowest in Manitoba (38%). At the ecozone level (Figure 4.11), adults appeared to be more active in the Boreal Cordillera (46%) and Montane Cordillera (47%) and least active in the Taiga Plains (22%). According to results from the 2015/2016 CCHS, 42.3% of Canadians aged 18+ are inactive (Statistics Canada n.d. (g)).

Diabetes

The crude weighted, self-reported rate of diabetes among First Nations adults was 21%: the lowest prevalence was 10% in BC (Figure 4.12). Only 8% of adults under the age of 40 reported having diabetes compared to 29% for those older than 40 (Figure 4.13). Data collection took place over two years in BC and as FNFNES only started to capture information on diabetes in Year 2, diabetes rates in BC may be underestimated. Since there was no information on diabetes collected in the Boreal Cordillera, this ecozone was not included. When stratified by ecozones, between 6% and 24% of adults indicated that they had diabetes (Figure 4.14). Most adults reported having type 2 diabetes, although 22% indicated that they did not know what type they had (Figure 4.15). Overall, 45% of adults with diabetes reported that they smoke (Figure 4.16). There seemed to be some regional variation, with the lowest rate of smoking among adults with diabetes in QC and the highest in SK.

In order to compare with previous studies, age-standardized diabetes rates were calculated using the 1991 Canadian census data (Statistics Canada's standard for vital statistics due to its relatively current population structure). Age standardization allows for comparison of populations with different age profiles. Age standardized rates were 19% for all adults, 21% for females and 17% for males (Figure 4.17). This rate is triple the age-standardized diabetes rate of 5.2% reported nationally in 2014 for Canadians aged 12 and older (Statistics Canada n.d. (h)) but similar to findings from other studies involving First Nations, Inuit and Métis communities including the Phase 3 of the 2015/2016 Regional Health Survey (RHS) (age-standardized rate of 19.2% among adults 18 years and older) (First Nations Information Governance Centre (FNIGC) 2018a).

Predictors of Diabetes

Diabetes was used as the dependent variable in a multi-variable logistic regression to assess whether location of the respondent (region, ecozone), as well as year-round road access, participant characteristics (age group, education level, gender, smoking status, self-reported health status, body mass index, source of income) and employment at the household level were predictors. Results are displayed in Figure 4.18. Variables in black reflect the highest prevalence while those in red are significantly different. Diabetes was more commonly reported by adults who were older, obese and reported poor health. Rates of diabetes were significantly lower in the regions of BC, AB, SK and MB. Diabetes was significantly lower among participants who: were younger (19-50); were not obese; reported wages or social assistance as their primary source of income; and reported "good" to "excellent" health. See Appendix I for the table with prevalence rates and adjusted odds ratios.

Self-reported Health

Participants are asked to identify their health on a five-point scale: poor, fair, good, very good, excellent. Only 26% of adults said their health was 'very good' or 'excellent' while 40% said their health was 'good' (Figure 4.19 and Figure 4.20). In the 2015/2016 RHS, 37.8% of First Nations adults nationally reported that their health was 'excellent' or 'very good' (First Nations Information Governance Centre (FNIGC) 2018b). In the general population, 61.5% of all Canadians aged 12+ say that their health is 'very good' or 'excellent' (Statistics Canada n.d. (i)).


BANNOCK, PHOTO BY KATHLEEN LINDHORST

Predictors of Self-reported Health

Self-reported health was used as the dependent variable in a multi-variable logistic regression (Figure 4.21). For the regression analyses, participants were assigned into one of two categories (good health or poor health). Participants who initially reported their health to be "very good" or "excellent" were classified as "good" while participants who reported that they considered their health as "poor" or "fair" were classified into the "poor" health category. In order to highlight differences between those with better and worse self-reported health, individuals who self-reported good health were left out of the analyses. The independent variables included the seven regions and 10 ecozones (the Boreal Cordillera was not included as no diabetes data were collected from this ecozone) in which the respondent resided, whether the community had year-round road access, the number of individuals in the house with full-time work (0, 1 or 2+), the main source of income (wages, salary or self-employment vs all other sources), age-group (19-30,31-50, 51-70, 71+), the individual's BMI category (normal, overweight, obese), the individual's attained education (8 years or less, 9 to 12 years, 13 years or more), gender, as well as diabetes (Yes/No) and smoking (Yes/No). The highest percentage of those reporting good health for each of the independent variables are displayed in black. Values shown in red are significantly different.

When tested for significance, there were significantly lower levels of good health ("very good to excellent") in three regions (Manitoba, Saskatchewan and Ontario), in two ecozones (the Taiga and Boreal Shield), and in households reporting no traditional food activity. Self-reported health was also significantly lower among adults who were male, obese and had finished less than nine years of education. See Appendix I for the table with prevalence rates and adjusted odds ratios.

Food Security

Food security is considered achieved by the Food and Agricultural Organization of the United Nations (2002) "... when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". In Canada and the U.S., the term "food insecurity" is commonly used to describe households and individuals who identify as not having enough income to cover food costs.

When FNFNES began, there was neither a solid definition of Indigenous food security or a validated tool to measure access to food from both the traditional and store-bought food system. For the traditional food system, a number of closed and open-ended questions were posed that captured information on harvest practices, barriers to traditional food use and adequacy and availability of traditional food supplies. Much of the answers are found in the *Traditional Food systems chapter,* however, a few are presented below. As reported in the *Traditional Food Systems* chapter, while the majority of adults would like to have more traditional food in their diet (Figure 3.23 and 3.24), several factors including financial and household constraints (see Figure 3.25) prevent greater access. Two questions, with three possible responses (never worried, sometimes worried, often worried), were posed to assess a household's adequacy of, and the ability to replenish traditional food supplies. Almost half of all participants (43%) said that they often or sometimes worried that their traditional food supplies would run out before they could get more while 47% of the population said that they had experienced a shortage in their traditional food supply (Figure 4.22).

For commercially available foods, FNFNES measured the economic dimension or the financial ability of First Nations households on-reserve to purchase store-bought food through the Household Food Security Survey Module (HFSSM) (Health Canada 2007b). Households were classified as food secure or food insecure (marginal, moderate or severe) based on their responses to the 18-questions (10 questions for adults' status and an additional 8 questions for households with children). Households were considered food secure only if there were no affirmed answers. Marginally insecure households were identified by one affirmed answer on either the adult or child-related questions (Tarasuk, Mitchell and Dachner 2013). Moderately insecure households were identified by two to five affirmed answers on the adult-related questions or two to four affirmed answers on the child-related questions and, severely food insecure households, by six or more affirmed answers on the adult survey section or five or more on the child survey section. Marginally food insecure households represent those households who are worried about having enough money to buy food. Households considered 'moderately food insecurity' may be purchasing lower quality foods whereas households classified as 'severely food insecure' would experience regular disruptions to eating patterns and food shortages.

Almost all participants (95.8%) completed the income-related Household Food Security Survey Module (HFSSM): respondents were dropped from the food security analyses if they answered "Don't know" to at least one of the first three questions. The food security status of 4.2% of all participants was treated as missing and unknowable.

Almost half (47.9%) of all participating households were food insecure while regional rates ranged between 38.8% and 60% (Figure 4.23). The rate of household food insecurity in Alberta was significantly higher compared to the other regions. At the ecozone level (Figure 4.24), household food insecurity ranged between 24% (Boreal Cordillera) to 60% (Hudson Plains).

Food insecurity rates were also significantly higher in remote communities with no year-round road access to a service centre (58%) (Figure 4.25).

Sixty-nine percent of households contained dependents under the age of 18 years with 58% in British Columbia, 68% in Alberta, 69% in Saskatchewan; 74% in Manitoba; 48% in Ontario, 55% in Quebec and 48% in the Atlantic. Household food insecurity rates among households by presence and absence of children are presented in Table 4.7 and at the regional and ecozone level in Figures 4.26 to 4.28. Significance testing at the regional level shows that households with children experience greater food insecurity than those without children. The prevalence of *food insecurity in households with children* in the Alberta region was significantly higher than all other regions except for British Columbia. The prevalence of food insecurity *in households without children* in Alberta was significantly higher compared to the Atlantic, Ontario and Saskatchewan but rates were similar to British Columbia, Manitoba and Quebec. Among households with children, 29% experienced food insecurity at the child level (Table 4.7). That is, one or more children in each of these households were food insecure in the last year. In general, children tend to be protected from food insecurity, and particularly so from its most severe form (9% of adults with severe food insecurity vs 3% of children). In 8 of the 11 ecozones, more than 5% of households with children experienced severe food insecurity (Figure 4.28). The high levels of food insecurity across most regions and ecozones as well as the challenges to having more traditional food in the diet explain the dietary pattern and inadequate intake of several nutrients described in the previous section.

Food insecurity rates among First Nations households on-reserve are much higher than other Canadian households. In 2011/2012, the national food insecurity rate (based on the percentage of households considered either moderately or severely insecure) was 8.3% and 23% among Indigenous households off reserve (Statistics Canada 2013). When researchers at PROOF added the category "marginal" the percentage of households considered food insecure was 12.2% in 2011 and 12.6% in 2012: the rate among Indigenous households off reserve was 27.1% and 28.2% respectively (Tarasuk, Mitchell and Dachner 2013) (Tarasuk, Mitchell and Dachner

2014). More recent household food insecurity rates exist, although data for a few regions (British Columbia, Manitoba, Newfoundland and Labrador and the Yukon) are not available as they opted out of the food security module. Data from 2013-2014 indicate that 12% of households and 25.7% of Indigenous households off-reserve experienced food insecurity (Tarasuk, Mitchell and Dachner 2016).

Food Costs and Food Insecurity

A combination of insufficient employment and wages relative to food costs are contributing factors to the high levels of food insecurity. Starting in the third year of the FNFNES (after data collection was completed in British Columbia), food costing was undertaken using the National Nutritious Food Basket tool (Health Canada 2009c). The total costs of these items were used to calculate the weekly costs of a food basket for a family of four consisting of two adults (one female and one male, aged 31-50 years) and two children (one male teenager aged 14-18 and one female child aged 4-8). Presented in Figure 4.29 by region are three food basket costs: 1) the cost of a food basket in the reference major urban centre; 2), the average cost in FNFNES communities; and 3) the highest community food basket cost. In all regions, food costs were lower in major urban centres: food costs between an urban centre and FNFNES communities were the lowest in the Atlantic region. This may somewhat explain the lower rates of food insecurity in the Atlantic region. To note, costs were not adjusted for inflation over the course of the study. Figure 4.30 shows the costs of the nutritious food basket at the ecozone level: as pricing was not undertaken in BC, ecozone level costs were imputed using data made available from the B.C. Provincial Health Services Authority and the Centre for Disease Control (personal communication, 2018) for costs in 2009. Food basket costs in almost all ecozones were higher than the average cost of a food basket in a major urban centre ($191). Food basket costs in communities, based on INACRIZ geographic zones, illustrates that prices in Zone 4 are $112-$140 higher than the other three zones (Table 4.8).

Predictors of Income-related Food Insecurity

Research in Canada has found that strong predictors of a household's income-related food security status include both income level and education (Tarasuk, Mitchell and Dachner 2016). FNFNES captured education attainment for participants but did not gather information on a household's income level. Only the participant's income source (wage, pension/senior's benefits, workers compensation/EI, social assistance, or other [student living allowance, parent/spousal support, foster parent compensation, residential school compensation]) and the number of people working were captured in the household survey.

A multivariable regression was performed to assess whether location (region, ecozone) road access, household socio-demographic characteristics (gender, age group, income source, number of adults with full-time employment, education), health (self-reported health, BMI status, smoking status) could predict whether a household was food insecure (Figure 4.31). Food insecurity rates were used as the dependent variable: households with "severe", "moderate", or "mild" food insecurity were grouped together and compared to food secure households. Variables in black reflect the highest prevalence while those in red are significantly different. Food insecurity rates were significantly higher in western AFN regions (BC, AB, SK, MB). At the ecozone level, food insecurity was lowest in the Boreal Cordillera, in households with two or more individuals with full-time work, among participants reporting either wages or pension or "other" as their main income source, among male participants and among those participants who did not smoke and/or reported very good health. Additionally, food insecurity rates were marginally lower in households that did not participate in traditional food activities (4%). There was no significant difference in income-related food insecurity between participants who lived in communities with and without year-round road access or among those participants with different amounts of education. See Appendix I for the table with prevalence rates and adjusted odds ratios.

Table 4.1 Assessment of nutrient intake, all regions combined (n=6,201) using SIDE[1]

Nutrient		Men 19-50	Men 51-70	Men 71+	Women 19-50	Women 51-70	Women 71+
Nutrients with an EAR value	Carbohydrates	inconclusive	inconclusive	inconclusive	inconclusive	inconclusive	inconclusive
	Vitamin A	>50%	>50%	>50%	>50%	>50%	>50%
	Vitamin C	11-50%	>50%	>50%	11-50%	11-50%	>50%
	Vitamin D	>50%	>50%	>50%	>50%	>50%	>50%
	Folate	11-50%	11-50%	11-50%	11-50%	>50%	inconclusive
	Vitamin B6	inconclusive	11-50%	inconclusive	11-50%	>50%	11-50%
	Vitamin B12	0-10%	inconclusive	0-10%	0-10%	inconclusive	inconclusive
	Thiamin	inconclusive	0-10%	inconclusive	inconclusive	inconclusive	inconclusive
	Riboflavin	0-10%	inconclusive	inconclusive	inconclusive	inconclusive	inconclusive
	Niacin	0-10%	0-10%	0-10%	0-10%	0-10%	0-10%
	Calcium	>50%	>50%	>50%	>50%	>50%	>50%
	Iron	0-10%	inconclusive	inconclusive	inconclusive	0-10%	0-10%
	Magnesium	>50%	>50%	>50%	>50%	>50%	>50%
	Phosphorus	0-10%	inconclusive	0-10%	0-10%	inconclusive	inconclusive
	Zinc	inconclusive	11-50%	inconclusive	inconclusive	inconclusive	inconclusive
Nutrients with an AI value	Linoleic acid	mean < AI	mean < AI	mean < AI	mean >= AI	mean < AI	mean >= AI
	Linolenic acid	mean >= AI	mean >= AI	mean < AI	mean >= AI	mean >= AI	mean >= AI
	Fibre	mean < AI	mean < AI	mean < AI	mean < AI	mean < AI	mean < AI
	Potassium	mean < AI	mean < AI	inconclusive	mean < AI	mean < AI	mean < AI
Nutrients with an UL value	Vitamin C	0%	0%	0%	0%	0%	0%
	Vitamin D	0%	0%	0%	0%	0%	0%
	Vitamin B6	0%	0%	0%	0%	0%	0%
	Calcium	0%	0%	0%	0%	0%	0%
	Iron	0%	0%	0%	0%	0%	0%
	Phosphorus	0%	0%	0%	0%	0%	0%
	Zinc	0%	0%	0%	0%	0%	0%

Interpretation	
%< EAR	
0-10%	low prevalence of inadequate intake
11-50%	moderate prevalence of inadequate
>50%	high prevalence of inadequate intake
	adequacy of intake is inconclusive
AI	
mean >= AI	intake likely adequate
mean < AI	adequacy unknown
UL	
0%	no one over UL
1-50%	some over UL
>50%	many over UL

Notes:

[1] The SIDE SAS sub-routine nutrient analyses were performed on data from a total of 6,201 participants (4,010 women and 2,191 men) to obtain the distribution (percentiles) of usual intake. Nutrient data for 286 individuals were excluded: 245 pregnant and/or lactating women due to different nutrient requirements for these groups; 27 participants with missing age and age group values; and 14 participants with zero kcal intake.

Figure 4.1 Supplement use by region

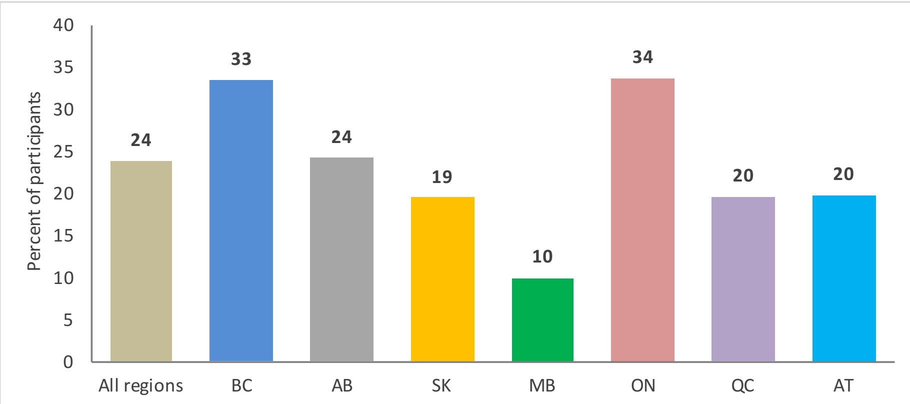


Table 4.2 Mean number of *Eating Well with Canada's Food Guide-First Nations, Inuit and Métis* (EWCGF-FNIM) servings compared to recommendations

Canada's Food Guide Recommended # of servings/day			Mean number of servings per day ± SE (95% CI)							
			All regions (n=4,030)	BC (n=662)	AB (n=351)	SK (n=675)	MB (n=452)	ON (n=856)	QC (n=392)	AT (n=642)
Women	7-8	Vegetables and Fruit	2.78 ± 0.07 (2.64, 2.91)	3.16 ± 0.07 (3.02, 3.3)	2.73 ± 0.22 (2.3, 3.15)	2.53 ± 0.11 (2.32, 2.75)	2.6 ± 0.24 (2.13, 3.08)	2.72 ± 0.19 (2.35, 3.09)	2.87 ± 0.13 (2.61, 3.13)	2.63 ± 0.08 (2.46, 2.8)
	6-7	Grain Products	4.79 ± 0.13 (4.54, 5.04)	4.14 ± 0.38 (3.39, 4.9)	5.11 ± 0.4 (4.34, 5.89)	4.99 ± 0.33 (4.34, 5.65)	4.88 ± 0.35 (4.19, 5.56)	4.65 ± 0.19 (4.28, 5.03)	5.45 ± 0.28 (4.9, 5.99)	4.4 ± 0.14 (4.13, 4.68)
	2-3	Milk and Alternatives	0.82 ± 0.04 (0.75, 0.89)	0.83 ± 0.09 (0.66, 1)	0.79 ± 0.14 (0.51, 1.07)	0.64 ± 0.07 (0.51, 0.77)	0.79 ± 0.09 (0.62, 0.96)	0.99 ± 0.09 (0.81, 1.17)	0.82 ± 0.03 (0.77, 0.88)	0.93 ± 0.06 (0.81, 1.04)
	2	Meat and Alternatives	3.2 ± 0.12 (2.97, 3.43)	3.47 ± 0.33 (2.81, 4.13)	3.4 ± 0.35 (2.71, 4.09)	2.92 ± 0.16 (2.61, 3.24)	3.18 ± 0.31 (2.56, 3.8)	3.24 ± 0.24 (2.76, 3.72)	3.14 ± 0.11 (2.93, 3.35)	2.36 ± 0.09 (2.18, 2.53)
			All regions (n=2,210)	BC (n=397)	AB (n=222)	SK (n=321)	MB (n=229)	ON (n=533)	QC (n=153)	AT (n=355)
Men	7-10	Vegetables and Fruit	3.0 ± 0.12 (2.75, 3.24)	3.37 ± 0.46 (2.47, 4.27)	2.79 ± 0.2 (2.39, 3.19)	2.96 ± 0.25 (2.48, 3.44)	2.85 ± 0.24 (2.38, 3.32)	2.99 ± 0.17 (2.66, 3.32)	3.04 ± 0.47 (2.11, 3.97)	2.87 ± 0.16 (2.55, 3.19)
	7-8	Grain Products	5.75 ± 0.22 (5.32, 6.18)	4.69 ± 0.42 (3.87, 5.51)	5.49 ± 0.51 (4.48, 6.5)	6.78 ± 0.82 (5.17, 8.39)	5.85 ± 0.17 (5.52, 6.18)	6.08 ± 0.17 (5.73, 6.42)	6.25 ± 1.83 (2.65, 9.86)	5.39 ± 0.29 (4.82, 5.97)
	2-3	Milk and Alternatives	0.95 ± 0.05 (0.85, 1.04)	0.82 ± 0.16 (0.51, 1.14)	0.95 ± 0.06 (0.82, 1.07)	0.98 ± 0.11 (0.77, 1.2)	0.88 ± 0.16 (0.56, 1.2)	1.09 ± 0.08 (0.94, 1.25)	0.88 ± 0.08 (0.71, 1.04)	1.06 ± 0.1 (0.86, 1.25)
	3	Meat and Alternatives	4.33 ± 0.18 (3.97, 4.68)	4.53 ± 0.47 (3.6, 5.47)	4.41 ± 0.4 (3.62, 5.2)	4.57 ± 0.31 (3.96, 5.17)	4.27 ± 0.59 (3.12, 5.43)	4.43 ± 0.36 (3.72, 5.14)	3.98 ± 0.51 (2.97, 4.98)	3.2 ± 0.14 (2.93, 3.48)

Table 4.3 Top 5 contributors to Canada's Food Guide (% of total group intake), First Nations women and men in Canada

Gender	Canada's Food Guide Food Groups							
	Vegetables and Fruit	(%)	Meat and Alternatives	(%)	Grain Products	(%)	Milk and Alternatives	(%)
Women	Fresh/frozen vegetables	25.4	Beef	20.3	White bread	23.2	Fluid milk	28.2
	Canned vegetables[a]	19.9	Chicken	18.6	Pasta/noodles	19.3	Cheese	21.8
	Potatoes	16.3	Wild meats[b]	13.6	Cereal[c]	10.4	Mixed dishes with cheese[e]	19.1
	Fruit	14.8	Pork	12.7	Whole wheat bread	10.2	Mashed potatoes with milk	11.4
	Fruit/vegetable juice	10.4	Eggs	9.6	Grains[d]	10.0	Cream soups	9.3
Men	Canned vegetables	22.5	Beef	20.0	White bread	27.1	Fluid milk	34.2
	Potatoes	20.9	Wild meats	19.8	Pasta/noodles	18.9	Mixed dishes with cheese	23.7
	Fresh/frozen vegetables	19.4	Chicken	15.9	Cereal	9.7	Cheese	15.7
	Fruit	12.3	Pork	14.0	Bannock	9.6	Cream soups	10.4
	Fruit/vegetable juice	10.4	Eggs	9.8	Grains	9.1	Mashed potatoes with milk	9.5

[a] Includes canned vegetable soups.
[b] Includes moose, caribou, deer, elk, rabbit, bear, beaver, groundhog, muskrat, porcupine, goose, duck, ptarmigan, grouse and pheasant.
[c] Includes both hot and cold cereal (51% hot/49% cold for women and 59% hot/41% cold for men).
[d] Includes rice, flour, wheatgerm, couscous.
[e] Includes macaroni and cheese, lasagna, pizza and cheeseburgers.

Table 4.4 Top 10 consumed store-bought beverages and foods (grams/person/day), consumers and non-consumers combined, ranked by overall decreasing amount of consumption, total participants

Total FNFNES participants (n=6,487)	
Beverages	grams/person/day
Coffee	427
Water, tap	401
Carbonated drinks, regular	213
Water, bottled	197
Tea	196
Fruit drink	93
Milk	67
Fruit juice	43
Carbonated drinks, diet	38
Iced tea	33

Total FNFNES participants (n=6,487)	
Food	grams/person/day
Soup	104
Pasta/noodles	64
Vegetables	63
Bread/buns, white	57
Potatoes	49
Fruits	45
Cereal	43
Mixed dishes	39
Chicken	36
Eggs	35

Table 4.5 Distribution of Healthy Eating Index (HEI) scores, by sex and age group (n=6,201)

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1,385	45.8 (0.8)	38.4 (1.6)	39.9 (1.3)	42.6 (1)	45.7 (0.9)	48.8 (1.1)	51.8 (1.5)	53.6 (1.8)
	51-70	680	51.8 (0.7)	40.3 (1.3)	42.9 (1.1)	47.3 (0.9)	52.2 (0.8)	56.9 (0.9)	61.0 (1.1)	63.2 (1.3)
	71+	126	50.9 (2.9)	39.1 (4.1)	41.6 (3.9)	45.7 (3.6)	50.6 (3.5)	55.6 (3.6)	60 (3.8)	62.3 (4)
Female	19-50	2,661	48.6 (0.4)	39.0 (0.9)	41.0 (0.8)	44.6 (0.7)	48.7 (0.5)	52.9 (0.5)	56.8 (0.7)	59.1 (0.8)
	51-70	1,131	52.0 (0.7)	42.6 (0.8)	44.8 (0.8)	48.2 (0.8)	52.1 (0.8)	56.0 (0.8)	59.6 (0.8)	61.7 (0.9)
	71+	218	53.9 (1.6)	44.4 (2.2)	46.7 (2.2)	50.4 (2.2)	54.5 (2)	58.3 (1.9)	61.5 (1.8)	63.3 (1.8)

Figure 4.2 Top 5 reported benefits of traditional food, all regions

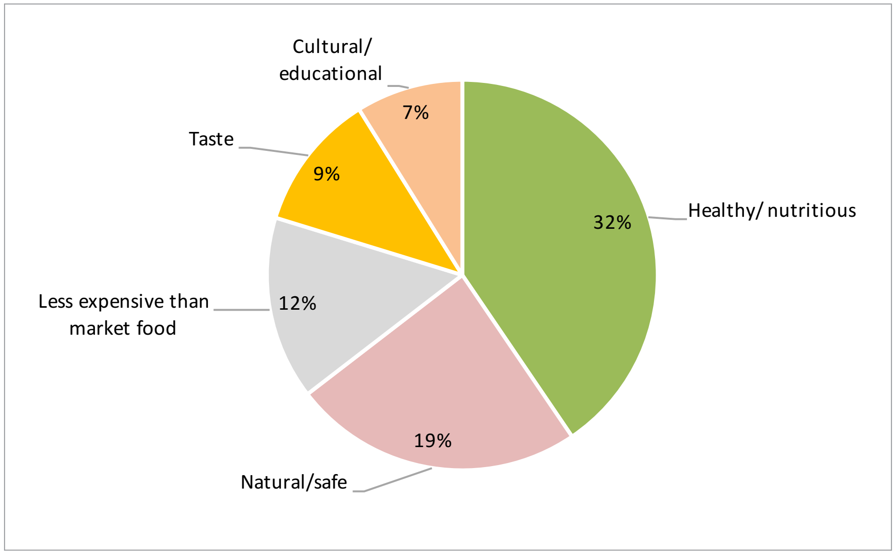


Figure 4.3 Top 5 reported benefits of store-bought food, all regions

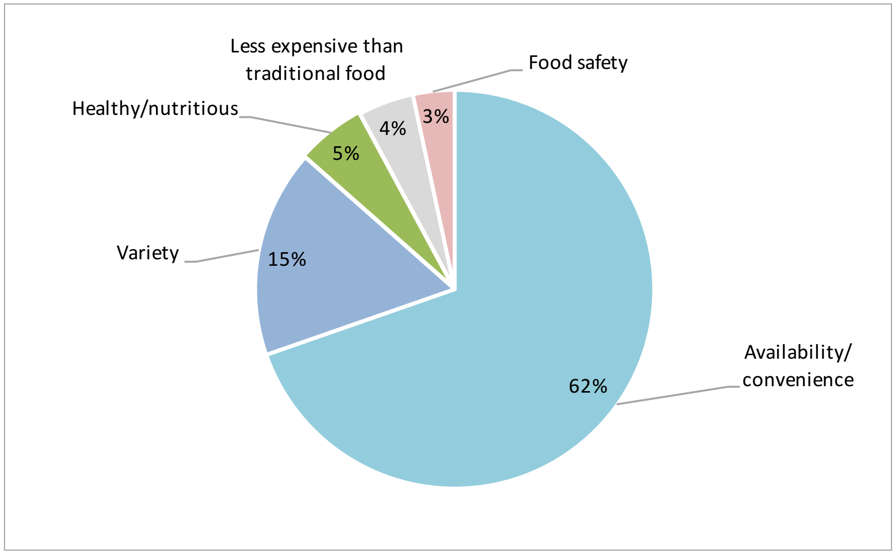


Figure 4.4 Mean (SE) percent of energy (calories) from traditional food for all adults from 24-hour recall data

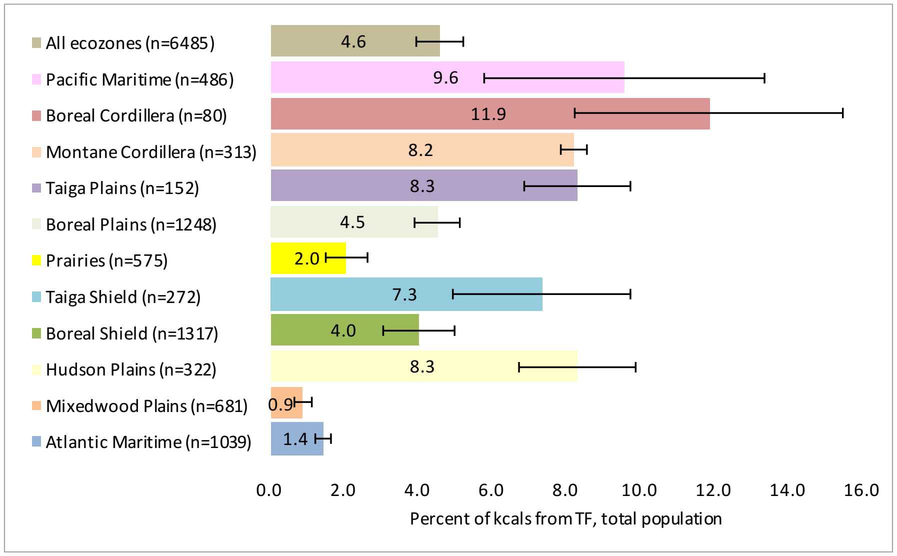


Figure 4.5 Mean (SE) percentage of calories from traditional food for consumers only, from 24-hour recall data

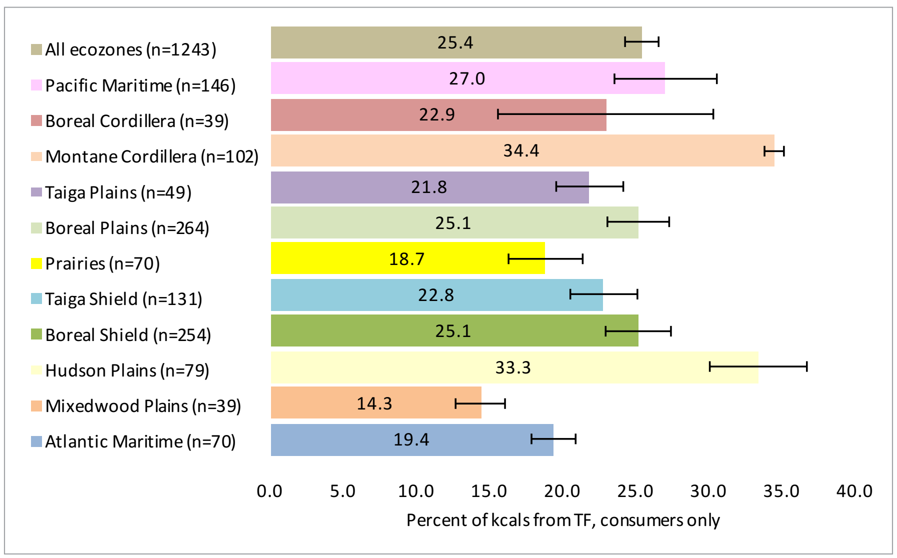


Table 4.6 Comparison of nutrient intake on days with and without traditional food

Nutrient	Days with TF (n=1,243 recalls)	Days without TF (n=5,242 recalls)
	mean ± SE	
Calories, kcal***	2,044 ± 28.85	1,912 ± 13.43
Protein, grams***	150 ± 3.26	74.7 ± 0.6
Fat, grams***	71.1 ± 1.3	78.5 ± 0.69
Carbohydrates, grams***	207 ± 3.40	232 ± 1.78
Total sugars, grams***	68.4 ± 1.87	79.5 ± 0.92
Fibre, grams***	12.2 ± 0.23	13.2 ± 0.12
Cholesterol, grams***	453 ± 11.12	312 ± 3.73
Total saturated fat, grams***	20.3 ± 0.4	25.4 ± 0.24
Monounsaturated fat, grams***	27.3 ± 0.59	30.1 ± 0.28
Polyunsaturated fat, grams	15.1 ± 0.34	15.6 ± 0.18
Linoleic acid, grams**	11.2 ± 0.27	12.3 ± 0.14
Linolenic acid, grams***	1.84 ± 0.06	1.37 ± 0.02
Calcium, mg**	576 ± 11.2	612 ± 6.26
Iron, mg***	24.6 ± 0.59	12.9 ± 0.11
Zinc, mg***	22.1 ± 0.61	10.2 ± 0.10
Magnesium, mg***	301 ± 5.21	231 ± 1.78
Copper, mg***	1.92 ± 0.05	1.13 ± 0.02
Potassium, mg***	3,308 ± 56.1	2,258 ± 17.2
Sodium, mg***	2,709 ± 56.5	3,136 ± 27.1
Phosphorus, mg***	1,770 ± 33.47	1,076 ± 8.44
Vitamin A, µg**	630 ± 56.7	453 ± 6.8
Vitamin D, µg***	10.6 ± 0.69	3.22 ± 0.05
Vitamin C, mg*	91.5 ± 4.26	79.9 ± 1.85
Folate, µg	347 ± 7.08	350 ± 3.48
Thiamin, mg	1.62 ± 0.03	1.63 ± 0.02
Riboflavin, mg***	2.44 ± 0.04	1.87 ± 0.01
Niacin, mg***	58.2 ± 1.17	35.4 ± 0.29
Vitamin B6, mg***	1.95± 0.04	1.41 ± 0.01
Vitamin B12, µg***	21.5 ± 1.11	3.95 ± 0.13

*Significantly different, unpaired t-test, *p<0.05; **p<0.01; ***p<0.0001.

Figure 4.6 Percentage of adults who are overweight and obese by region

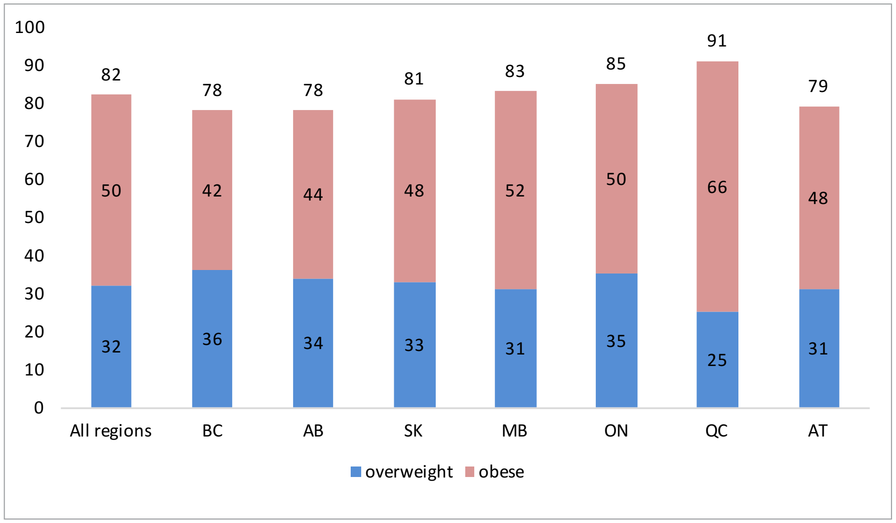


Figure 4.8 Smoking by region

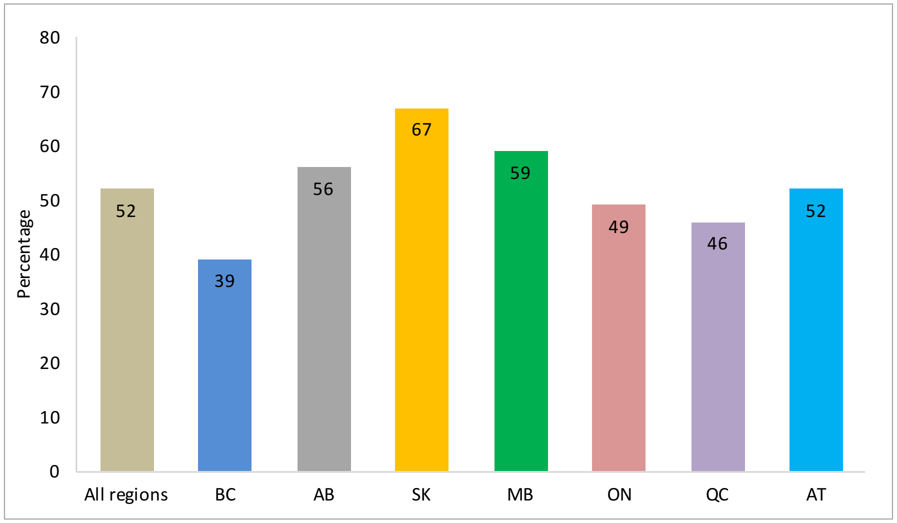


Figure 4.7 Percentage of adults who are overweight or obese by ecozone

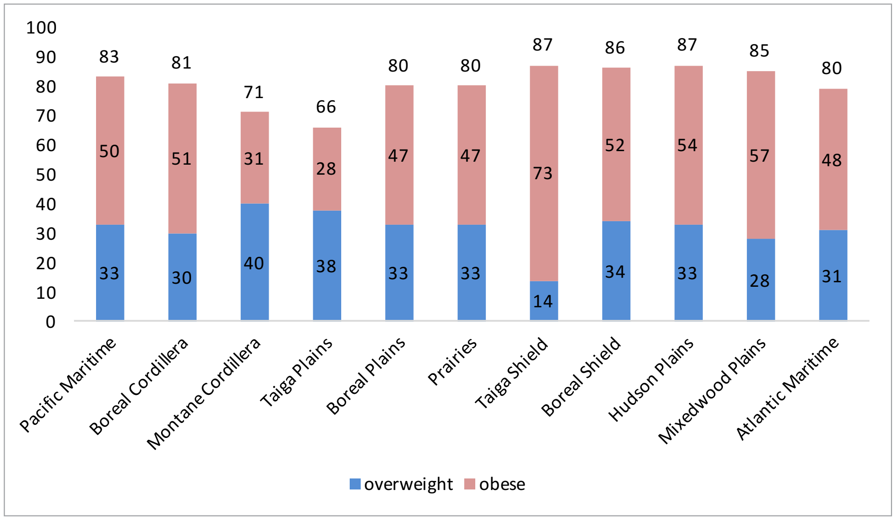


Figure 4.9 Smoking by ecozone

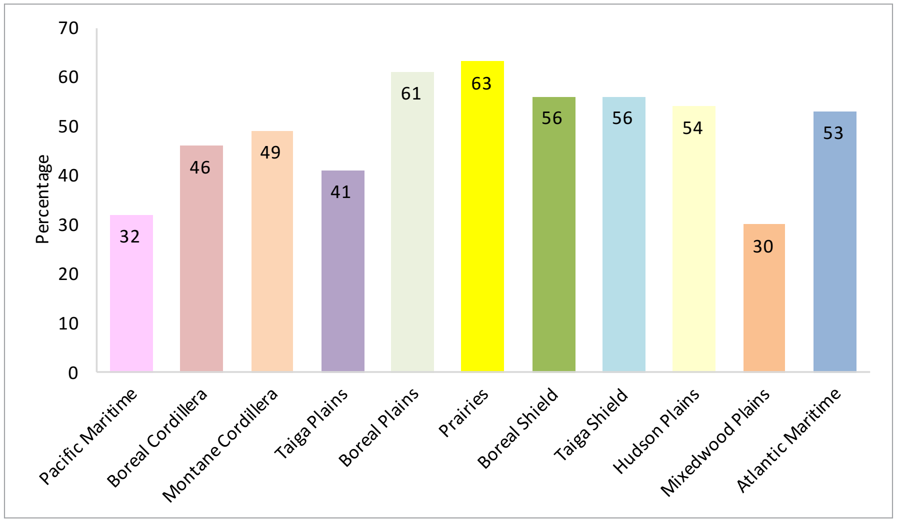


Figure 4.10 Self-reported activity levels by region

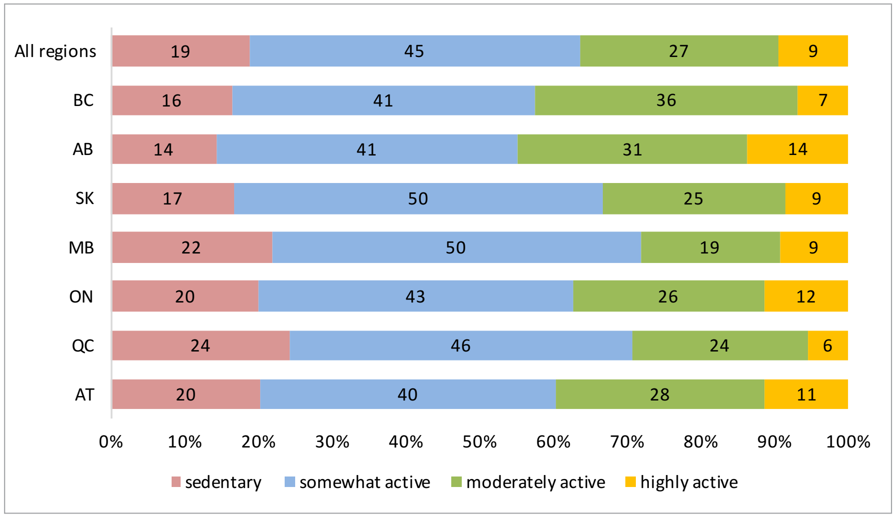


Figure 4.12 Diabetes by region (crude weighted)

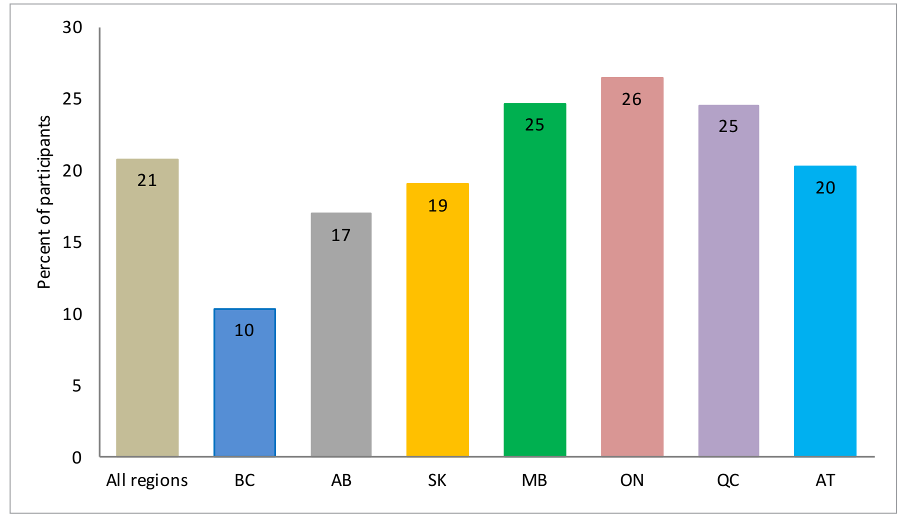


Figure 4.11 Self-reported activity levels by ecozone

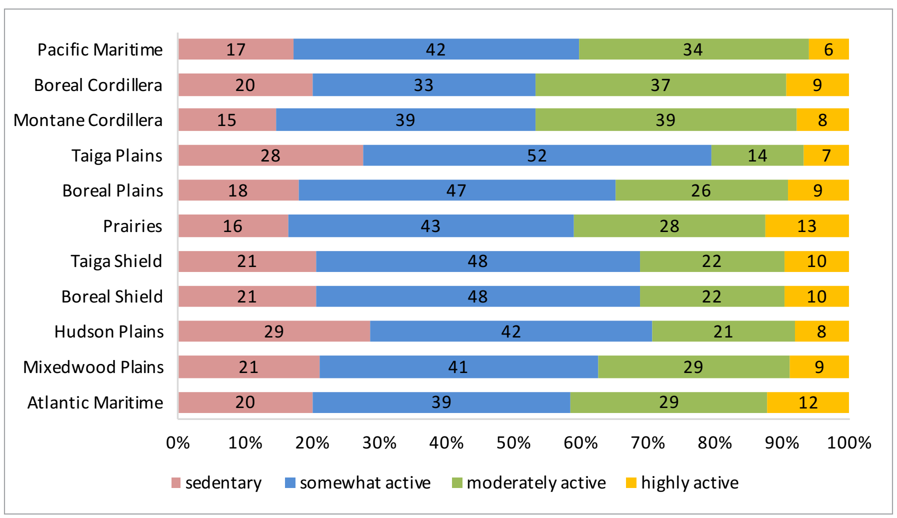


Figure 4.13 Diabetes prevalence by gender and age

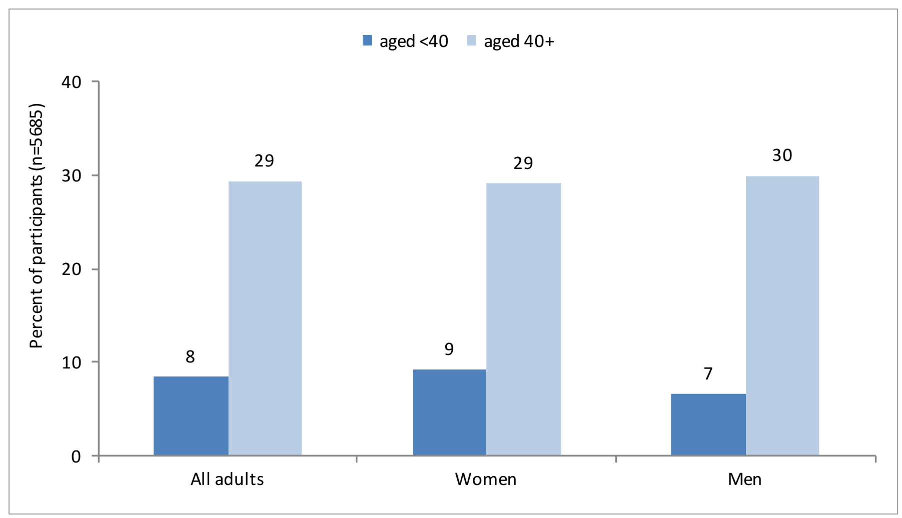
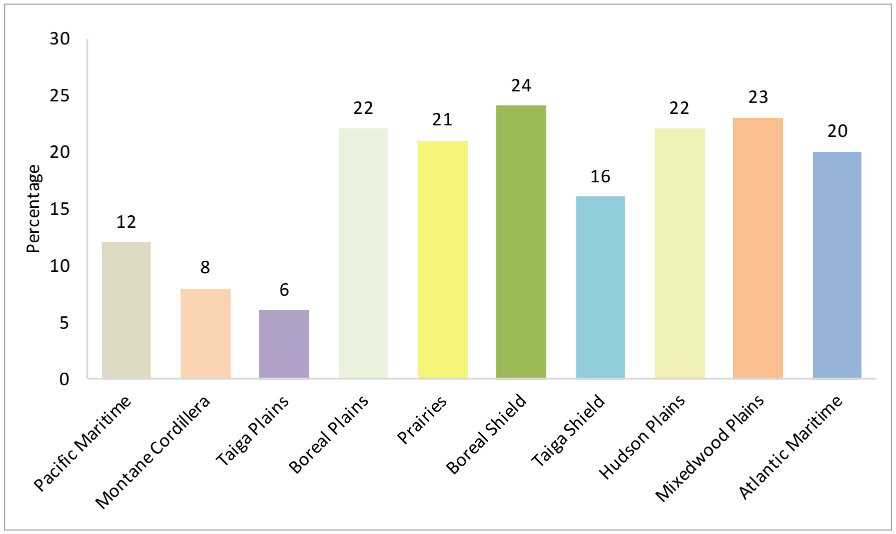


Figure 4.14 Diabetes by ecozone (crude weighted)



Note: As there were no data on diabetes collected in the Boreal Cordillera, this ecozone was not included.

Figure 4.15 Type of diabetes reported

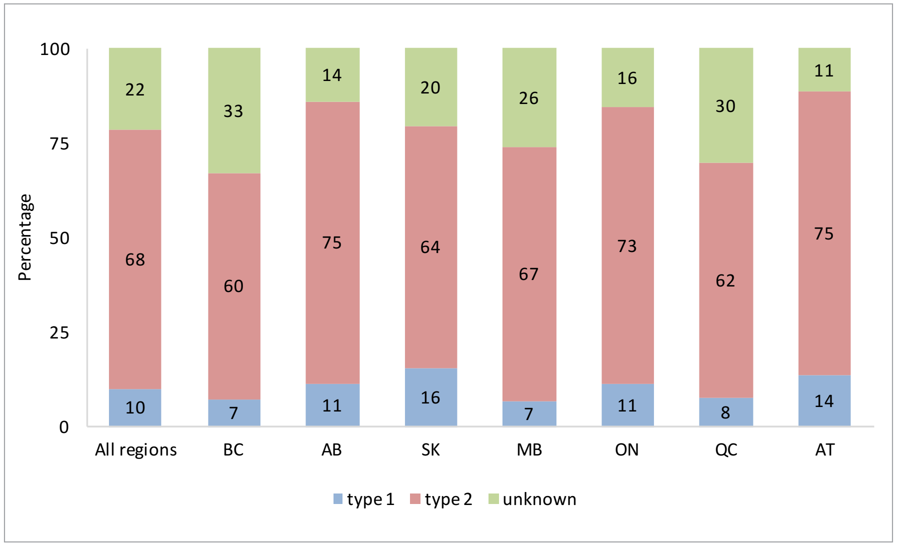


Figure 4.16 Rate of smoking among those who self-identified as having diabetes

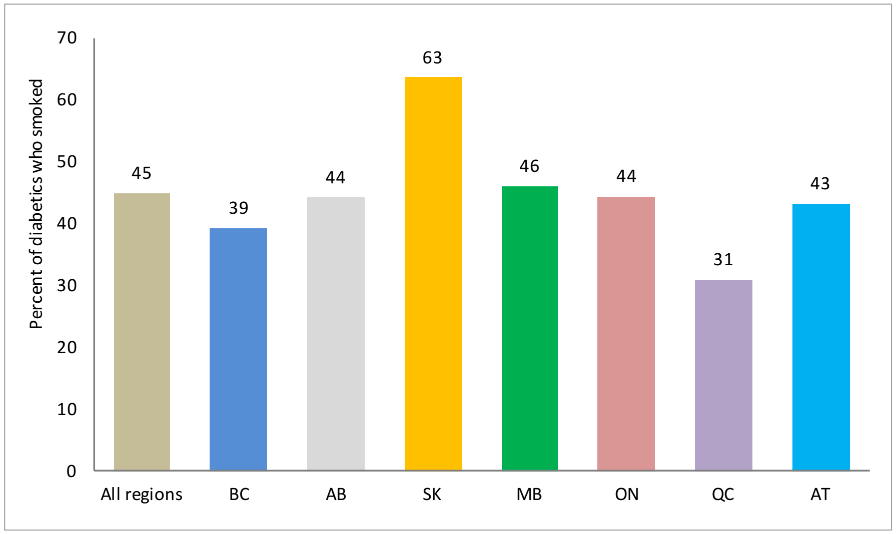


Figure 4.17 Diabetes prevalence by gender (age-standardized and crude weighted)

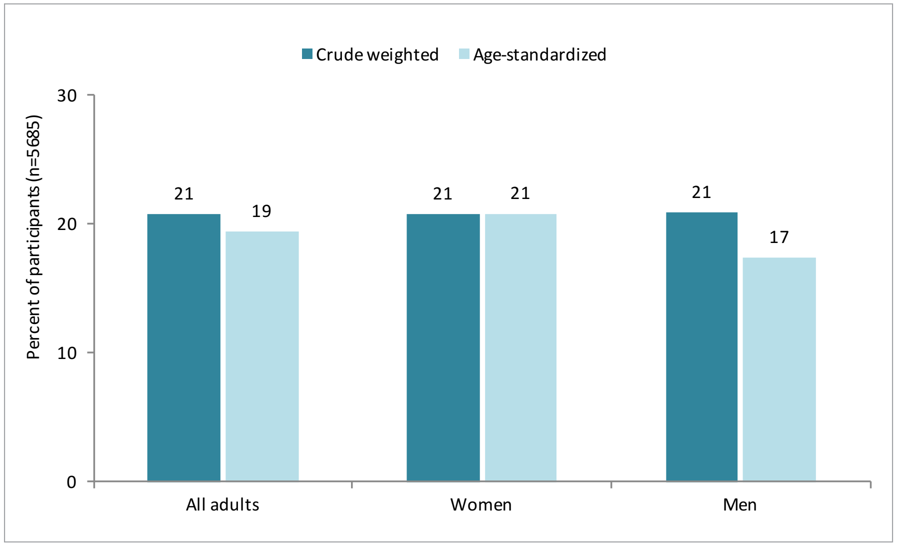
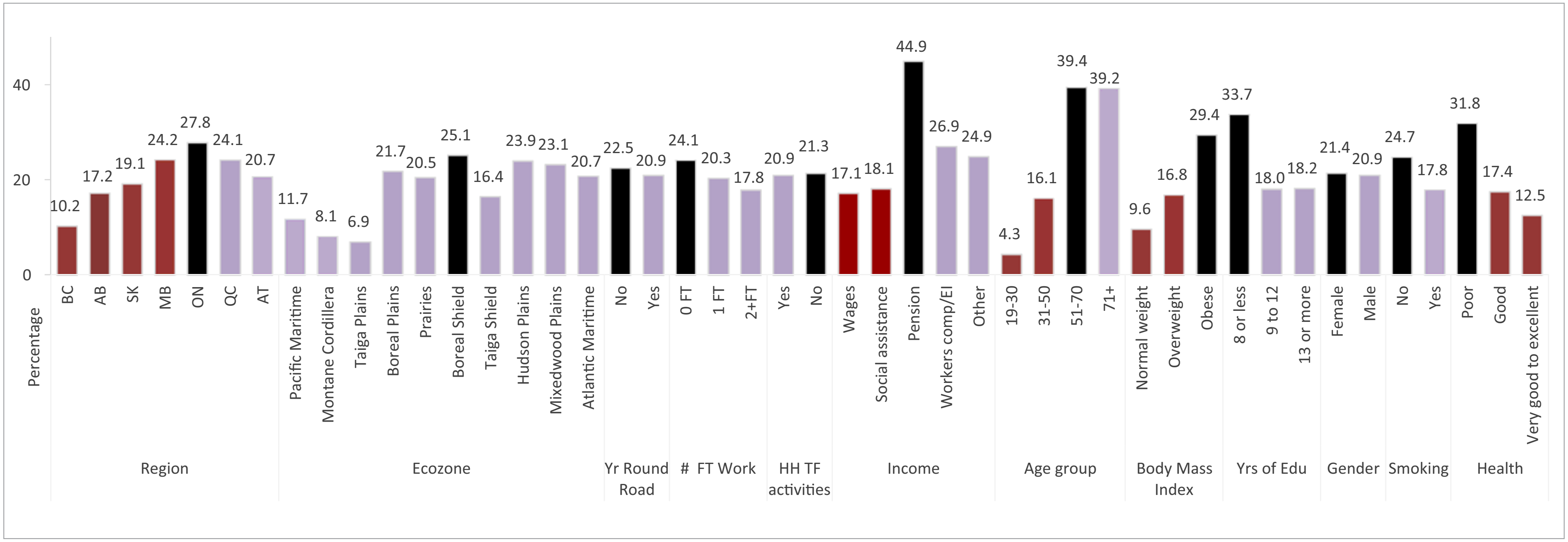


Figure 4.18 Predictors of diabetes



Note: Diabetes values are weighted. Values in each independent variable (region, ecozone, year round access, number of people working full-time, TF activities, income, age group, BMI, years of education, gender, smoking, self-reported health) were tested for significance against maximum prevalence identified in black. Values with no significant differences are presented in purple. Values in red are significantly less than max (AOR<1, p<0.05)*. Significant differences in the prevalence of diabetes by region and ecozone were generally not seen due to large standard errors which suggests wide variability between individuals in these ecozones. Note: For health variable "very good" is comprised of self-perceived health is "very good" to "excellent", while "poor" is comprised of "poor" and "fair" responses. See Appendix I for more information.

Figure 4.19 Self-reported health status

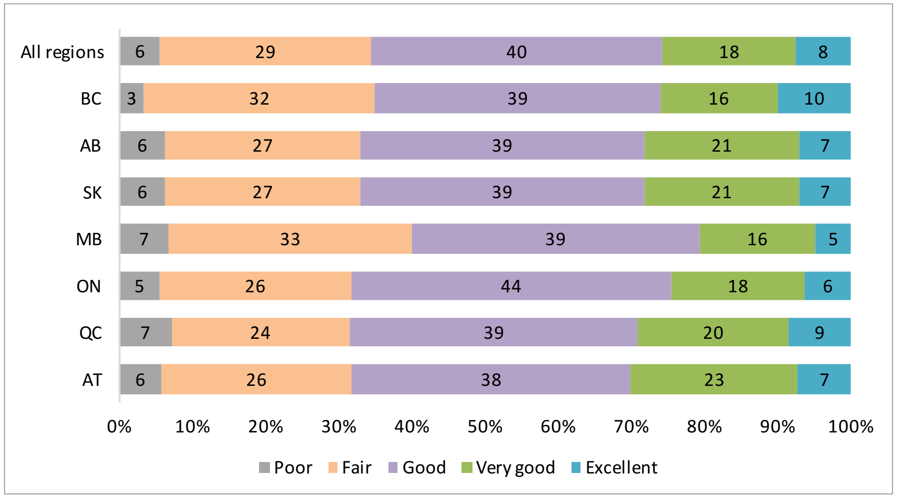


Figure 4.20 Self-reported health status by ecozone

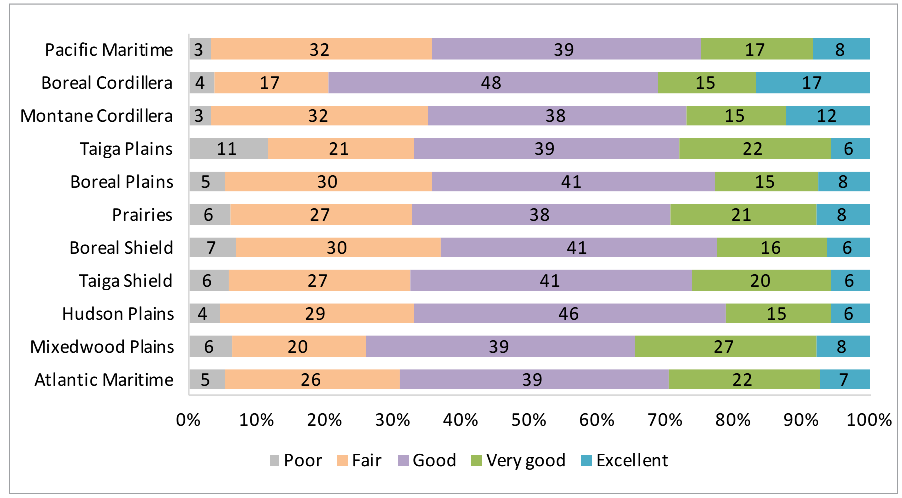
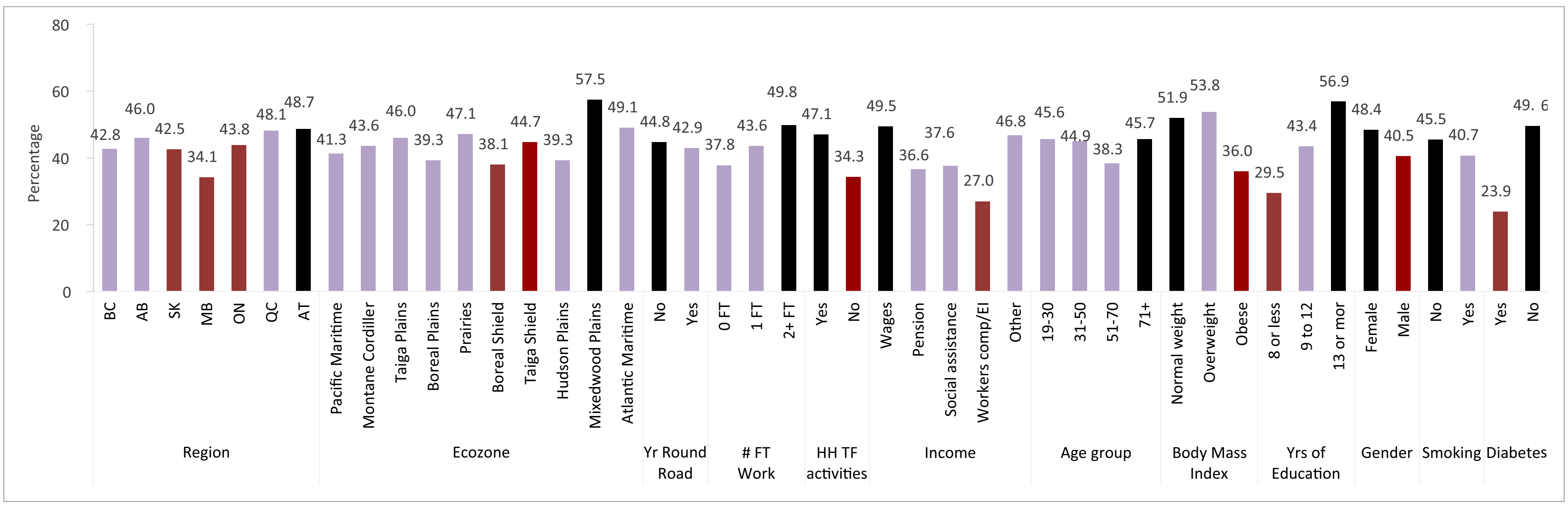


Figure 4.21 Predictors of self-reported health status (“very good to excellent” vs “poor and fair”), unadjusted



Note: Values in each independent variable (region, ecozone, road access, #FT, TF activity, income, age group, BMI, Years of education, gender, diabetes, smoking) were tested for significance against maximum prevalence identified in black. Values in red are significantly less than max (AOR<1, p<0.05).

Values in purple are not significantly different from max. See Appendix I for more information.

Figure 4.22 Percentage of participants who experienced a traditional food shortage and worried about the status of their traditional food supply in the last 12 months

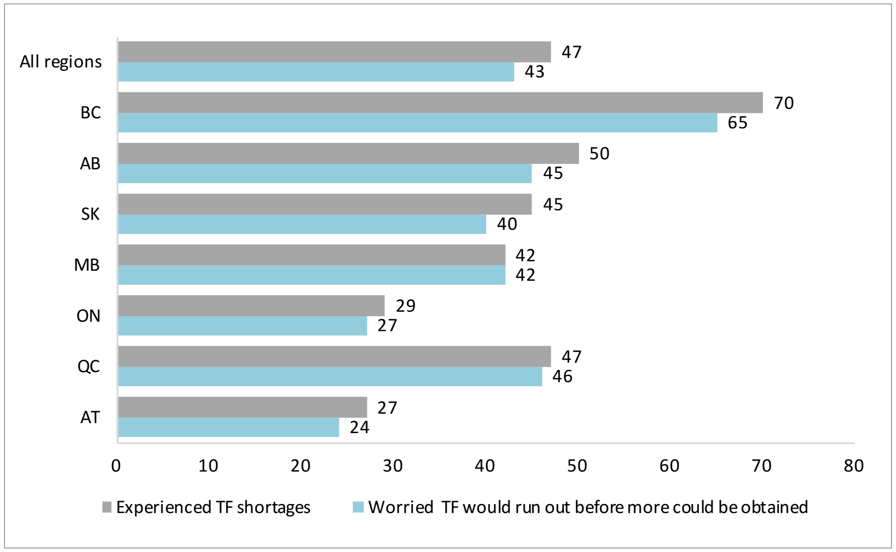
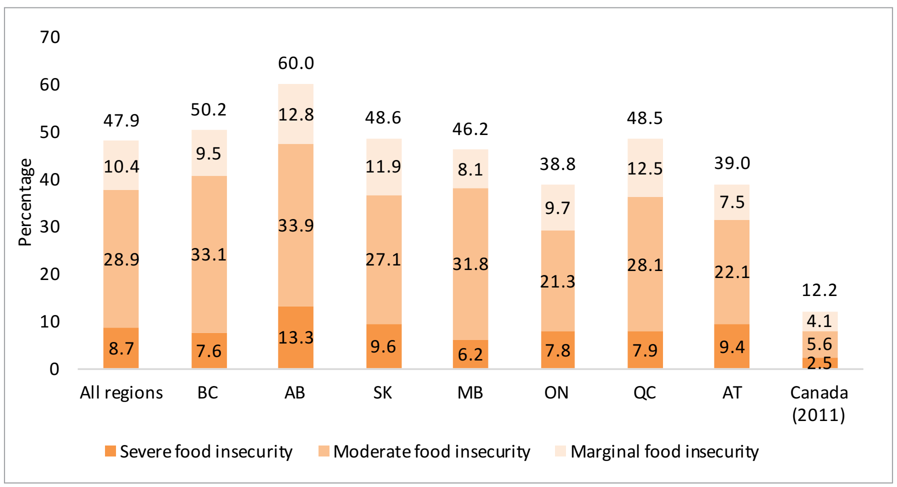


Figure 4.23 Household food insecurity by region, compared to Canada



Note: Each regional rate reported in this study was tested for significance against the other rates. The rate for Alberta was significantly higher than all other regions (Chi-square analyses, p<0.0001).

Figure 4.24 Household food insecurity by ecozone

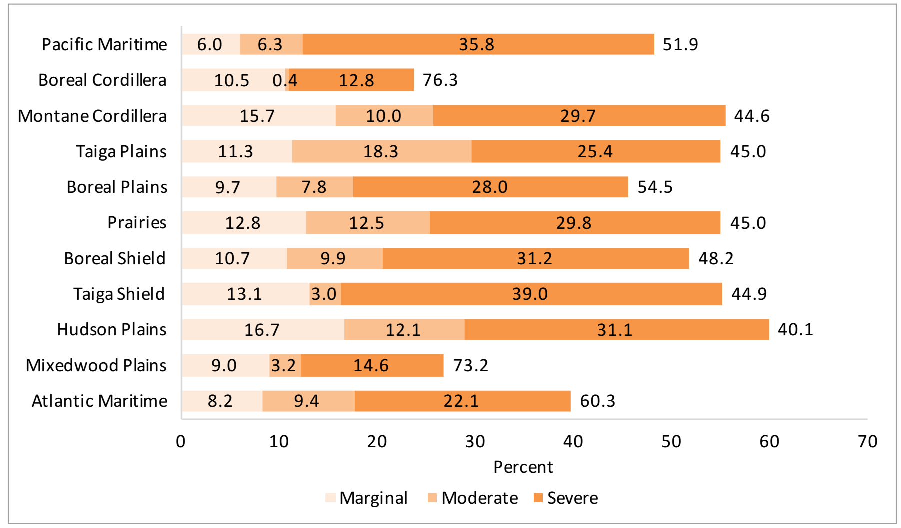
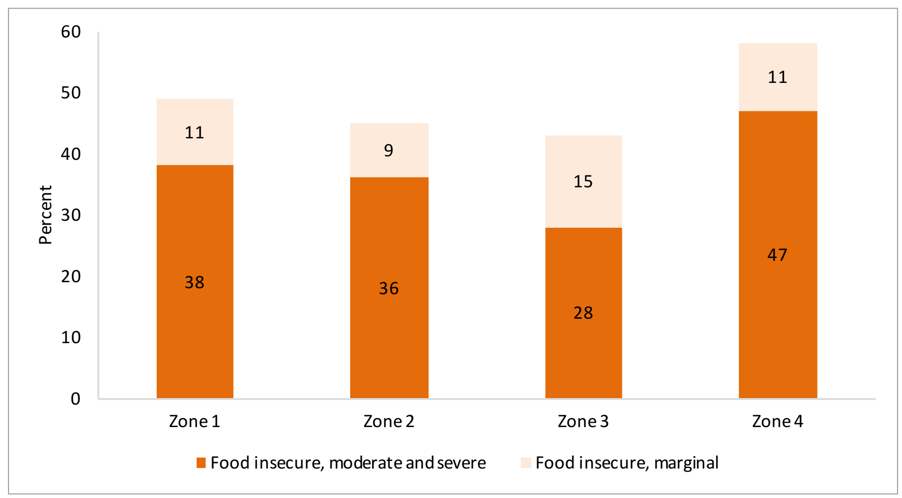


Figure 4.25 Household food insecurity rates by remoteness (INACRIZ zones)

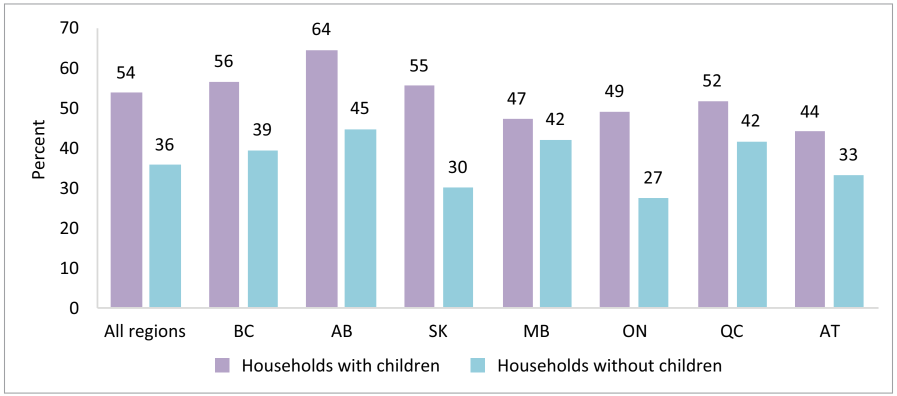


Notes: P<0.0001 Chi-Square analyses (food security rates in Zone 4 significantly higher than in other zones). Only 2% (unweighted; 4% weighted) of participating communities found in Zone 3. INACRIZ zones are defined in Chapter 2.

Table 4.7 Income-related household food security status for First Nations across Canada, by households with and without children, in the previous 12 months

		INCOME-RELATED FOOD SECURITY STATUS														
		Food Secure			Food Insecure											
		All			All			Marginal			Moderate			Severe		
		n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI
All households	Household status	3,461	52.1	50-54	2,797	47.9	46-50	600	10.4	9-12	1,632	28.9	27-30	565	8.7	8-10
	Adult status	3,576	54.0	52-56	2,638	45.5	44-47	509	8.9	8-10	1,574	28.2	26-30	555	8.4	7-10
	Child status	2,266	61.5	59-64	1,062	28.8	27-31	180	3.3	3-4	790	21.0	19-23	92	3.0	2-4
Households with children	Household status	1,788	46.4	44-48	1,868	53.6	52-56	423	12.2	11-14	1,113	32.2	30-34	332	9.2	8-11
	Adult status	1,903	49.1	47-51	1,709	50.0	48-52	332	10.0	9-12	1,055	31.2	29-33	322	8.8	8-10
	Child status	2,266	61.5	59-64	1,062	28.8	27-31	180	4.8	4-6	790	21.0	19-23	92	3.0	2-4
Households without children	Household status	1,673	64.4	62-67	929	35.6	33-38	177	6.5	5-8	519	21.6	19-24	233	7.5	6-9

Figure 4.26 Household food insecurity in First Nations households with and without children, by total and region (including marginal category)



Notes: Rates were tested for significant differences between households with and without children using Chi-Square analyses. Overall, households with children experienced significantly greater food insecurity than those without children. In households with children, the rate in AB was significantly higher than all other regions except for BC. In households without children, the rate in AB was significantly higher compared to the AT, ON and SK but rates were similar to BC, MB and QC.

Figure 4.27 Household food insecurity in First Nations households with and without children, by ecozone (including marginal category)

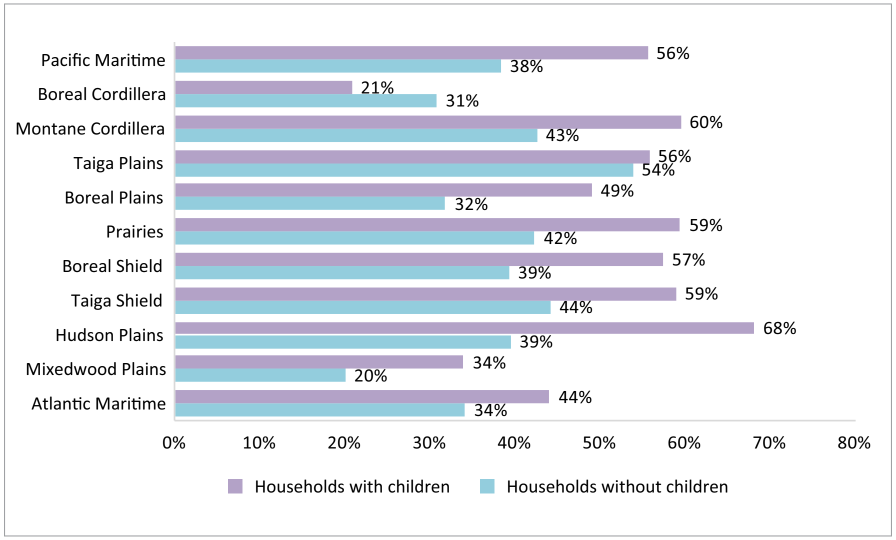


Figure 4.28 Degree of food insecurity in households with children by ecozone

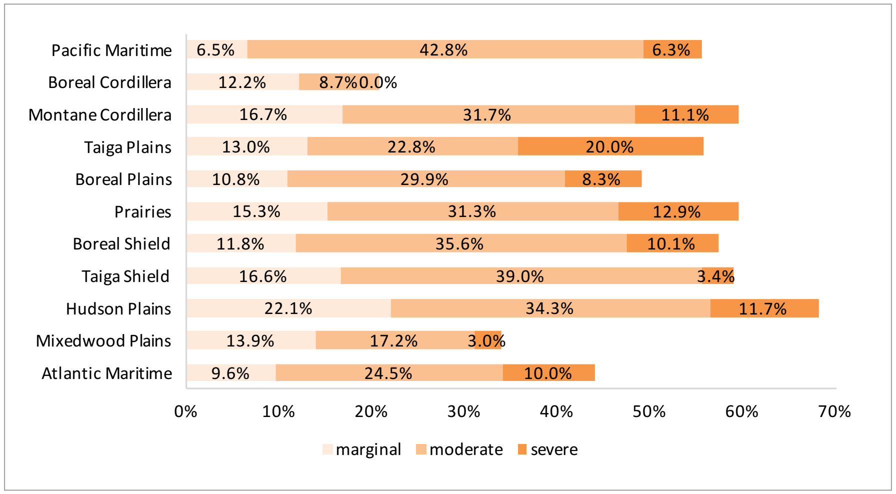


Figure 4.29 Healthy food basket costs comparisons: average cost among FNFNES participating communities, maximum community cost and cost in a major urban centre

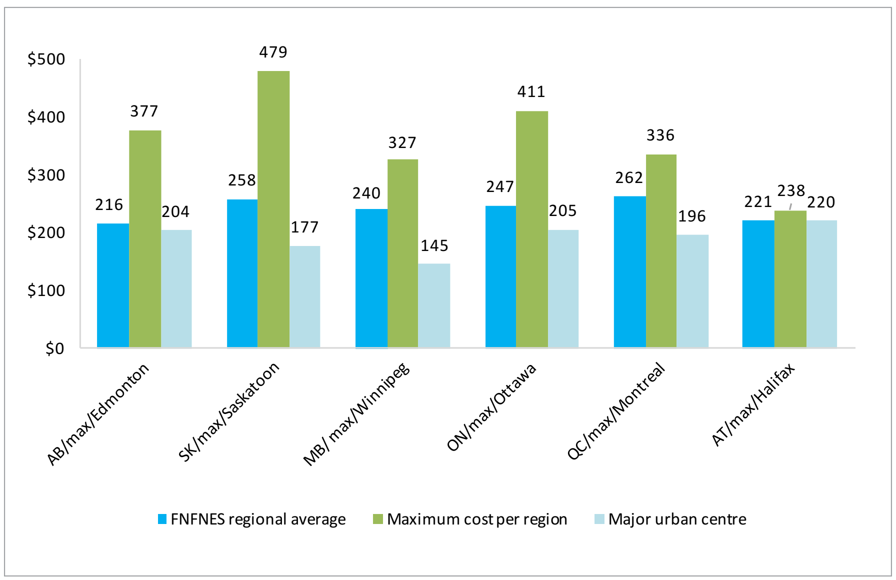
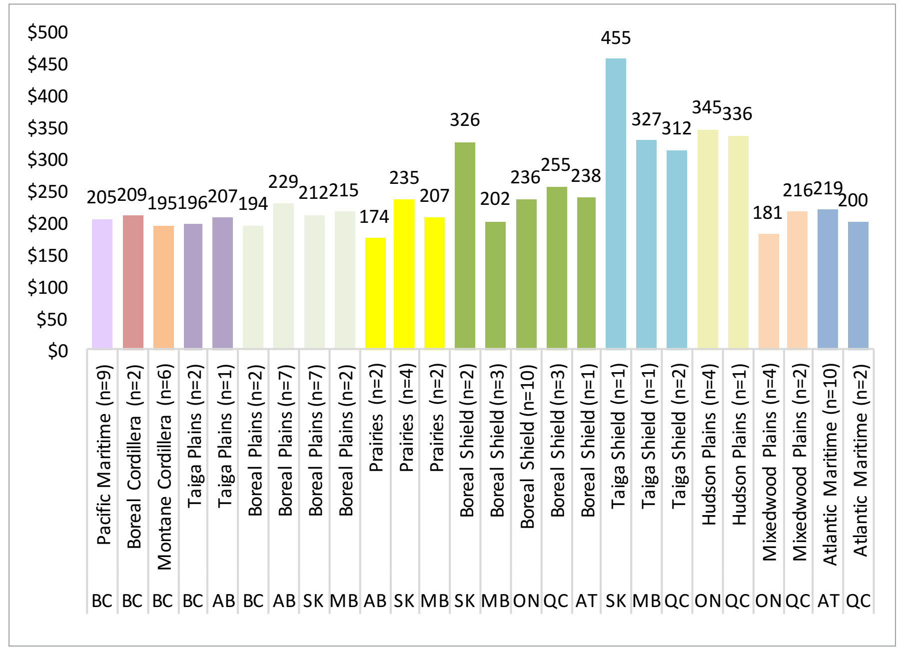


Figure 4.30 Average food basket costs in communities by region and ecozone

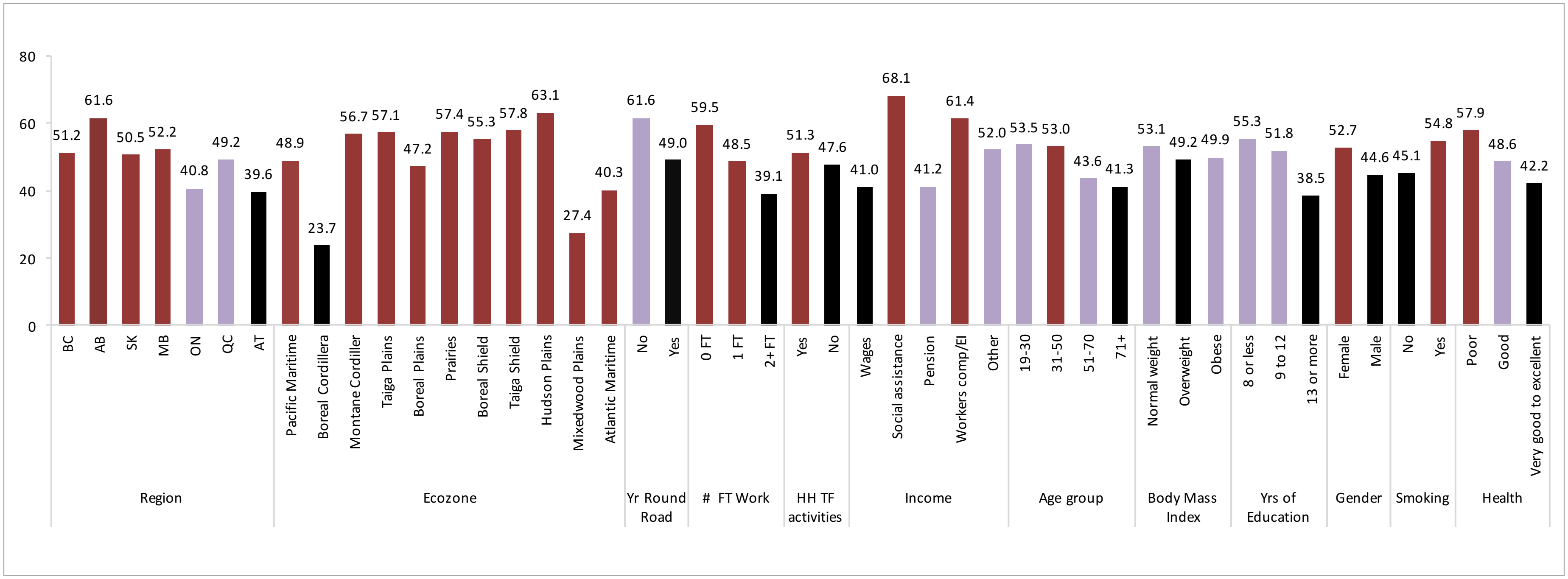


Note: Food costs were imputed from BC using 2009 data from the Provincial Health Services Authority. Prices were gathered in 2010 (Manitoba), 2011/2012 (ON), 2013 (AB), 2014 (AT), 2015 (SK), 2016 (QC). The average food basket cost across the reference major urban centre in each region was $191.

Table 4.8 Average food basket costs for a family of four by INACRIZ zones

INACRIZ zone	Number of communities	Average cost	Average cost difference from Zone 4
1	37	200.55	-140.41
2	36	210.14	-130.82
3	3	228.44	-112.52
4	17	340.96	-

Figure 4.31 Predictors of food insecurity



Note: Values in each independent variable (region, ecozone, year round access, number of people working full-time, TF activities, income, age group, BMI, years of education, gender, smoking, self-reported health) were tested for significance against minimum prevalence identified in black. Values with no significant differences are presented in purple. Values in red are significantly higher than minimum prevalence (AOR<1, p<0.05). See Appendix I for more information.

CHAPTER 5

Water Quality

Tap Water

The drinking water component of FNFNES aimed to estimate the chemical safety of the community water supplies through collection of tap water samples from 20 participating households in every community. In each household, two tap water samples were collected: the first draw sample was collected after the water had been sitting stagnant in the pipes for a minimum of four hours and a second draw sample was taken after running the water for five minutes, or until cold to flush out the water that had been sitting in the pipes. All samples were analysed by a contract lab: MAXXAM Analytics in Burnaby analysed samples from BC, Manitoba and Ontario (year 1) while ALS Global analysed samples collected in Ontario (year 2), Alberta, the Atlantic, Saskatchewan and Quebec. Additionally, in each First Nation a series of questions were asked about the community water system and use of water at the household level. In this chapter, results for tap water are presented at the regional and ecozone levels. Further details can be found in the regional reports available at fnfnes.ca.

FARAH CHEEZO, LA NATION ANISHNABE DU LAC SIMON, PHOTO BY MARIE PIER BOLDUC

Availability and Use at the Household Level

Almost all respondents (99.5%) reported that they had tap water: 79% of households reported receiving tap water from the community's public water system (71.2% piped, 7.6% trucked in), while 14.8% were on a well or individual water system and 2.2% of households received water through a municipal transfer agreement. Additionally, 4% reported that they obtained water from nearby surface water sources and 0.2% said they used a rainwater cistern. Although almost all households have tap water, only 73.9% reported using it for drinking while 92.5% reported using tap water for cooking purposes. Tap water avoidance is mainly due to concerns about the taste and colour of the water. Information by ecozone is presented in Figure 5.1.

Trace Metals of Human Health Concern

The FNFNES quantified 10 metals of concern to human health in drinking water samples when the maximum acceptable concentration (MAC) of the Guidelines for Canadian Drinking Water Quality were exceeded in the flushed samples (Health Canada 2017):

- Antimony;
- Arsenic;
- Barium;
- Boron;
- Cadmium;
- Chromium;
- Lead;
- Mercury;
- Selenium; and
- Uranium.

The results of water sampling testing for metals of public health concern in drinking water are listed in Table 5.1 by ecozone. Of the 1,516 households, exceedances of these metals were found in 1.9% (29/1,516). Three households had elevated arsenic in the first draw sample with one exceedance in the flushed sample. Seventy households had elevated lead in the first draw with three exceedances in the flushed samples and three exceedances in the duplicates. One of those households was resampled and the follow up sample was below the guideline value. One household had elevated selenium in the first draw sample and a selenium exceedance in the flushed sample. Lastly, 24 households had elevated levels of uranium in the first draw sample and exceedances in the flushed sample: three duplicate uranium samples also exceeded the Canadian guideline.

Arsenic

One community had arsenic above the guideline value of 10 µg/L (in flushed samples):

- Three households in two communities in the Prairies ecozone in the Saskatchewan region had first draw sampling levels ranging from 11 to 14 µg/L. Following a five-minute flush, there was one exceedance in one of the Prairie communities and one duplicate exceedance. One household had an elevated level of 12 µg/L in the flushed sample and a second household had an elevated level of 10.9 µg/L in the duplicate flushed sample. These results indicate that, in the homes where levels remained elevated after flushing, the water should not be used for drinking or cooking. In the home that had an acceptable level after flushing, the water needs to be run for several minutes before being used for drinking or cooking. This information was communicated to Chief and Council.

Lead[10]

Three communities had lead levels above the guidance value of 10 µg/L (in flushed samples):

- Three households, each one located in three separate communities in the Pacific Maritime ecozone in the British Columbia region, had a first draw sampling level ranging from 11 to 20 µg/L. Following a five-minute flush, the lead levels were acceptable.

10 The guideline for lead has been updated in the *Guidelines for Canadian Drinking Water Quality: Guideline Technical Document — Lead* (Health Canada 2019). The maximum acceptable concentration (MAC) for total lead in drinking water is 0.005 mg/L (5 µg/L), based on a sample of water taken at the tap and using the appropriate protocol for the type of building being sampled. Every effort should be made to maintain lead levels in drinking water as low as reasonably achievable (or ALARA).

- Six households in three communities within the Boreal Plains ecozone in the Alberta (1), Saskatchewan (1) and Manitoba (1) regions had first draw sampling levels ranging from 10 to 44 µg/L. Following a five-minute flush, the lead level remained above the guideline in one household in the Saskatchewan region with a level of 22 µg/L and an elevated level of 22.6 µg/L in the duplicate flushed sample. Tap water in this home should not be used for drinking or cooking. This information was communicated to Chief and Council.
- Two households, located in two separate communities in the Prairies ecozone (one in the Saskatchewan region and one in the Manitoba region) had first draw samples elevated from 11 to 12 µg/L. Following a five-minute flush, the lead levels were acceptable.
- Thirty-seven households in nine communities in the Boreal Shield ecozone in the regions of Manitoba, Ontario and the Atlantic had first draw samples elevated ranging from 11 to 120 µg/L. Following a five-minute flush, one household in the Manitoba region, which had an elevated level in the first sample of 51 µg/L remained above the guideline with a level of 25 µg/L. Tap water in this home should not be used for drinking or cooking. This information was communicated to Chief and Council.
- Two households in two communities in the Taiga Shield ecozone in the Saskatchewan and Manitoba regions had first draw sampling levels of 11 µg/L. Following a five-minute flush, the lead levels were acceptable.
- Twelve households in the Hudson Plains ecozone located in three communities within the Ontario and Quebec regions had elevated first draw samples ranging from 10 to 62.3 µg/L. Following a five-minute flush, the lead levels were acceptable.
- Eight households located in five communities in the Mixedwood Plains ecozone in the Ontario and Quebec regions had elevated lead levels in the first draw sample ranging from 12 to 34 µg/L. Following a five-minute flush, the lead level remained above the guideline in one household in Ontario region with a level of 12 µg/L. Tap water in this home should not be used for drinking or cooking. This information was communicated to Chief and Council.

Selenium

One community had selenium above the guidance value of 50 µg/L (in flushed samples):

- One household in a community in the Prairies ecozone in the Saskatchewan region had a first draw sampling level of 79 µg/L. Following a five-minute flush, this household still had a selenium level of 76 µg/L. This indicates that water from this household should not be used for drinking or cooking purposes. This information has been communicated to the Chief and Council.

Uranium

Three communities had uranium levels above the guidance value of 20 µg/L (in flushed samples):

- Two households in one community in the Prairies ecozone in the Saskatchewan region had first draw uranium levels from 29 to 30 µg/L. Following a five-minute flush, the uranium levels remained elevated from 28 to 46 µg/L. This indicates that water from this household should not be used for drinking or cooking purposes. This information has been communicated to the Chief and Council.
- Twenty-two households in two communities in the Boreal Shield ecozone in the Ontario region had first draw uranium levels from 20 to 58 µg/L. Following a five-minute flush, the uranium levels remained elevated with a range of 21 to 38 µg/L. This indicates that water from this household should not be used for drinking or cooking purposes. This information has been communicated to the Chief and Council.

Metals with Aesthetic Objective (AO) and Operational Guidance (OG)

The FNFNES quantified six metals that have operational guidance values (OG) and aesthetic objectives (AO):

- Aluminum;
- Copper;
- Iron;
- Manganese;
- Sodium; and
- Zinc.

All six metals had concentrations above the aesthetic guidelines of the Canadian Guidelines of Drinking Water Quality (Health Canada 2017). The results of water sample testing for metals with OG and AO values in drinking water are listed in Table 5.2. Of the 1,516 households, exceedances of metals with OG or AO was 30% (453/1,516).

Aluminum

Two hundred and eight households in 23 communities had aluminum levels above the guidance value of 100 µg/L (in flushed samples):

- Six households in one community in the Montane Cordillera ecozone in British Columbia had elevated aluminum levels ranging from 140 to 287 µg/L. After a five-minute flush, the aluminum levels remained above guideline in eight households.
- Forty-three households in four communities in the Boreal Plains ecozone (one community in the Alberta region, two communities in the Saskatchewan region and one community in the Manitoba region) had elevated aluminum levels ranging from 110 to 449 µg/L in the first draw samples. After a five-minute flush the aluminum levels remained above guideline in 41 households.
- Fifteen households in one community in the Taiga Shield ecozone in the Manitoba region had elevated aluminum levels ranging from 571 to 1,060 µg/L. After a five-minute flush, the aluminum levels remained above guideline in all 15 households.
- Fifty-seven households in nine communities in the Boreal Shield ecozone (one community in Saskatchewan, three communities in Manitoba, three communities in Ontario, one community in Quebec and one community in the Atlantic region) had elevated aluminum levels ranging from 127 to 33,100 µg/L. After a five-minute flush, the aluminum levels were above guideline in 77 households.
- Seventeen households in one community in the Prairies ecozone in the Manitoba region had elevated aluminum levels ranging from 133 to 290 µg/L. After a five-minute flush, the aluminum levels remained above the guideline level in 14 households.
- Twenty-one households in two communities in the Hudson Plains ecozone in the Ontario region had elevated aluminum levels ranging from 127 to 1,920 µg/L. After a five-minute flush, the aluminum levels remained above guideline in 21 households.
- Eleven households in two communities in the Mixedwood Plains ecozone in the Ontario region had elevated aluminum levels ranging from 105 to 596 µg/L in the first draw samples. After a five-minute flush, the aluminum levels remained above guideline in 11 households.
- Eighteen households in three communities in the Atlantic Maritime ecozone in the Atlantic region had elevated aluminum levels ranging from 150 to 543 µg/L in the first draw samples. After a five-minute flush, the aluminum levels were above guideline in 21 households.

While there are no health concerns, the Chief and Council, the Department of Indigenous Services Canada EPHO for the communities and the householders have been made aware of these exceedances.

Copper

Eight households in five communities had copper levels above the guidance value of 1,000 µg/L (in flushed samples):

- Thirteen households in four communities in the Pacific Maritime ecozone in the British Columbia region had elevated copper levels ranging from 1,060 to 2,930 µg/L in the first draw sample. After a five-minute flush, the copper levels were all below guideline levels.
- Two households, each one located in two separate communities in the Montane Cordillera ecozone in the British Columbia region had elevate copper levels ranging from 1,340 to 2,200 µg/L in the first draw sample. After a five-minute flush, the copper levels were all below guideline levels.
- Nine households in seven communities in the Boreal Plains ecozone in the British Columbia, Saskatchewan and Manitoba regions had elevated copper levels ranging from 1,020 to 5,130 µg/L in the first draw sample. After a five-minute flush, the copper levels remained above guideline in one household in Saskatchewan region.
- Two households, each in two separate communities in the Prairies ecozone in the Saskatchewan and Manitoba region had elevated copper levels ranging from 1,260 to 1,890 µg/L in the first draw sample. After a five-minute flush, the copper levels remained above guideline in one household in Saskatchewan region.
- Twenty-five households in five communities in the Boreal Shield ecozone in the Manitoba (two), Ontario (two) and Atlantic (one) regions, had elevated copper values ranging from 1,060 to 6,540 µg/L in the first draw sample. After a five-minute flush, the copper levels remained above guideline in two households in one community in the Manitoba region.
- Two households, each in two separate communities in the Taiga Shield ecozone in the Manitoba and Quebec regions had elevated copper levels ranging from 1,260 to 1,270 µg/L in the first draw sample. After a five-minute flush, the copper levels were all below guideline levels.
- Six households in three communities in the Hudson Plains ecozone in the Ontario region had elevated copper levels ranging from 1,030 to 2,050 µg/L in the first draw sample. After a five-minute flush, the copper levels were all below guideline levels.
- Five households in four communities in the Mixedwood Plains ecozone in the Ontario and Quebec regions had elevated copper levels ranging from 1,080 to 5,850 µg/L in first draw samples. After a five-minute flush, the copper remained elevated in four households in two communities in the Ontario region.
- Four households in two communities in the Atlantic Maritime ecozone in the Atlantic region had elevated copper levels ranging from 1,470 to 1,570 µg/L in the first draw sample. After a five-minute flush, the copper levels were all below guideline levels.

While there are no health concerns, the Chief and Council, the Department of Indigenous Services Canada EPHO for the communities and the householders have been made aware of these exceedances.

Iron

Fifty-two households in 17 communities had iron levels above the guideline values of 300 µg/L.

- Two households, each in two communities in the Pacific Maritime ecozone had elevated iron levels ranging from 576 to 1,310 µg/L. After a five-minute flush, the iron levels remained elevated in both households.
- One household in a community in the Montane Cordillera ecozone in British Columbia had a level of 1,420 µg/L. After a five-minute flush, the iron level remained elevated.

- Ten households in seven communities in the Boreal Plains ecozone in Alberta (four), Saskatchewan (two) and Manitoba (one) had elevated iron levels ranging from 345 to 5,810 µg/L in the first draw sample. After a five-minute flush, the iron levels remained elevated in 10 households in six communities in Alberta (three), Saskatchewan (two) and Manitoba (one).
- Two households, each in separate communities in the Prairies ecozone in the Alberta and Saskatchewan regions had elevated iron levels ranging from 356 to 580 µg/L in the first draw sample. After a five-minute flush the iron levels were below the guideline level.
- Twenty-six households in four communities in the Boreal Shield ecozone in the Manitoba (one), Ontario (two) and Atlantic (one) regions had iron levels ranging from 303 to 1,830 µg/L in the first draw sample. After a five-minute flush, the iron levels remained elevated in 22 households in two communities.
- Six households in one community in the Taiga Shield ecozone in the Saskatchewan region had levels ranging from 349 to 768 µg/L in the first draw sample. After a five-minute flush, the iron levels were elevated in 10 households.
- Seven households in four communities in the Mixedwood Plains ecozone in the Ontario (three) and Quebec (one) regions had elevated iron levels ranging from 400 to 5,070 µg/L in the first draw sample. After a five-minute flush, the iron levels remained elevated in six households in four communities.
- One household in one community in the Atlantic Maritime ecozone in the Atlantic region had an iron level of 589 µg/L in the first draw sample. After a five-minute flush, the iron level remained elevated.

While there are no health concerns, the Chief and Council, the Department of Indigenous Services Canada EPHO for the communities and the householders have been made aware of these exceedances.

Manganese[11]

One hundred and fourteen households in 25 communities were found to have elevated levels of manganese above the aesthetic objective of 50 µg/L (in flushed samples):

- One household in one Boreal Cordillera community in the British Columbia region had an elevated manganese level of 69.8 µg/L in the first draw sample. After a five-minute flush, the manganese level remained elevated.
- Four households in one community in the Montane Cordillera ecozone in the British Columbia region, had elevated manganese levels ranging from 83 to 250 µg/L in the first draw sample. After a five-minute flush, the manganese levels remained elevated in three households.
- Eleven households in eight communities in the Boreal Plains ecozone in the British Columbia, Alberta, Saskatchewan and Manitoba regions, had elevated manganese levels ranging from 50 to 191 µg/L in the first draw sample. After a five-minute flush, the manganese levels were elevated in twelve households in seven communities in British Columbia, Alberta, Saskatchewan and Manitoba regions.
- Fifteen households in three communities in the Prairies ecozone in the Saskatchewan and Alberta regions, had elevated manganese levels ranging from 51 to 3,250 µg/L in the first draw sample. After

11 The guideline for manganese has been updated in the Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Manganese (Health Canada 2019). Until recently, Health Canada's guideline for manganese in drinking water was based only on aesthetic effects. The AO for total manganese in drinking water is 0.02 mg/L (20 µg/L) to reduce consumer complaints regarding discoloured water (Health Canada 2019). Following epidemiological evidence on the association between exposure to manganese in drinking water and neurological effects in children, Health Canada established a new guideline for manganese. The maximum acceptable concentration (MAC) is 0.12 mg/L (120 µg/L) to protect neurological effects in infants, the most sensitive population (Health Canada 2019).

AHTAHKAKOOP FIRST NATION, PHOTO BY CAROL ARMSTRONG-MONOHAN

a five-minute flush, the manganese levels were elevated in 18 households in four communities in the Alberta, Saskatchewan and Manitoba regions.

- Twenty households in one community in the Boreal Shield ecozone in the Manitoba region had elevated manganese levels ranging from 78 to 444 µg/L in the first draw sample. After a five-minute flush, the manganese levels were elevated in 21 households in two communities in the Manitoba and Ontario regions.
- Seven households in one community in the Taiga Shield ecozone in the Saskatchewan region had elevated manganese levels ranging from 51 to 142 µg/L in the first draw sample. After a five-minute flush, the manganese levels were elevated in 16 households.
- No households in communities in the Hudson Plains ecozone had elevated manganese in the first draw sample. After a five-minute flush, the manganese levels were elevated in four households in one community in the Ontario region with a maximum of 62.5 µg/L.
- Six households in three communities in the Mixedwood Plains ecozone in the Ontario and Quebec regions had elevated manganese levels ranging from 51 to 370 µg/L. After a five-minute flush, the manganese levels were elevated in seven households in these communities.
- Thirty-three households in five communities in the Atlantic Maritime ecozone in the Quebec and Atlantic regions had elevated manganese levels ranging from 51 to 975 µg/L in the first draw sample. After a five-minute flush, the manganese levels remained elevated in 32 households in the Quebec and Atlantic regions.

While there are no health concerns, the Chief and Council, the Department of Indigenous Services Canada EHO for the communities and the householders have been made aware of these exceedances.

Sodium

Seventy-one households in 11 communities were found to have elevated levels of sodium above the aesthetic objective of 200,000 µg/L:

- One household in a community in the Montane Cordillera ecozone in the British Columbia region had an elevated sodium level of 298,000 µg/L. After a five-minute flush, the sodium level remained elevated.

- Thirty-four households in two communities in the Boreal Plains ecozone in the Alberta and Manitoba regions were found to have elevated sodium levels ranging from 201,000 to 485,000 µg/L in the first draw sample. After a five-minute flush, the sodium levels remained elevated in 33 households in those two communities.
- Thirty-two households in five communities in the Prairies ecozone in the Alberta, Saskatchewan and Manitoba regions were found to have elevated sodium levels ranging from 208,000 to 766,000 µg/L in the first draw sample. After a five-minute flush, the sodium levels remained elevated in 26 households in four of these communities (Note: In one Alberta community, flush samples were not collected).

Twelve households in four communities in the Mixedwood Plains ecozone in the Ontario and Quebec regions, had elevated sodium levels ranging from 209,000 to 866,000 µg/L in the first draw sample. After a five-minute flush, the sodium levels were elevated in 14 households in the Ontario and Quebec regions.

While there are no health concerns, the Chief and Council, the Department of Indigenous Services Canada EPHO for the communities and the householders have been made aware of these exceedances.

Zinc

No households were found to have elevated zinc levels above the aesthetic parameter of 5,000 µg/L (in flush samples):

- Two households in one community in the Boreal Shield ecozone in Manitoba had elevated zinc levels at 6,460 µg/L in the first draw sample. After a five-minute flush the levels of zinc were below the guideline value.

Surface Water (Pharmaceuticals)

In the last 10 years, there has been considerable interest concerning the occurrence of pharmaceuticals in surface water and drinking water (Aga 2008). These emerging chemicals that find their way into the environment have yet to be characterized in surface waters on-reserve. This study component was undertaken to:

- Establish a baseline of agricultural, veterinary and human pharmaceuticals occurrence in surface water on reserves in Canada;
- Determine the exposure of fish and shellfish (an important component of many First Nations' diets) to pharmaceuticals in surface water on reserves in Canada; and
- Establish a pharmaceuticals priority list for future health and environmental effects studies.

Ninety-five communities[12] participated in this component of FNFNES. In each community, three sampling sites were chosen by the community. These sites were selected based on where fish may be harvested, at the drinking water supply intake, wastewater discharge sites, or other locations of importance to the participating First Nation. The criteria used for the selection of pharmaceuticals were: 1) levels of detection of the pharmaceuticals in the aquatic environment in previous studies; 2) frequency of detection of the pharmaceuticals in the environment in previous studies; and, 3) evidence of usage of the pharmaceuticals in First Nations communities. The First Nation usage information was provided by Non-Insured Health Benefits (NIHB), FNIHB (Booker and Menzies 2017).

FNFNES quantified 43 pharmaceuticals listed in Table 5.3. These pharmaceuticals are widely used in human medicines, veterinary drugs and aquaculture as analgesics, antacids, antibiotics, anticoagulants, anticonvulsants, antidepressants, antidiabetics, antihistamines, antihypertensives, diuretics,

12 Three Manitoba communities participated only in this component. One community in the Hudson Plains ecozone did not participate (93 +3 -1 = 95).

lipid regulators, steroids and contraceptives. These pharmaceuticals are of concern to human and/or environmental health and have been frequently reported in other Canadian and American studies (Blair, Crago and Hedman 2013; Deo 2014; Geurra et al. 2014; Glassmeyer et al. 2005; Kleywegt et al. 2011; Kone et al. 2013; Kolpin et al. 2002; Kostich, Batt and Lazorchak 2014; Waiser et al. 2011; Wu et al. 2009; Yargeau, Lopata and Metcalfe 2007). All samples were analysed by a contract lab: MAXXAM Analytics in Burnaby analysed samples from BC, Manitoba and Ontario (year 1) while ALS Global analysed samples collected in Ontario (year 2), Alberta, the Atlantic, Saskatchewan and Quebec.

Overall, 432 samples were collected at 302 sampling sites (285 surface water sites, 11 drinking water sites and 6 wastewater sites) in 95 First Nations communities across Canada[13]. Four communities identified drinking water sites: two communities chose drinking water sites where the source was surface water (two sites in a community in Quebec and five sites in a community in Ontario) and two communities chose sites where the water source was groundwater (one site in a community in Alberta and three sites in a community in Ontario). Five communities chose wastewater sites (5 lagoons and a garbage dump) for sampling. Pharmaceuticals were found in 193 of the 285 surface water sites (64.7%), in 4/11 drinking water sites, and in all (6/6) wastewater sites sampled. In total, pharmaceuticals were found in 79 of the 95 (83.2%) participating communities.

13 Two communities in Ontario with a high number of pharmaceuticals (approximately 20) and elevated levels of pharmaceuticals compared to other communities were persuaded by Dr. Laurie Chan to have their drinking water sampled as well. One of these communities has a drinking water treatment plant and the other uses wells for drinking water. Drinking water was sampled from several location in both these communities and the levels found were low for the two pharmaceuticals that were quantified in each community. The Alberta groundwater sampling took place as the First Nation thought its community well was contaminated and wanted to see the levels. No pharmaceuticals were found in this sample. The Quebec drinking water samples were taken in one community where the EPHO started sampling the day after the water on the river froze. It was too dangerous to go out on the river. So, the EPHO collected two samples from drinking water sites in the community. One pharmaceutical was found in the two drinking water samples.

YONGSHENG LIANG AND STÉPHANE DECELLES IN MOOSE CREE FIRST NATION, PHOTO GARY CORSTON

The levels of pharmaceuticals detected in surface water in First Nations communities in Canada are summarized in Table 5.4 at the summative level. Information by ecozones is presented in Appendix J. Overall, 35 unique pharmaceuticals were detected in surface water in 79 communities. At drinking water sites, three pharmaceuticals were found where the source was surface water and two pharmaceuticals were detected in groundwater sites (Table 5.5). In the five communities where samples were collected at wastewater sites, 28 pharmaceuticals were detected (Table 5.6).

The maximum concentrations of pharmaceuticals found in the FNFNES study and a comparison to the highest levels reported in other Canadian, the United States and global studies are presented in Table 5.7. Most of the FNFNES results are lower than those found in other surface waters and wastewater studies in Canada, the United States, Europe, Asia and Central America. The FNFNES values for cimetidine, diltiazem, atenolol, metoprolol, dehydronifedipine, pentoxifylline, gemfibrozil and caffeine in surface water were higher than those detected in other Canadian studies. The FNFNES value for ketoprofen was the highest in Canada and the U.S. However, based on human health risk assessments, one would have to drink hundreds of glasses of water per day from these surface water sites for a prolonged period to experience health effects (Bruce et al. 2010; Houtman et al. 2014).

Pharmaceuticals Detected by Type and Prevalence in Surface Water

The 35 pharmaceuticals detected in surface water are presented below in the order of the number of sites where they were detected. Reasons as to why they may have been found are provided where possible. Table 5.4 contains information on the number of sites and communities detected as well as the maximum concentration of pharmaceuticals found in surface water in First Nations communities.

Caffeine was the most prevalent pharmaceutical detected in surface water. It was detected at 105 of the 285 surface water sites in 57 of the 95 communities sampled across Canada. Caffeine is a component of the most highly prescribed pharmaceuticals in most First Nations communities across Canada (acetaminophen/caffeine/codeine, (Tylenol No. 1)) (Booker and Michaud 2008; Booker and Gardner 2013, 2014, 2015, 2016; Booker and Menzies 2017). Caffeine is also present in many coffees, teas, soft drinks, energy drinks, and foods containing chocolate.

Atenolol was the second most prevalent pharmaceutical detected. It was found at 78 of the 285 surface water sites in 28 of the 95 communities sampled. Atenolol is an antihypertensive medication that was among the topmost prescribed pharmaceuticals in some First Nations communities but rarely prescribed in other communities (Booker and Michaud 2008; Booker and Gardner 2013, 2014, 2015, 2016; Booker and Menzies 2017). Therefore, there must be alternative sources of this pharmaceutical.

Metformin is an anti-diabetic medication that was detected in 27of the 95 communities and in 60 of the 285 sites sampled throughout Canada. Metformin was one of the most commonly prescribed medications in the communities where it was detected (NIHB 2011; Booker and Gardner 2013, 2014, 2015, 2016; Booker and Menzies 2017).

Cotinine (a metabolite of nicotine) was detected in 28 communities and 50 surface water sites. An average of 80% of nicotine that is consumed by people is excreted as cotinine. Although nicotine is prescribed (e.g., smoking cessation products, such as patches and gum) in some communities where it was detected (NIHB 2011; Booker and Gardner 2013, 2014, 2015, 2016; Booker and Menzies 2017), its presence most probably reflects tobacco use.

Carbamazepine is a medication prescribed as an anticonvulsant and mood stabilizer. It is also a potential endocrine disrupting chemical. Carbamazepine was detected in 18 of the 95 communities and in 40 of the 285 surface water sites. Overall, carbamazepine is not a highly prescribed medication in First Nations in Canada, but it was prescribed in the communities where it was detected (NIHB 2011, Booker and Gardner 2013, 2015, 2016; Booker and Menzies 2017).

Sulfamethoxazole is an antibiotic used to treat urinary tract and respiratory tract infections and it is a potential endocrine disrupting chemical. It was found in 15 communities and 41 of the 285 surface water sites. Sulfamethoxazole is moderately prescribed medication (ranking within the top 100 pharmaceuticals prescribed in the First Nations communities) (Booker and Gardner 2013, 2014, 2015, 2016; Booker and Menzies 2017). It has also been detected at a rate of 100% of surface water samples in a previous Canadian study (Metcalfe, Miao et al. 2004).

Cimetidine is an ulcer medication that was detected in 15 of the 95 communities and 37 of the 285 surface water sites. Cimetidine is not on the list of medications prescribed in the communities where it was found (Booker and Gardner 2013, 2015; Booker and Menzies 2017).

Naproxen, a pain reliever and a fever reducer, was detected in 13 communities at 24 sites. Naproxen was among the top pharmaceutical prescribed in the communities where it was detected (Booker and Gardner 2013, 2015, 2016; Booker and Menzies 2017).

Acetaminophen is a pain reliever and a fever reducer. It was detected in 13 communities at 23 communities at 25 sites. Acetaminophen was ranked within the top five prescribed medications in the communities where it was detected. It is also a component of one of the top prescribed pharmaceuticals in First Nations communities. Like caffeine and codeine, acetaminophen is also a component of Tylenol No. 1 (Booker and Gardner 2014, 2015, 2016; Booker and Menzies 2017).

Clarithromycin, an antibiotic used to treat bacterial infections such as strep throat and pneumonia, was found in 10 communities at 23 sites. It is not highly prescribed medication among First Nations. However, clarithromycin was among the top commonly prescribed pharmaceuticals in the communities where it was detected (Booker and Gardner 2013, 2015, 2016; Booker and Menzies 2017).

Trimethoprim is an antibiotic medication used to treat bladder and ear infections. It was detected in 9 communities at 20 sites. Trimethoprim is a moderately prescribed medication. It was used by communities where it was found (Booker and Gardner 2015).

Bezafibrate is a cholesterol medication that was detected in 8 of the 95 communities at 19 of the 285 sites. Bezafibrate was not prescribed in communities where it was detected (Booker and Gardner 2013, 2015; Booker and Menzies 2017).

Metoprolol is a beta-blocker used to treat angina and hypertension. It was detected in six communities at 18 of the 285 surface water sites. Metoprolol is a highly prescribed medication in the communities where it was found (Booker and Gardner 2013, 2015; Booker and Menzies 2017).

Ketoprofen is an arthritis and pain medication that was detected in 10 of the 95 communities sampled and in 17 of the 285 surface water sites. Ketoprofen was not prescribed in the communities where it was found (Booker and Gardner 2013, 2015, 2016; Booker and Menzies 2017). Its presence may reflect a veterinary source.

Codeine is a pain and cough relief medication that was detected in six communities at 16 sites. Codeine is a moderately prescribed medication in the communities where it was found (Booker and Gardner 2013, 2015). However, codeine was also detected in a community where it was not used (Booker and Menzies 2017).

Hydrochlorothiazide is a blood pressure medication that was detected in six communities and 16 surface water sites. It was one of the most commonly prescribed medications in the communities where it was detected (Booker and Gardner 2013, Booker and Menzies 2017).

Gemfibrozil is a cholesterol medication that was detected in seven communities at 15 sites. Gemfibrozil was not prescribed in any of the participating communities (Booker and Gardner 2013, 2015; Booker and Menzies 2017).

Ranitidine is an antacid used to treat ulcers. It was detected in four communities and at 12 of the 285 surface water sites. Ranitidine was a moderately prescribed medication among the communities where it was detected (Booker and Gardner 2013; Booker and Menzies 2017).

Warfarin is an anticoagulant blood thinner that was detected in five communities and 11 sites. Warfarin was one of the most prescribed medications in some participating communities but much less prescribed in other communities where it was found (Booker and Gardner 2013). Its presence may reflect a veterinary source.

Diclofenac is an arthritis medication that was detected in six communities and at 10 sites. Diclofenac was one of the most prescribed pharmaceuticals in the communities where it was found (Booker and Gardner 2013, 2014).

Clofibric Acid is a cholesterol medication used to reduce the risk of heart attack and/or stroke. It was detected in five communities at nine sites. Clofibric Acid was not a prescribed medication in the participating communities (Booker and Gardner 2015). Since it may persist in the environment for years (Zuccato et al. 2000), its presence may reflect either past consumption or an alternative source such as veterinary use.

Ciprofloxacin is antibiotic commonly used to treat skin, bladder and kidney infections. It was detected in four communities at eight surface water sites. Ciprofloxacin is among the 100 most commonly prescribed medications in the communities where it was detected (Booker and Gardner 2013; Booker and Menzies 2017). The presence of this antibiotics may also indicate its use in aquaculture.

Sulfamethazine, an antibiotic used to treat bacterial infections in livestock, was detected in four communities at eight surface water sites. Sulfamethazine is not prescribed for human use but was reportedly used to treat dogs in several of the communities where it was detected (Booker and Gardner 2013; Booker and Menzies 2017).

Ibuprofen is a pain reliever, fever and inflammation reducer. It was detected in five of the 95 communities and at seven of the 285 surface water sites. It was one of the most prescribed medications in some participating communities (Booker and Gardner 2013) but was not prescribed in one participating community where it was detected (Booker and Menzies 2017).

Diphenhydramine is an antihistamine commonly used to treat allergy symptoms, nausea, and vomiting and the common cold that was detected in four communities at six surface water sites. Diphenhydramine was not on the list of medications prescribed in the communities where it was found (Booker and Gardner 2013; Booker and Menzies 2017).

Dehydronifedipine is a metabolite of nifedipine (a blood pressure medication) that is used to control chest pain (angina). Dehydronifedipine was found in five communities and five surface water sites. Dehydronifedipine was not prescribed in the communities where it was found (Booker and Gardner 2013).

Fluoxetine, an antidepressant, is used to treat major depressive and panic disorder. It was found in four communities at five surface water sites. Fluoxetine was not highly prescribed in the communities where it was detected. Its presence may indicate a veterinary source.

Pentoxifylline is an antidiabetic medication that was detected in three communities and at five surface water sites. Pentoxifylline was not prescribed in any of the participating communities where it was detected (Booker and Gardner 2013; Booker and Menzies 2017).

Ethinylestradiol was detected in three communities and five surface water sites. It is an oral contraceptive and an endocrine disrupting chemical. Interestingly, ethinylestradiol was not on the list of medications prescribed in the communities where it was detected (NIHB 2011; Booker and Gardner 2013).

Furosemide is a diuretic commonly used to treat hypertension and edema. It was detected in two communities and at four surface water sites. Furosemide was moderately prescribed in some participating communities where it was found (Booker and Gardner 2013; Booker and Menzies 2017).

Chlortetracycline was detected in two communities at three surface water sites. Chlortetracycline is a veterinary pharmaceutical used to treat domestic poultry and cattle. Chlortetracycline enters the environment primarily through the application of manure to fields (the (United States. Environmental Protection Agency (US EPA). 2009).

Diltiazem is a blood pressure medication that was detected in two communities at two surface water sites. Diltiazem was prescribed in one community but not prescribed in the other community (Booker and Gardner 2013).

Atorvastatin is a cholesterol medication that was detected in one community at one surface water site. Atorvastatin is a highly prescribed medication in the community where it was detected (Booker and Menzies 2017).

Erythromycin, an antibiotic, was found in one community at one site. Erythromycin was not prescribed in the community where it was found (Booker and Gardner 2013).

Isochlortetracycline is an inactive degradation product of the broad-spectrum antibiotic chlortetracycline that is widely used to treat domestic poultry and cattle (Kennedy et al. 1998; Zurhelle et al. 2000). Therefore, the main source of isochlortetracycline is a veterinary use (US EPA 2009). Isochlortetracycline was found in one community at one site.

Pharmaceuticals Detected by Type and Prevalence in Drinking Water

A total of 11 drinking water sites were sampled for pharmaceuticals in four communities: in two communities, the water source was surface water (five tap water sites in one community and two drinking water intake sites in one community), and in two communities, the water source was groundwater (one well site in one community and three well sites in one community). Results are displayed in Table 5.5. Atenolol and carbamazepine were found at one tap water site while ketoprofen was detected at two drinking water intake sites. Ketoprofen was not prescribed in the community where it was detected (Booker and Menzies 2017). Caffeine and cotinine were found at one groundwater site.

Pharmaceuticals Detected by Type and Prevalence in Wastewater

Overall, five communities requested that their wastewater be tested for the presence of pharmaceuticals. In all, six sites were sampled in two ecozones (the Prairies and Hudson Plains): five lagoons and water in one garbage dump. In total, 28 pharmaceuticals were detected in the wastewater. The results are not presented separately by ecozone as there was only one community in the Hudson Plains (Table 5.6).

Analgesic:

- Codeine was found in five communities at six sites (all lagoons except the garbage dump water).

Analgesic/Anti-inflammatory:

- Acetaminophen was found in all communities at five sites (four lagoon sites and the garbage dump water);
- Diclofenac was detected in two lagoons and the garbage dump water of two communities;
- Ibuprofen was found in four communities at five sites (four lagoons and the garbage dump site);
- Ketoprofen was found at two sites (garbage dump water and a lagoon) of one community; and
- Naproxen was detected in all six sites of the five communities sampled.

Antacid:

- Cimetidine was found in all six sites sampled; and
- Ranitidine was found in lagoon sites of three communities.

Antibiotics:

- Ciprofloxacin was detected in three lagoons sampled in three communities;
- Clarithromycin was detected in three communities at three lagoons and the garbage dump site;
- Erythromycin was found in one lagoon of one community;
- Sulfamethazine was detected in one lagoon of one community;
- Sulfamethoxazole was detected in all sites sampled; and
- Trimethoprim was found in four communities at the lagoons and the garbage dump water sampled.

Anticoagulant:

- Warfarin was found in the garbage dump water and the lagoon of one community.

Anticonvulsant:

- Carbamazepine was found in all six sites tested.

Antidiabetic:

- Metformin was found in all six sites sampled.

Antihistamine:

- Diphenhydramine was found in one lagoon.

Antihypertensive (Beta-blocker):

- Atenolol was found in four lagoons of four communities; and
- Metoprolol was found in lagoons and the garbage dump water of three communities.

Antihypertensive:

- Diltiazem was found in one lagoon.

Diuretic:

- Furosemide was detected in both lagoons of one community; and
- Hydrochlorothiazide was found in four communities at the lagoons and the sampled garbage dump water.

Lipid Regulator:

- Atorvastatin was detected in the lagoon of one community;
- Clofibric acid was found in the garbage dump water of one community; and
- Gemfibrozil was found in two communities at three sites: the two lagoons and the garbage dump water.

Stimulant:

- Caffeine was found in all six sites.

A metabolite of nicotine:

- Cotinine was found in all six sites tested.

Overview of Pharmaceuticals Detected in Surface Water by Ecozones

The levels of pharmaceuticals in surface water by ecozones are presented in Appendix I. Results for 11 ecozones including the Boreal Cordillera, Boreal Plains, Montane Cordillera, Pacific Maritime, Taiga Plains, Taiga Shield, Boreal Shield, Prairies, Hudson Plains, Mixedwood Plains and Atlantic Maritime are summarized.

Pacific Maritime*:* Nine communities were sampled

Eleven pharmaceuticals were detected in seven communities:

- Analgesic/Anti-inflammatory: Acetaminophen and Ketoprofen
- Antihypertensives (Beta-blockers): Atenolol
- Antibiotics: Ciprofloxacin and Trimethoprim
- Anticoagulant: Warfarin
- Antidiabetic: Pentoxifyline
- Lipid Regulators: Clofibric Acid
- Stimulant: Caffeine
- Antianginal metabolite: Dehydronifedipine
- Antidepressant: Fluoxetine

Boreal Cordillera: Two communities were sampled

Four pharmaceuticals were detected in two communities:

- Stimulant: Caffeine
- Lipid Regulator: Clofibric Acid
- Antidepressant: Fluoxetine
- Antibiotic: Trimethoprim

Montane Cordillera: Six communities were sampled

Nine pharmaceuticals were detected in five communities:

- Analgesic/Anti-inflammatory: Acetaminophen and Ketoprofen
- Antihypertensives (Beta-blockers): Atenolol
- Anticoagulant: Warfarin
- Lipid Regulators: Clofibric Acid
- Stimulant: Caffeine
- A metabolite of nicotine: Cotinine
- Antianginal metabolite: Dehydronifedipine
- Antidepressant: Fluoxetine

Taiga Plains: Three communities were sampled

Four pharmaceuticals were detected in two communities:

- Antibiotics: Clarithromycin and Isochlortetracycline
- Antacid: Cimetidine
- Stimulant: Caffeine

Boreal Plains: Eighteen communities were sampled

Eighteen pharmaceuticals were detected in 16 communities:

- Analgesic/Anti-inflammatory: Acetaminophen and Ketoprofen
- Antibiotics: Chlortetracycline, Clarithromycin, Sulfamethoxazole and Trimethoprim
- Antacid: Cimetidine
- Antidiabetic: Metformin
- Antihypertensives (Beta-blockers): Atenolol and Metoprolol
- Anticonvulsant: Carbamazepine
- Analgesic: Codeine
- Lipid Regulators: Bezafibrate and Gemfibrozil
- Stimulant: Caffeine
- A metabolite of nicotine: Cotinine
- Antianginal metabolite: Dehydronifedipine
- Antidepressant: Fluoxetine

Prairies*:* Eight communities were sampled

Eleven pharmaceuticals were detected in seven communities:

- Analgesics/Anti-inflammatory: Acetaminophen, Diclofenac, Ketoprofen and Naproxen
- Antacid: Cimetidine
- Anticonvulsant: Carbamazepine
- Antidiabetic: Metformin
- Antihypertensives (Beta-blockers): Atenolol
- Lipid Regulator: Clofibric Acid
- Stimulant: Caffeine
- A metabolite of nicotine: Cotinine

Boreal Shield: Twenty-one communities were sampled

Twenty-five pharmaceuticals were detected in 17 communities:

- Analgesic/Anti-inflammatory: Acetaminophen, Diclofenac, Ibuprofen and Ketoprofen
- Analgesic: Codeine
- Anticonvulsant: Carbamazepine
- Antibiotics: Clarithromycin, Erythromycin, Sulfamethoxazole and Trimethoprim
- Antacid: Cimetidine
- Antianginal metabolite: Dehydronifedipine

- Antidiabetic: Metformin and Pentoxifylline
- Antihistamine: Diphenhydramine
- Antihypertensive: Diltiazem
- Antihypertensives (Beta-blockers): Atenolol and Metoprolol
- Anticoagulant: Warfarin
- Diuretic: Hydrochlorothiazide
- Lipid Regulators: Bezafibrate and Gemfibrozil
- A metabolite of nicotine: Cotinine
- Oral Contraceptive: 17 α-Ethinylestradiol
- Stimulant: Caffeine

Taiga Shield: Five communities were sampled

Six pharmaceuticals were detected in three communities:

- Analgesics/Anti-inflammatory: Acetaminophen
- Antacid: Cimetidine
- Anticonvulsant: Carbamazepine
- Antidiabetic: Metformin
- Stimulant: Caffeine
- A metabolite of nicotine: Cotinine

Hudson Plains: Four communities were sampled

Sixteen pharmaceuticals were detected in the four communities:

- Analgesics/Anti-inflammatory: Acetaminophen, Ibuprofen and Naproxen
- Analgesic: Codeine
- Antacid: Ranitidine
- Antibiotics: Sulfamethoxazole and Trimethoprim
- Anticonvulsant: Carbamazepine
- Antidiabetic: Metformin
- Antihistamine: Diphenhydramine
- Antihypertensives (Beta-blockers): Atenolol
- Diuretic: Hydrochlorothiazide
- Lipid Regulator: Gemfibrozil
- A metabolite of nicotine: Cotinine
- Oral Contraceptive: 17 α -Ethinylestradiol
- Stimulant: Caffeine

Mixedwood Plains: Six communities were sampled

Twenty-seven pharmaceuticals were detected in six communities:

- Analgesic/Anti-inflammatory: Acetaminophen, Diclofenac, Ibuprofen, Ketoprofen and Naproxen
- Analgesic: Codeine
- Anticonvulsant: Carbamazepine
- Antibiotics: Ciprofloxacin, Clarithromycin, Sulfamethazine, Sulfamethoxazole and Trimethoprim
- Antacid: Cimetidine and Ranitidine
- Antidiabetic: Metformin
- Antihistamine: Diphenhydramine
- Antihypertensive: Diltiazem
- Antihypertensives (Beta-blockers): Atenolol and Metoprolol
- Anticoagulant: Warfarin
- Diuretic: Hydrochlorothiazide and Furosemide
- Lipid Regulators: Bezafibrate and Gemfibrozil
- A metabolite of nicotine: Cotinine
- Oral Contraceptive: 17 α -Ethinylestradiol
- Stimulant: Caffeine

Atlantic Maritime: Twelve communities were sampled

Twenty-two pharmaceuticals were detected in 11 communities:

- Analgesic/Anti-inflammatory: Acetaminophen, Diclofenac, Ibuprofen, Ketoprofen and Naproxen
- Analgesic: Codeine
- Anticonvulsant: Carbamazepine
- Antibiotics: Clarithromycin, Sulfamethazine and Sulfamethoxazole
- Antacid: Ranitidine
- Antidiabetic: Metformin and Pentoxifylline
- Antihistamine: Diphenhydramine
- Antihypertensives (Beta-blockers): Atenolol and Metoprolol
- Diuretic: Hydrochlorothiazide and Furosemide
- Lipid Regulators: Atorvastatin and Bezafibrate
- A metabolite of nicotine: Cotinine
- Stimulant: Caffeine
- A metabolite of nicotine: Cotinine

FNFNES Findings Compared to Pharmaceutical Guidelines

Ambient Guidelines

Currently, only one pharmaceutical in Canada has an ambient water guideline level, 17 α-Ethinylestradiol at 0.5 ng/L in the province of British Columbia (Nagpal and Meays 2009). This pharmaceutical was detected at 0.40, 0.55 and 0.74 ng/L in three locations in two First Nations communities in Ontario and at 0.45 ng/L in one First Nation community in Manitoba. Ethinylestradiol exceeded the BC guideline in two communities in Ontario. The maximum values in these two communities were above the 30-day average concentration of the province of British Columbia guideline to protect aquatic life but below the maximum allowable guideline (for a single value) of 0.75 ng/L (Nagpal and Meays 2009)). Levels found at these sites could affect the fertility of some fish. The European Commission (EC) has proposed a freshwater Environmental Quality Standard of 0.035 ng/L for Ethinylestradiol. All sites would exceed the EC's proposed guideline (Scientific Committee on Health and Environmental Risks (SCHER) 2011).

The EC has proposed a freshwater Environmental Quality Standard of 100 ng/L for Diclofenac. Diclofenac was detected in surface water in three communities in Ontario, one community in Alberta and one community in Quebec. However, no FNFNES samples exceeded the proposed Diclofenac guideline (SCHER 2011). Diclofenac was also detected in the wastewater samples in two First Nations communities in Saskatchewan at the max level of 506 ng/L. The concentrations of other pharmaceuticals in the FNFNES study would not pose a threat to human health or the aquatic environment.

REBECCA HARE, PHOTO BY FRANCIS KAWAPIT, WHAPMAGOOSTUI FIRST NATION

Drinking Water Guidelines

There are no Canadian Drinking Water Quality Guidelines for pharmaceuticals. Australia has set a drinking water guideline for water recycling that includes 27 of the 35 pharmaceuticals found in surface water of the FNFNES study: acetaminophen, atorvastatin, bezafibrate, caffeine, carbamazepine, chlortetracycline, cimetidine, ciprofloxacin, clarithromycin, clofibric acid, codeine, cotinine, dehydronifedipine, diclofenac, diltiazem, erythromycin, 17-α-Ethinylestradiol, fluoxetine, gemfibrozil, ibuprofen, ketoprofen, metformin, metoprolol, naproxen, sulfamethazine, sulfamethoxazole and trimethoprim (Environmental Protection and Heritage Council; National Health and Medical Research Council; National Resource Management Management Ministerial Council; 2008). The state of California has developed Monitoring Trigger Levels (MTLs) for potable water reuse for 19 of the pharmaceuticals found in the FNFNES study: acetaminophen, atorvastatin, atenolol, caffeine, carbamazepine, ciprofloxacin, clofibric acid, diclofenac, erythromycin, 17-α-Ethinylestradiol, fluoxetine, gemfibrozil, ibuprofen, ketoprofen, metoprolol, naproxen, sulfamethoxazole, trimethoprim and warfarin (Anderson et al. 2010). The state of New York has established standards for acetaminophen, caffeine, carbamazepine, cotinine, diltiazem, gemfibrozil, ibuprofen and sulfamethoxazole (New York City Environment Protection 2011).

The comparison of the FNFNES results to drinking water guidelines in Australia, California and New York is provided in Table 5.8. No FNFNES samples exceeded these guideline levels except caffeine with respect to the guidelines in Australia and California. Caffeine was detected at 355, 502 and 4,018 ng/L in surface water in three communities in Ontario and at 851 ng/L in one community in Quebec. In wastewater samples, caffeine was found at 2,750 ng/L in one community in Ontario, at 776 ng/L in one community in Alberta, and at 1,320 and 12,600 ng/L in two communities in Saskatchewan.

The concentrations of the pharmaceuticals found in the FNFNES study should not pose a threat to human health. In some communities, there are as many as 21 different pharmaceuticals in the surface water. It is unknown at this time the health effects of drinking the water from these surface water sites over a prolonged period.

To reduce the presence of pharmaceuticals in the environment, it is recommended to return unused or expired prescription drugs, over-the-counter medications and natural health products to a local pharmacy for proper disposal instead of flushing them down the toilet or throwing them into the garbage.

Figure 5.1 Household tap water use by ecozone

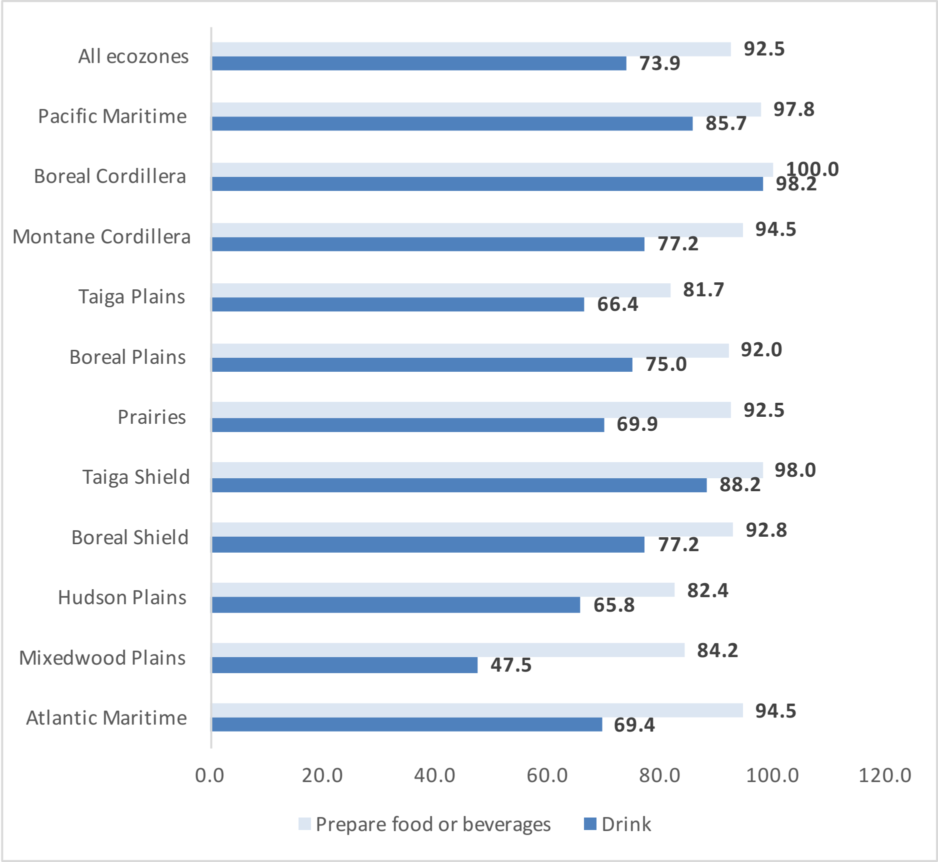


Table 5.1 Trace metals analysis results for parameters of health concern

Trace metal detected	Maximum detected	Detection Limit	Maximum Allowable Concentration (GCDWQ 2017)	Number of communities exceeding the guideline value	Total number of samples in excess			Comments
	µg/L				First Draw	Flushed (5 Min)	Duplicate	
All ecozones								
Antimony, Sb	0.86	0.5	6	0	0	0	0	Below guideline value.
Arsenic, As	14	0.1	10	1	3	1	1	**Above guideline value in one community.**
Barium, Ba	878	0.2	1,000	0	0	0	0	Below guideline value.
Boron, B	3,000	10	5,000	0	0	0	0	Below guideline value.
Cadmium, Cd	1.91	0.04	5	0	0	0	0	Below guideline value.
Chromium, Cr	28.2	0.2	50	0	0	0	0	Below guideline value.
Lead, Pb	120	0.2	10	3	70	3	3	**Above guideline value in three communities.**
Mercury, Hg	1.75	0.1	1	0	1	0	0	Flushed sample below guideline value.
Selenium, Se	79	0.05	50	1	1	1	0	**Above guideline value in one community.**
Uranium, U	57.5	0.01	20	3	24	24	3	**Above guideline value in three communities.**
Pacific Maritime								
Antimony, Sb	0.2	0.2	6	0	0	0	0	Below guideline value.
Arsenic, As	4.6	0.2	10	0	0	0	0	Below guideline value.
Barium, Ba	12.8	0.2	1,000	0	0	0	0	Below guideline value.
Boron, B	109	10	5,000	0	0	0	0	Below guideline value.
Cadmium, Cd	1.86	0.04	5	0	0	0	0	Below guideline value.
Chromium, Cr	22.9	0.2	50	0	0	0	0	Below guideline value.
Lead, Pb	20.4	0.2	10	0	3`	0	0	Below guideline value.
Selenium, Se	0.5	0.2	10	0	0	0	0	Below guideline value.
Uranium, U	0.6	0.1	20	0	0	0	0	Below guideline value.
Boreal Cordillera								
Antimony, Sb	<0.2	0.2	6	0	0	0	0	Below guideline value.
Arsenic, As	3.7	0.2	10	0	0	0	0	Below guideline value.

Trace metal detected	Maximum detected	Detection Limit	Maximum Allowable Concentration (GCDWQ 2017)	Number of communities exceeding the guideline value	Total number of samples in excess			Comments
	µg/L				First Draw	Flushed (5 Min)	Duplicate	
Barium, Ba	76.3	.2	1,000	0	0	0	0	Below guideline value.
Boron, B	39	10	5,000	0	0	0	0	Below guideline value.
Cadmium, Cd	<0.4	0.04	5	0	0	0	0	Below guideline value.
Chromium, Cr	.2	0.2	50	0	0	0	0	Below guideline value.
Lead, Pb	6	0.2	10	0	0	0	0	Below guideline value.
Selenium, Se	0.8	0.2	10	0	0	0	0	Below guideline value.
Uranium, U	0.4	0.1	20	0	0	0	0	Below guideline value.
Montane Cordillera								
Antimony, Sb	0.2	0.2	6	0	0	0	0	Below guideline value.
Arsenic, As	5	0.2	10	0	0	0	0	Below guideline value.
Barium, Ba	143	0.2	1,000	0	0	0	0	Below guideline value.
Boron, B	36	10	5,000	0	0	0	0	Below guideline value.
Cadmium, Cd	0.1	0.04	5	0	0	0	0	Below guideline value.
Chromium, Cr	2	0.2	50	0	0	0	0	Below guideline value.
Lead, Pb	3.6	0.2	10	0	0	0	0	Below guideline value.
Selenium, Se	1.4	0.2	50	0	0	0	0	Below guideline value.
Uranium, U	10.3	0.1	20	0	0	0	0	Below guideline value.
Taiga Plains								
Antimony, Sb	<0.2	0.2	6	0	0	0	0	Below guideline value.
Arsenic, As	<0.2	0.2	10	0	0	0	0	Below guideline value.
Barium, Ba	73	0.2	1,000	0	0	0	0	Below guideline value.
Boron, B	45	10	5,000	0	0	0	0	Below guideline value.
Cadmium, Cd	0.04	0.04	5	0	0	0	0	Below guideline value.
Chromium, Cr	0.7	0.5	50	0	0	0	0	Below guideline value.
Lead, Pb	7.9	0.2	10	0	0	0	0	Below guideline value.
Selenium, Se	0.8	0.2	10	0	0	0	0	Below guideline value.
Uranium, U	0.8	0.1	20	0	0	0	0	Below guideline value.
Boreal Plains								
Antimony, Sb	0.4	0.1	6	0	0	0	0	Below guideline value.

Trace metal detected	Maximum detected	Detection Limit	Maximum Allowable Concentration (GCDWQ 2017)	Number of communities exceeding the guideline value	Total number of samples in excess			Comments
	µg/L				First Draw	Flushed (5 Min)	Duplicate	
Arsenic, As	4.0	0.1	10	0	0	0	0	Flushed sample below guideline value.
Barium, Ba	312	0.2	1,000	0	0	0	0	Below guideline value.
Boron, B	472	0.2	5,000	0	0	0	0	Below guideline value.
Cadmium, Cd	0.21	.04	5	0	0	0	0	Below guideline value.
Chromium, Cr	28.2	0.2	50	0	0	0	0	Below guideline value.
Lead, Pb	44	0.2	10	1	6	1	1	Flushed sample above guideline value.
Mercury, Hg	1.75	0.1	1	0	1	0	0	Flushed sample above guideline value.
Selenium, Se	1.2	0.05	50	0	0	0	0	Below guideline value.
Uranium, U	13	0.01	20	0	0	0	0	Below guideline value.
Prairies								
Antimony, Sb	0.5	0.2	6	0	0	0	0	Below guideline value.
Arsenic, As	14	0.1	10	1	2	1	1	**Above guideline value in one community.**
Barium, Ba	240	2	1,000	0	0	0	0	Below guideline value.
Boron, B	1,500	10	5,000	0	0	0	0	Below guideline value.
Cadmium, Cd	0.1	0.01	5	0	0	0	0	Below guideline value.
Chromium, Cr	1.2	0.2	50	0	0	0	0	Below guideline value.
Mercury, Hg	<0.01	0.01	1	0	0	0	0	Below guideline value.
Lead, Pb	12.3	0.1	10	0	2	0	0	Flushed sample below guideline value.
Selenium, Se	79.2	0.2	50	1	1	1	0	**Above guideline value in one community.**
Uranium	46	0.01	20	1	2	2	0	**Above guideline value in one community.**
Boreal Shield								
Antimony, Sb	0.3	0.2	6	0	0	0	0	Below guideline value.
Arsenic, As	5.8	0.2	10	0	0	0	0	Below guideline value.
Barium, Ba	243	0.2	1,000	0	0	0	0	Below guideline value.

Trace metal detected	Maximum detected	Detection Limit	Maximum Allowable Concentration (GCDWQ 2017)	Number of communities exceeding the guideline value	Total number of samples in excess			Comments
		µg/L			First Draw	Flushed (5 Min)	Duplicate	
Boron, B	420	10	5,000	0	0	0	0	Below guideline value.
Cadmium, Cd	2.8	0.04	5	0	0	0	0	Below guideline value.
Chromium, Cr	2.6	0.2	50	0	0	0	0	Below guideline value.
Lead, Pb	**120**	0.1	10	1	37	1	1	One flushed sample above guideline value.
Mercury, Hg	<0.01	0.01	1	0	0	0	0	Below guideline value.
Selenium, Se	0.64	0.2	50	0	0	0	0	Below guideline value.
Uranium, U	58	0.1	20	2	22	22	3	**Above guideline value in two communities.**
Taiga Shield								
Antimony, Sb	0.12	0.1	6	0	0	0	0	Below guideline value.
Arsenic, As	0.14	0.1	10	0	0	0	0	Below guideline value.
Barium, Ba	34.7	2.0	1,000	0	0	0	0	Below guideline value.
Boron, B	97	10	5,000	0	0	0	0	Below guideline value.
Cadmium, Cd	0.07	0.01	5	0	0	0	0	Below guideline value.
Chromium, Cr	2.6	0.5	50	0	0	0	0	Below guideline value.
Lead, Pb	11.1	0.1	10	0	2	0	0	Flushed sample below guideline value.
Mercury, Hg	<0.01	0.01	0	0	0	0	0	Below guideline value.
Selenium, Se	0.5	0.05	50	0	0	0	0	Below guideline value.
Uranium, U	2.2	0.01	20	0	0	0	0	Below guideline value.
Hudson Plains								
Antimony, Sb	0.05	0.2	6	0	0	0	0	Below guideline value.
Arsenic, As	0.53	0.2	10	0	0	0	0	Below guideline value.
Barium, Ba	20.6	0.2	1,000	0	0	0	0	Below guideline value.
Boron, B	<10	10	5,000	0	0	0	0	Below guideline value.
Cadmium, Cd	1.91	0.04	5	0	0	0	0	Below guideline value.
Chromium, Cr	0.4	0.2	50	0	0	0	0	Below guideline value.
Lead, Pb	62.3	0.2	10	0	12	0	0	Flushed samples below guideline value.
Mercury, Hg	<0.01	0.01	0	0	0	0	0	Below guideline value.

Trace metal detected	Maximum detected	Detection Limit	Maximum Allowable Concentration (GCDWQ 2017)	Number of communities exceeding the guideline value	Total number of samples in excess			Comments
	µg/L				First Draw	Flushed (5 Min)	Duplicate	
Selenium, Se	0.08	0.2	50	0	0	0	0	Below guideline value.
Uranium, U	0.08	0.1	20	0	0	0	0	Below guideline value.
Mixedwood Plains								
Antimony, Sb	0.69	0.2	6	0	0	0	0	Below guideline value.
Arsenic, As	1.99	0.2	10	0	0	0	0	Below guideline value.
Barium, Ba	878	0.2	1,000	0	0	0	0	Below guideline value.
Boron, B	3,000	10	5,000	0	0	0	0	Below guideline value.
Cadmium, Cd	0.49	0.04	5	0	0	0	0	Below guideline value.
Chromium, Cr	1.6	0.5	50	0	0	0	0	Below guideline value.
Lead, Pb	34.4	0.2	10	1	8	1	1	**Above guideline value in one community.**
Mercury, Hg	<0.01	0.01	0	0	0	0	0	Below guideline value.
Selenium, Se	0.16	0.05	50	0	0	0	0	Below guideline value.
Uranium, U	4.0	0.1	20	0	0	0	0	Below guideline value.
Atlantic Maritime								
Antimony, Sb	0.86	0.5	6	0	0	0	0	Below guideline value.
Arsenic, As	1.8	0.1	10	0	0	0	0	Below guideline value.
Barium, Ba	716	2	1,000	0	0	0	0	Below guideline value.
Boron, B	375	10	5,000	0	0	0	0	Below guideline value.
Cadmium, Cd	0.24	0.09	5	0	0	0	0	Below guideline value.
Chromium, Cr	3.67	0.5	50	0	0	0	0	Below guideline value.
Lead, Pb	8.57	0.5	10	0	0	0	0	Below guideline value.
Mercury, Hg	0.01	0.01	0	0	0	0	0	Below guideline value.
Selenium, Se	1.48	0.4	50	0	0	0	0	Below guideline value.
Uranium, U	9.62	0.01	20	0	0	0	0	Below guideline value.

Table 5.2 Trace metals analysis results for parameters of aesthetic or operational concern

Trace Metal detected	Maximum detected (µg/L)	Detection Limit (µg/L)	AO-Aesthetic Objective (GCDWQ 2017) (µg/L)	Number of communities exceeding the guideline value	Total number of samples in excess: First Draw	Flushed (5 Min)	Duplicate	Comments
All ecozones								
Aluminum, Al	33,100	1	100/200*	23	188	208	54	Above guideline. Elevated levels pose no health concern.
Copper, Cu	6,540	0.2	1,000	5	68	8	1	Above guideline. Elevated levels pose no health concern.
Iron, Fe	5,810	10	300	16	56	52	11	Above guideline. Elevated levels pose no health concern.
Manganese, Mn	3,250	0.5	50	25	97	114	13	Above guideline. Elevated levels pose no health concern.
Sodium, Na	866,000	500	200,000	11	79	74	12	Above guideline. Elevated levels pose no health concern.
Zinc, Zn	6,890	3.0	5,000	0	2	0	0	Below guideline value.
Pacific Maritime								
Aluminum, Al	37	1	100/200*	0	0	0	0	Below guideline value
Copper, Cu	2,930	0.2	1,000	0	13	0	0	Flushed samples below guideline value.
Iron, Fe	1,310	10	300	2	2	2	0	Above guideline. Elevated levels pose no health concern
Manganese, Mn	44	0.2	50	0	0	0	0	Below guideline value
Sodium, Na	62,300	10	200,000	0	0	0	0	Below guideline value
Zinc, Zn	725	1	5,000	0	0	0	0	Below guideline value
Boreal Cordillera								
Aluminum, Al	6	1	100/200*	0	0	0	0	Below guideline value.
Copper, Cu	602	0.2	1,000	0	0	0	0	Below guideline value.
Iron, Fe	85	10	300	0	0	0	0	Below guideline value.
Manganese, Mn	70	0.2	50	1	1	1	0	Above guideline. Elevated levels pose no health concern
Sodium, Na	25,600	10	200,000	0	0	0	0	Below guideline value.
Zinc, Zn	175	1	5,000	0	0	0	0	Below guideline value.

Trace Metal detected	Maximum detected	Detection Limit	AO-Aesthetic Objective (GCDWQ 2017)	Number of communities exceeding the guideline value	Total number of samples in excess			Comments
	µg/L				First Draw	Flushed (5 Min)	Duplicate	
Montane Cordillera								
Aluminum, Al	287	1	100/200*	1	6	8	3	Above guideline. Elevated levels pose no health concern
Copper, Cu	2,200	0.2	1,000	0	2	0	0	Flushed samples below guideline value.
Iron, Fe	1,420	10	300	1	1	1	1	Above guideline. Elevated levels pose no health concern
Manganese, Mn	250	0.2	50	1	4	3	0	Above guideline. Elevated levels pose no health concern
Sodium, Na	298,000	10	200,000	1	1	1	0	Above guideline. Elevated levels pose no health concern
Zinc, Zn	1,130	1	5,000	0	0	0	0	Below guideline value.
Taiga Plains								
Aluminum, Al	40	10	100/200*	0	0	0	0	Below guideline value
Copper, Cu	337	0.2	1,000	0	0	0	0	Below guideline value
Iron, Fe	76	10	300	0	0	0	0	Below guideline value
Manganese, Mn	21	0.2	50	0	0	0	0	Below guideline value
Sodium, Na	14,700	2,000	200,000	0	0	0	0	Below guideline value
Zinc, Zn	745	1	5,000	0	0	0	0	Below guideline value
Boreal Plains								
Aluminum, Al	448	1	100/200*	4	43	41	22	Above guideline. Elevated levels pose no health concern.
Copper, Cu	5,130	0.2	1,000	1	9	1	0	Above guideline. Elevated levels pose no health concern.
Iron, Fe	5,810	10	300	5	11	10	4	Above guideline. Elevated levels pose no health concern.
Manganese, Mn	191	0.2	50	7	11	12	4	Above guideline. Elevated levels pose no health concern
Sodium, Na	485,000	10	200,000	2	34	33	7	Above guideline. Elevated levels pose no health concern
Zinc, Zn	6,890	1	5,000	0	1	0	0	Flushed samples below guideline value.

Trace Metal detected	Maximum detected	Detection Limit	AO-Aesthetic Objective (GCDWQ 2017)	Number of communities exceeding the guideline value	Total number of samples in excess			Comments
	µg/L				First Draw	Flushed (5 Min)	Duplicate	
Prairies								
Aluminum, Al	290	10	100/200*	1	17	14	5	Above guideline. Elevated levels pose no health concern.
Copper, Cu	1,890	1.0	1,000	1	2	1	0	Below guideline value.
Iron, Fe	580	50	300	0	2	0	0	Flushed samples below guideline value.
Manganese, Mn	3,250	0.5	50	4	15	18	2	Above guideline. Elevated levels pose no health concern.
Sodium, Na	766,000	500	200,000	4	32	26	4	Below guideline value.
Zinc, Zn	2,420	3.0	5,000	0	0	0	0	Below guideline value.
Boreal Shield								
Aluminum, Al	33,100	10	100/200*	9	57	77	11	Above guideline. Elevated levels pose no health concern.
Copper, Cu	6,540	1.0	1,000	1	25	2	0	Above guideline. Elevated levels pose no health concern.
Iron, Fe	1,830	50	300	2	26	22	4	Above guideline. Elevated levels pose no health concern
Manganese, Mn	444	0.5	50	2	20	21	4	Above guideline. Elevated levels pose no health concern
Sodium, Na	125,000	10	200,000	0	0	0	0	Below guideline value.
Zinc, Zn	6,460	1.0	5,000	0	2	0	0	Flushed samples below guideline value.
Taiga Shield								
Aluminum, Al	1,060	1	100/200*	1	15	15	3	Above guideline. Elevated levels pose no health concern
Copper, Cu	1,270	0.2	1,000	0	2	0	0	Flushed samples below guideline value.
Iron, Fe	768	10	300	1	6	10	2	Above guideline. Elevated levels pose no health concern
Manganese, Mn	142	0.2	50	1	7	16	2	Above guideline. Elevated levels pose no health concern
Sodium, Na	17,500	10	200,000	0	0	0	0	Below guideline value
Zinc, Zn	2,030	1	5,000	0	0	0	0	Below guideline value

Trace Metal detected	Maximum detected	Detection Limit	AO-Aesthetic Objective (GCDWQ 2017)	Number of communities exceeding the guideline value	Total number of samples in excess			Comments
	µg/L				First Draw	Flushed (5 Min)	Duplicate	
Hudson Plains								
Aluminum, Al	1,920	1	100/200*	2	21	21	5	Above guideline. Elevated levels pose no health concern.
Copper, Cu	3,460	0.2	1,000	0	6	0	0	Flushed samples below guideline value.
Iron, Fe	1,540	10	300	0	0	0	0	Below guideline value.
Manganese, Mn	62.5	0.2	50	1	0	4	0	Above guideline. Elevated levels pose no health concern.
Sodium, Na	24,200	10	200,000	0	0	0	0	Below guideline value.
Zinc, Zn	3,930	3.0	5,000	0	0	0	0	Below guideline value.
Mixedwood Plains								
Aluminum, Al	596	1	100/200*	2	11	11	1	Above guideline. Elevated levels pose no health concern.
Copper, Cu	5,850	0.2	1,000	2	5	4	1	Above guideline. Elevated levels pose no health concern.
Iron, Fe	5,070	10	300	4	7	6	0	Above guideline. Elevated levels pose no health concern.
Manganese, Mn	370	0.5	50	3	6	7	1	Above guideline. Elevated levels pose no health concern.
Sodium, Na	866,000	500	200,000	4	14	12	1	Above guideline. Elevated levels pose no health concern.
Zinc, Zn	2,760	3	5,000	0	0	0	0	Below guideline value.
Atlantic Maritime								
Aluminum, Al	543	10	100/200*	3	18	21	4	Above guideline. Elevated levels pose no health concern.
Copper, Cu	1,570	1	1,000	0	4	0	0	Flushed samples below guideline value.
Iron, Fe	589	50	300	1	1	1	0	Above guideline. Elevated levels pose no health concern
Manganese, Mn	975	0.5	50	5	33	32	0	Above guideline. Elevated levels pose no health concern
Sodium, Na	133,000	500	200,000	0	0	0	0	Below guideline value.
Zinc, Zn	2,100	3	5,000	0	0	0	0	Below guideline value.

*This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants. The operational guidance values of 0.1mg/L applies to conventional treatment plants, and 0.2 mg/L applies to other types of treatment systems

Table 5.3 Pharmaceuticals tested for and quantified in First Nations communities

	Pharmaceutical	Areas of Use			Detected Surface Water
		Human	Veterinary	Aquaculture	
1	Acetaminophen	X			**Yes**
2	Atenolol	X			**Yes**
3	Atorvastatin	X			**Yes**
4	Bezafibrate	X			**Yes**
5	Caffeine	X			**Yes**
6	Carbamazepine	X			**Yes**
7	Chlortetracycline		X		**Yes**
8	Cimetidine	X			**Yes**
9	Ciprofloxacin	X			**Yes**
10	Clarithromycin	X			**Yes**
11	Clofibric Acid	X	X		No
12	Codeine	X			**Yes**
13	Cotinine	X			**Yes**
14	Dehydronifedipine	X			**Yes**
15	Diclofenac	X			**Yes**
16	Diltiazem	X			**Yes**
17	Diphenhydramine	X			**Yes**
18	Erythromycin	X	X		**Yes**
19	Fluoxetine	X	X		**Yes**
20	Furosemide	X			**Yes**
21	Gemfibrozil	X			**Yes**
22	Hydrochlorothiazide	X			**Yes**
23	Ibuprofen	X			**Yes**
24	Indomethacin	X			No
25	Isochlortetracycline		X		**Yes**
26	Ketoprofen	X	X		**Yes**
27	Lincomycin		X		No
28	Metformin	X			**Yes**
29	Metoprolol	X			**Yes**
30	Monensin		X		No
31	Naproxen	X			**Yes**
32	Oxytetracycline		X	X	No
33	Pentoxifylline	X	X		**Yes**
34	Ranitidine	X			**Yes**
35	Roxithromycin	X			No
36	Sulfamethazine		X		**Yes**
37	Sulfamethoxazole	X			**Yes**
38	Tetracycline	X	X		No
39	Trimethoprim	X	X	X	**Yes**
40	Warfarin	X	X		**Yes**
41	17-alpha-Ethinylestradiol	X			**Yes**
42	17-alpha-Trenbolone		X		No
43	17-beta-Trenbolone		X		No

Table 5.4 Maximum concentration of pharmaceuticals in surface water in First Nations communities

	Pharmaceutical	Max concentration (ng/L)	Number of communities		Number of sites	
			Collected	Detected	Collected	Detected
	Across all ecozones					
1	Acetaminophen	307	95	13	285	23
2	Atenolol	245	95	28	285	78
3	Atorvastatin	8.8	95	1	285	1
4	Bezafibrate	11.2	95	8	285	19
5	Caffeine	4,018	95	57	285	105
6	Carbamazepine	91.5	95	18	285	40
7	Chlortetracycline	12	95	2	285	3
8	Cimetidine	40.9	95	15	285	37
9	Ciprofloxacin	37.7	95	4	285	8
10	Clarithromycin	69.6	95	10	285	23
11	Clofibric Acid	8.6	95	5	285	9
12	Codeine	101	95	6	285	16
13	Cotinine	90	95	28	285	50
14	Dehydronifedipine	9.5	95	5	285	5
15	Diclofenac	38	95	6	285	10
16	Diltiazem	73.1	95	2	285	2
17	Diphenhydramine	9.5	95	4	285	6
18	Erythromycin	23	95	1	285	1
19	Fluoxetine	50.7	95	4	285	5
20	Furosemide	30.7	95	2	285	4
21	Gemfibrozil	16.8	95	7	285	15
22	Hydrochlorothiazide	85.9	95	6	285	16
23	Ibuprofen	367	95	5	285	7
24	Indomethacin	<15	95	0	285	0
25	Isochlortetracycline	13	95	1	285	1
26	Ketoprofen	307	95	10	285	17
27	Lincomycin	<10	95	0	285	0
28	Metformin	6,210	95	27	285	60
29	Metoprolol	77	95	6	285	18
30	Monensin	<10	95	0	285	0
31	Naproxen	244	95	13	285	24
32	Oxytetracycline	<10	95	0	285	0
33	Pentoxifylline	26.9	95	3	285	5
34	Ranitidine	33	95	4	285	12
35	Roxithromycin	<5	95	0	285	0
36	Sulfamethazine	24.2	95	4	285	8
37	Sulfamethoxazole	87	95	15	285	41
38	Tetracycline	<10	95	0	285	0
39	Trimethoprim	32	95	9	285	20
40	Warfarin	6.9	95	5	285	11
41	17-alpha-Ethinylestradiol	0.74	95	3	285	5
42	alpha-Trenbolone	<2	95	0	285	0
43	beta-Trenbolone	<2	95	0	285	0

Table 5.5 Maximum concentration of pharmaceuticals in drinking water sites in the four communities where sampled.

	Pharmaceutical	Max concentration (ng/L)	Number of communities		Number of sites	
			Collected	Detected	Collected	Detected
1	Acetaminophen	<10	4	0	11	0
2	Atenolol	6.9	4	1	11	1
3	Atorvastatin	<5	4	0	11	0
4	Bezafibrate	<1	4	0	11	0
5	Caffeine	96.2	4	1	11	1
6	Carbamazepine	9.2	4	1	11	1
7	Chlortetracycline	<10	4	0	11	0
8	Cimetidine	<2	4	0	11	0
9	Ciprofloxacin	<20	4	0	11	0
10	Clarithromycin	<2	4	0	11	0
11	Clofibric Acid	<1	4	0	11	0
12	Codeine	<5	4	0	11	0
13	Cotinine	14.4	4	1	11	1
14	Dehydronifedipine	<2	4	0	11	0
15	Diclofenac	<15	4	0	11	0
16	Diltiazem	<5	4	0	11	0
17	Diphenhydramine	<10	4	0	11	0
18	Erythromycin	<10	4	0	11	0
19	Fluoxetine	<5	4	0	11	0
20	Furosemide	<5	4	0	11	0
21	Gemfibrozil	<10	4	0	11	0
22	Hydrochlorothiazide	<5	4	0	11	0
23	Ibuprofen	<20	4	0	11	0
24	Indomethacin	<15	4	0	11	0
25	Isochlortetracycline	<10	4	0	11	0
26	Ketoprofen	5.5	4	1	11	2
27	Lincomycin	<10	4	0	11	0
28	Metformin	<10	4	0	11	0
29	Metoprolol	<5	4	0	11	0
30	Monensin	<10	4	0	11	0
31	Naproxen	<5	4	0	11	0
32	Oxytetracycline	<10	4	0	11	0
33	Pentoxifylline	<2	4	0	11	0
34	Ranitidine	<10	4	0	11	0
35	Roxithromycin	<5	4	0	11	0
36	Sulfamethazine	<5	4	0	11	0
37	Sulfamethoxazole	<2	4	0	11	0
38	Tetracycline	<10	4	0	11	0
39	Trimethoprim	<2	4	0	11	0
40	Warfarin	<0.5	4	0	11	0
41	17-alpha-Ethinylestradiol	<0.20	4	0	11	0
42	alpha-Trenbolone	<2	4	0	11	0
43	beta-Trenbolone	<2	4	0	11	0

Table 5.6 Maximum concentration of pharmaceuticals in wastewater sites in the five communities where sampled

	Pharmaceutical	Max concentration (ng/L)	Number of communities		Number of sites	
			Collected	Detected	Collected	Detected
1	Acetaminophen	14,600	5	5	6	5
2	Atenolol	165	5	4	6	4
3	Atorvastatin	5.6	5	1	6	1
4	Bezafibrate	<1	5	0	6	0
5	Caffeine	12,600	5	5	6	6
6	Carbamazepine	398	5	5	6	6
7	Chlortetracycline	<10	5	0	6	0
8	Cimetidine	36.2	5	5	6	6
9	Ciprofloxacin	7,970	5	3	6	3
10	Clarithromycin	929	5	3	6	4
11	Clofibric Acid	6.4	5	1	7	1
12	Codeine	563	5	5	6	6
13	Cotinine	1,860	5	5	6	6
14	Dehydronifedipine	<2	5	0	6	0
15	Diclofenac	506	5	2	6	3
16	Diltiazem	60.9	5	1	6	1
17	Diphenhydramine	838	5	1	6	1
18	Erythromycin	21	5	1	6	1
19	Fluoxetine	<5	5	0	6	0
20	Furosemide	128	5	1	6	1
21	Gemfibrozil	8.7	5	2	6	3
22	Hydrochlorothiazide	44.8	5	4	6	4
23	Ibuprofen	15,200	5	4	6	5
24	Indomethacin	<15	5	0	6	0
25	Isochlortetracycline	<10	5	0	6	0
26	Ketoprofen	77.3	5	1	6	2
27	Lincomycin	<10	5	0	6	0
28	Metformin	17,700	5	5	6	6
29	Metoprolol	26.4	5	3	6	4
30	Monensin	<10	5	0	**6**	0
31	Naproxen	4,370	5	5	6	6
32	Oxytetracycline	<10	5	0	6	0
33	Pentoxifylline	<2	5	0	6	0
34	Ranitidine	238	5	3	6	3
35	Roxithromycin	<5	5	0	6	0
36	Sulfamethazine	15.6	5	1	6	1
37	Sulfamethoxazole	2,010	5	5	6	6
38	Tetracycline	<10	5	0	6	0
39	Trimethoprim	696	5	4	6	5
40	Warfarin	171	5	1	6	2
41	17-α-Ethinylestradiol	<0.20	5	0	6	0
42	alpha-Trenbolone	<2	5	0	6	0
43	beta-Trenbolone	<2	5	0	6	0

Table 5.7 Comparison of pharmaceutical levels detected in surface and wastewater in First Nations communities participating in FNFNES to findings from Canadian, U.S. and global studies

Pharmaceutical	FNFNES Maximum concentration (ng/L) and location		Maximum reported concentration (ng/L) and location						Reference
			Canada		USA		Global		
	Surface water	Waste-water	Surface water	Waste-water	Surface water	Waste-water	Surface Water	Waste-water	
Analgesic									
Codeine	101	563	232 a	5,700 b	1,000 c	730 d	815 e	32,295 f	(a) (de Solla et al. 2016); (b) (Guerra et al. 2014); (c) (Kolpin et al. 2002); (d) (Glassmeyer et al. 2005); (e) (Kasprzyk-Hordern, Dinsdale and Guwy 2008); (f) (Kasprzyk-Hordern, Dinsdale and Guwy 2009)
	ON	*SK*	*ON*	*Unspecified*	*Unspecified*	*Unspecified*	*Wales*	*Wales*	
Analgesic/Anti-Inflammatory									
Acetaminophen	307	14,600	3,500 g	500,000 b	10,000 c	1,000,000 h	106,970 i	1,510,000 j	(g) (Waiser et al. 2011); (b) (Guerra et al. 2014); (c) (Kolpin et al. 2002); (h) (Wilcox et al. 2009) (i) (K'oreje et al. 2016); (j) (Wiest et al. 2018)
	AT	*SK*	*SW*	*Unspecified*	*Unspecified*	*WI*	*Kenya*	*France*	
Diclofenac	38	506	260 g	28,400 k	4,830 l	640 m	18,740 n	836,000 o	(g) (Waiser et al. 2011); (k) (Metcalfe et al. 2004); (l) (Bai et al. 2018); (m) (Fang et al. 2012); (n) (Ginebreda et al. 2010); (o) (Ashfaq et al. 2017)
	ON	*SK*	*SK*	*ON*	*CO*	*CA*	*Spain*	*Pakistan*	
Ibuprofen	367	15,200	6,400 p	75,800 q	2,796,000 r	110,000 s	303,000 t	1,673,000 u	(p) (Sadezky et al. 2010); (q) (Metcalfe, Koenig et al. 2003a); (r) (Wu et al. 2009); (s) (Conn et al. 2010); (t) (Aus der Beek et al. 2016); (u) (Ashfaq et al. 2017)
	ON	*SK*	*ON*	*Unspecified*	*WA*	*Unspecified*	*Bulgaria*	*Pakistan*	
Indomethacin	0	0	150 v	803 w	48 p	29 p	2,323 x	3,220 y	(v) (Brun et al. 2006); (w) (Sosiak and Hebben 2005); (p) (Sadezky et al. 2010); (x) (Spongberg et al. 2011); (y) (Pais and Nascimento 2018)
			NL	*AB*	*Unspecified*	*Unspecified*	*Costa Rica*	*Brazil*	
Ketoprofen	307	7	79 v	5,700 q	10 z	1,000 aa	9,808 x	233,630 ab	(v) (Brun et al. 2006); (q) (Metcalfe et al. 2003a); (z) (Gross et al. 2004); (aa) (Benotti and Brownawell, Distributions of pharmaceuticals in an urban estuary during both dry- and wet-weather conditions 2007); (x) (Spongberg et al. 2011); (ab) (Kotowska, Kapelewska and Sturgulewska 2014)
	BC	*SK*	*NL*	*Unspecified*	*CA*	*NY*	*Costa Rica*	*Poland*	
Naproxen	244	4,370	4,500 v	611,000 p	310 ac	210,000 ad	59,300 ae	611,000 af	(v) (Brun et al. 2006); (p) (Sadezky et al. 2010); (ac) (Benotti, Stanford and Snyder 2010); (ad) (Yu, L. and Chang 2013); (ae) (Gumbi et al. 2017); (af) (Miege et al. 2009).
	QC	*SK*	*NL*	*Unspecified*	*NE*	*CA*	*South Africa*	*France*	

Pharmaceutical	FNFNES Maximum concentration (ng/L) and location		Maximum reported concentration (ng/L) and location						Reference
			Canada		USA		Global		
	Surface water	Waste-water	Surface water	Waste-water	Surface water	Waste-water	Surface Water	Waste-water	
Antacid									
Cimetidine	41	36	5.3 a	100 ag	688 ah	463 ai	1,338 aj	61,200 ak	(a) (de Solla et al. 2016); (ag) (Kim et al. 2014) (ah) (Bradley et al. 2014); (ai) (Lara-Martin et al. 2014); (aj) (Choi et al. 2008); (ak) (Wang and Lin 2014)
	SK	***SK***	***ON***	***ON***	***IA***	***NY***	***Korea***	***Taiwan***	
Ranitidine	33	238	127 a	801 al	2,200 ah	1,400 am	1,944 an	160,000 ao	(a) (de Solla et al. 2016); (al) (Liu et al. 2012); (ah) Bradley et al. 2014; (am) (Batt et al. 2016); (an) (Valcarcel, Gonzalez et al. 2011a); (ao) (Lindberg et al. 2014)
	ON	***SK***	***ON***	***ON***	***IA***	***Unspecified***	***Spain***	***India***	
Antianginal metabolite									
Dehydronifedipine	9.5	0	4.14 a	NA	70 abt	1,560 abu	NA	89 abv	(a) de Solla et al. 2016; (abt) (Oppenheimer et al. 2011); (abu) (Lietz and Meyer 2006); (abv) (Ternes, Bonerz and Schmidt 2001)
	BC		***ON***		***Unspecified***	***FL***		***Germany***	
Antibiotic									
Chlortetracycline	12	0	192 ap	7,970 aq	1,500 ar	1,000,000 ar	3,330 as	310,000 at	(ap) (Lissemore et al. 2006); (aq) (Frey et al. 2015); (ar) (Campagnolo et al. 2002);(as) (Kim et al. 2019); (at) (Hou et al. 2016)
	AB		***ON***	***ON***	***GA***	***GA***	***Korea***	***China***	
Ciprofloxacin	38	7,970	188 au	1,790 av	360 p	6,441 aw	6,500,000 ax	31,000,000 ao	(au) (Kleywegt et al. 2011) (av) (Lawrence et al. 2014); (p) (Sadezky et al. 2010); (aw) (Mohapatra et al. 2016); (ax) (Hoa et al. 2011) ; (ao) (Lindberg et al. 2014)
	ON	***SK***	***AB***	***SK***	***Unspecified***	***GA***	***India***	***India***	
Clarithromycin	70	929	243 a	800 b	72 r	8,100 ay	1,727 an	15,000 az	(a) (de Solla et al. 2016); (b) (Guerra et al. 2014); (r) (Wu et al. 2009); (ay) Blair et al. 2015; (an) (Valcarcel et al. 2011a); (az) (Yilmaz et al. 2017)
	ON	***SK***	***ON***	***Unspecified***	***OH***	***WI***	***Spain***	***Turkey***	
Erythromycin	23	21	590 g	1,727 aaa	1,209,000 p	18,000 aab	7,200 aac	55,300 ak	(g) (Waiser et al. 2011); (aaa) (Bergh 2000); (p) (Sadezky et al. 2010); (aab) (Godfrey, Woessner and Benotti 2007); (aac) (Agunbiade and Moodley 2014); (ak) (Wang and Lin 2014)
	ON	***SK***	***SK***	***BC***	***Unspecified***	***MT***	***South Africa***	***Taiwan***	
Isochlortetracycline	13	0	NA	NA	NA	NA	15	NA	(adc) (Bu et al. 2013)
	AB						***China***		
Lincomycin	0	0	355 ap	110 b	730 c	240,000 ar	21,100 aad	43,909,000 aae	(ap) (Lissemore et al. 2006); (b) Guerra et al. 2014; (c) Kolpin et al. 2002; (ar) (Campagnolo et al. 2002); (aad) B (Boxall et al. 2005); (aae) (Sim et al. 2011)
			ON	***Unspecified***	***Unspecified***	***GA***	***UK***	***Korea***	

Pharmaceutical	FNFNES Maximum concentration (ng/L) and location		Maximum reported concentration (ng/L) and location						Reference
			Canada		USA		Global		
	Surface water	Waste-water	Surface water	Waste-water	Surface water	Waste-water	Surface Water	Waste-water	
Monensin	0	0	1,172 ap	22 aaf	3.410 aag	13,000 aah	150 aai	20 aai	(ap) Lissemore et al. 2006; (aaf) (Hao et al. 2008); (aag) (Kurwadkar et al. 2012); (aah) (Bartelt-Hunt, Snow and Damon-Powell et al. 2011); (aai) (Watkinson et al. 2009)
			ON	***ON***	***TX***	***NE***	***Australia***	***Australia***	
Oxytetracycline	0	0	250 aaj	440 aak	1,340 aal	47,000 aam	712,000 aan	920,000,000 aan	(aaj) (Forrest et al. 2011); (aak) (Gagne, Blaise and Andre 2006); (aal) (Lindsey, Meyer and Thurman 2001); (aam) (Karthikeyan and Meyer 2006); (aan) (Li et al. 2008)
			AB	***QC***	***Unspecified***	***WI***	***China***	***China***	
Roxithromycin	0	0	66 au	18 aao	18 c	1,500 aam	3,700 aap	1,700 c	(au) Kleywegt et al. 2011; (aao) Miao et al. 2004; (c) Kolpin et al. 2002; (aam) Karthikeyan and Meyer 2006; (aap) Bu et al. 2013
			ON	***Unspecified***	***Unspecified***	***WI***	***China***	***Germany***	
Sulfamethazine	24.2	15.6	408 ap	363 aao	220 p, aal	400,000 ar	21,300 as	400,000 aar	(ap) Lissemore et al. 2006; (aao) (Miao et al. 2004); (c) Kolpin et al. 2002; (aal) Lindsey et al. 2001; (ar) Campagnolo et al. 2002; (as) (Kim et al. 2019); (aar) (Babic et al. 2007)
	QC	***ON***	***ON***	***Unspecified***	***Unspecified***	***GA***	***Korea***	***Croatia***	
Sulfamethoxazole	87	2,010	600 g	3,278 w	3,280 ah	180,000 aas	53,828 ax	1,340,000 aat	(g) (Waiser et al. 2011); (w) (Sosiak and Hebben 2005); (ah) (Bradley et al. 2014) ; (aas) (Nagarnaik, Batt and Boulanger 2012); (ax) (Segura et al. 2015); (aat) (Lin and Tsai 2009)
	ON	***SK***	***SK***	***AB***	***IA***	***TX***	***Mozambique***	***Taiwan***	
Tetracycline	0	0	35 au	977 aaa	140 aau	48,000 aam	3,000 aac	2,600,000 at	(au) Kleywegt et al. 2011; (aaa) (Bergh 2000); (aau) (Yang and Carlson 2004); (aam) (Karthikeyan and Meyer 2006); (aac) (Agunbiade and Moodley 2014); (at) (Hou et al. 2016)
			ON	***BC***	***CO***	***WI***	***South Africa***	***China***	
Trimethoprim	32	696	176 aav	5,300 aaw	1,220 ah	62,100 aas	11,383 ax	162,000 aae	(aav) Hebben 2005; (aaw) Chen et al. 2015; (ah) Bradley et al. 2014; (aas) Nagarnaik et al. 2012; (ax) Segura et al. 2015; (aae) Sim et al. 2011
	ON	***SK***	***AB***	***AB***	***IA***	***TX***	***Kenya***	***Korea***	
Anticoagulant									
Warfarin	6.9	171	NA	8.39 al	131.3 am	1,300 aab	3 aax	105 aay	(al) (Liu et al. 2012); (am) Batt et al. 2016; (aab) Godfrey et al. 2007; (aax) (Huerta-Fontela, Galcerna and Ventura 2011); (aay) (Schlabach, Dye et al. 2008)
	BC	***SK***		***ON***	***Unspecified***	***MT***	***Spain***	***Norway***	

Pharmaceutical	FNFNES Maximum concentration (ng/L) and location		Maximum reported concentration (ng/L) and location						Reference
			Canada		USA		Global		
	Surface water	Waste-water	Surface water	Waste-water	Surface water	Waste-water	Surface Water	Waste-water	
Anticonvulsant									
Carbamazepine	39.6	398	749 au	3,287 w	3,480 aaz	1,500 aba	67,715 an	840,000 abb	(au) (Kleywegt et al. 2011); (w) Sosiak and Hebben 2005; (aaz) (Roden 2013); (aba) (Writer et al. 2013); (an) Valcarcel et al. 2011a; (abb) (Lester et al. 2013)
	ON	***SK***	***ON***	***AB***	***NJ***	***MN***	***Spain***	***Israel***	
Antidepressant									
Fluoxetine	50.7	0	141 abw	799 w	596 aa	600 aa	66.1 abx	1,760 aby	(abw) (Metcalfe, Chu et al. 2010); (w) (Sosiak and Hebben 2005); (aa) (Benotti et al. 2007); (abx) (Fernandez et al. 2010); (aby) (Biel-Maeso, Corada-Fernandez and Lara-Martín 2018)
	BC		***ON***	***AB***	***NY***	***NY***	***Spain***	***Spain***	
Antidiabetics									
Metformin	5,880	17,700	10,100 a	95,300 al	7,810 ah	99,000 ay	20,015 abc	339,000 abd	(a) (de Solla et al. 2016); (al) (Liu et al. 2012); (ah) (Bradley et al. 2014); (ay) (Blair et al. 2015); (abc) (Kong et al. 2015); (abd) (de Jesus Gaffney et al. 2017)
	QC	***SK***	***ON***	***ON***	***IA***	***WI***	***China***	***Portugal***	
Pentoxifylline	26.9	0	15 w	600 k	92 abe	110 abe	570 abf	9,767 abg	(w) (Sosiak and Hebben 2005); (k) (Metcalfe et al. 2004); (abe) (Chiu and Westerhoff 2010); (abf) (Sacher et al. 2008); (abg) (Lin, Yu and Lin 2008)
	QC		***AB***	***Unspecified***	***AZ***	***AZ***	***Germany***	***Taiwan***	
Antihistamine									
Diphenhydramine	56	838	58.8 a	2,380 ag	1,411 abh	1,800 abi	121 abj	12,400 abk	(a) (de Solla et al. 2016); (ag) Kim et al. 2014; (abh) (Bartelt-Hunt, Snow and Damon et al. 2009); (abi) (Li, Zheng and Kelly 2013); (abj) (Bayen et al. 2013); (abk) (D'Alessio et al. 2018)
	QC	***SK***	***ON***	***ON***	***NE***	***IL***	***South Korea***	***Hawai'i***	
Antihypertensives									
Diltiazem	73.1	61	38 a	1,350 ag	130 r	425 abl	65 abm	5,258 f	(a) (de Solla et al. 2016); (ag) (Kim et al. 2014); (r) (Wu et al. 2009); (abl) (Meador et al. 2016); (abm) (Kasprzyk-Hordern, Dinsdale and Guwy 2008); (f) Kasprzyk-Hordern et al. 2009
	ON	***SK***	***ON***	***ON***	***OH***	***WA***	***Wales***	***Wales***	
Antihypertensives (Beta-blockers)									
Atenolol	245	165	204 a	3,380 ag	1,850 l	10,900 abn	39,100 aac	122,000 abo	(a) (de Solla et al. 2016); (ag) (Kim et al. 2014); (l) (Bai et al. 2018); (abn) (Teerlink et al. 2012); (aac) Agunbiade and Moodley 2014; (abo) (Gomez et al. 2006)
		SK	***ON***	***ON***	***CO***	***CO***	***South Africa***	***Spain***	

Pharmaceutical	FNFNES Maximum concentration (ng/L) and location		Maximum reported concentration (ng/L) and location						Reference
			Canada		USA		Global		
	Surface water	Waste-water	Surface water	Waste-water	Surface water	Waste-water	Surface Water	Waste-water	
Metoprolol	77	26	37.3 a	745 abp	2,021 abq	2,269 abr	8,041 abs	950,000 ao	(a) de Solla et al. 2016; (abp) (Ortiz de Garcia, García-Encina and Irusta-Mata 2018); (abq) (Cantwell et al. 2018.); (abr) (Fono, Kolodziej and Sedlak 2006); (abs) (Lopez-Roldan et al. 2010); (ao) (Lindberg et al. 2014)
	ON	***SK***	***ON***	***MB***	***NY***	***TX***	***Spain***	***India***	
Antidepressant									
Fluoxetine	50.7	0	141 abw	799 w	596 aa	600 aa	66.1 abx	1,760 aby	(abw) (Metcalfe, Chu et al. 2010); (w) (Sosiak and Hebben 2005); (aa) (Benotti et al. 2007); (abx) (Fernandez et al. 2010); (aby) (Biel-Maeso, Corada-Fernandez and Lara-Martín 2018)
	BC		***ON***	***AB***	***NY***	***NY***	***Spain***	***Spain***	
Diuretics									
Furosemide	30.7	128	284 a	913 ag	1,234.8 adq	1,830 ai	630 f	32,558 abz	(a) (de Solla et al. 2016); (ag) (Kim et al. 2014); (abq) (Cantwell et al. 2018); (ai) (Lara-Martin et al. 2014) (f) (Kasprzyk-Hordern et al. 2009); (abz) (Santos et al. 2013)
	QC	***SK***	***ON***	***ON***	***NY***	***NY***	***Wales***	***Portugal***	
Hydrochlorothiazide	85.9	45	324 a	313 ag	1,470 l	2,950 aca	17,589 acb	6,370 acc	(a) (de Solla et al. 2016); (ag) (Kim et al. 2014); (l) (Bai et al. 2018); (aca) (Batt et al. 2008); (acb) (Valcarcel, Gonzalez et al. 2011b); (acc) (Valls-Cantenys et al. 2016)
	ON	***SK***	***ON***	***ON***	***CO***	***OH***	***Spain***	***Germany***	
Lipid regulators									
Atorvastatin	8.8	5.6	59.1 acd	860 ace	101.3 acf	939 ai	233 acg	1,101 acg	(acd) (Lee et al. 2009); (ace) (Ghoshdastidar, Fox and Tong 2015); (acf) (Conley et al. 2008); (ai) (Lara-Martin et al. 2014); (acg) (Archer et al. 2017)
	QC	***ON***	***ON***	***NS***	***TN***	***NY***	***South Africa***	***South Africa***	
Bezafibrate	11.2	0	470 v	810 v	NA	4 ai	15,060 n	7,600 ach	(v) (Brun et al. 2006); (ai) (Lara-Martin et al. 2014); (n) (Ginebreda et al. 2010) (Clara et al. 2005); (ach) Clara et al. 2005
	ON		***NL***	***PE***		***NY***	***Spain***	***Austria***	
Clofibric Acid	8.6	6	175 aci	283 acj	630 ack	1,250 acl	7,910 n	4,550 acm	(aci) (C. Metcalfe, X. Miao et al. 2003b); (acj) (Hua et al. 2006); (ack) (Loraine and Pettigrove 2006); (acl) (Xu et al. 2009); (n) (Ginebreda et al. 2010); (acm) (Nikolaou, Meric and Fatta 2007)
	BC	***SK***	***ON***	***ON***	***CA***	***CA***	***Spain***	***Germany***	
Gemfibrozil	16.8	9	4.2 g	36.53 acn	1.4404 aco	63.8 m	17.036 x	99.574 acp	(g) (Waiser et al. 2011); (acn) (Lee, Peart and Svoboda 2005); (aco) (Machado 2010); (m) (Fang et al. 2012); (x) (Spongberg et al. 2011); (acp) (Urtiaga et al. 2013)
	ON	***SK***	***SK***	***ON***	***NY***	***TX***	***Costa Rica***	***Spain***	

Pharmaceutical	FNFNES Maximum concentration (ng/L) and location		Maximum reported concentration (ng/L) and location						Reference
			Canada		USA		Global		
	Surface water	Waste-water	Surface water	Waste-water	Surface water	Waste-water	Surface Water	Waste-water	
Metabolite of nicotine (smoking cessation)									
Cotinine	90	1,860	189 w	3,476 w	1,400 abe	51,000 acq	6,582 an	42,300 acr	(w) (Sosiak and Hebben 2005); (abe) (Chiu and Westerhoff 2010); (acq) (Hinkle et al. 2005); (an) (Valcarcel, Gonzalez et al. 2011a); (acr) (Huerta-Fontela, Galceran et al. 2008)
	AB	*SK*	*AB*	*AB*	*AZ*	*OR*	*Spain*	*Spain*	
Steroid									
α – Trenbolone	0	0	NA	4.2 acs	120 act	1,720 acu	27.6 al	107 al	(acs) (Kleywegt, Pileggi and Lam et al. 2016); (act) (Durhan et al. 2006); (acu) (Khan and Lee 2012); (al) (Liu et al. 2012)
				ON	*OH*	*IN*	*China*	*China*	
β – Trenbolone	0	0	NA	NA	20 act	110 acu	96.4 al	40.6 al	(act) (Durhan et al. 2006); (acu) (Khan and Lee 2012); (al) (Liu et al. 2012)
					OH	*IN*	*China*	*China*	
Stimulant									
Caffeine	4,018	12,600	1,960 a	135,000 aaw	7,110 acv	9,300,000 s	1,121,446,000 x	3,549,000 acw	(a) (de Solla et al. 2016); (aaw) (Chen et al. 2015); (acv) (Young et al. 2008); (s) (Conn, Lowe et al. 2010); (x) (Spongberg et al. 2011); (acw) (Tran et al. 2014)
	ON		*ON*	*AB*	*MD*	*CO*	*Costa Rica*	*Singapore*	
Oral contraceptive									
17-alpha-Ethinylestradiol	0.74	0	3.1 acx	494 acy	431 l	242 acz	5,900 adb	9,833 ada	(acx) (Environment Canad. 2012); (acy) (Darwano, Duy and Sauve 2014); (l) (Bai et al. 2018); (acz) (Yang et al. 2011); (ada) (Kanama et al. 2018); (adb) (Sodré, Dutra and Portela dos Santos 2018)
	ON		*QC*	*QC*	*CO*	*GA*	*Brazil*	*South Africa*	

Table 5.8 Comparison of FNFNES results to drinking water guidelines in Australia, California and New York

Pharmaceutical	FNFNES Max concentration (ng/L)			Australian guideline (ng/L)	California monitoring trigger level (ng/L)	New York State standard (ng/L)
	Surface Water	Wastewater	Drinking Water			
All Ecozones combined: pharmaceuticals detected						
Analgesic						
Codeine	101	563	0	50,000	NA	NA
Analgesic/Anti-inflammatory						
Acetaminophen	307	14,600	0	175,000	350,000	5,000
Diclofenac	38	506	0	1,800	1,800	NA
Ibuprofen	367	15,200	0	400,000	34,000	50,000
Ketoprofen	307	7	5.5	3,500	3,500	NA
Naproxen	244	4,370	0	220,000	220,000	NA
Antacid						
Cimetidine	41	36	0	200,000	NA	NA
Ranitidine	33	238	0	NA	NA	NA
Antianginal metabolite						
Dehydronifedipine	56	838	0	20,000	NA	NA
Antibiotic						
Ciprofloxacin	38	7,970	0	250,000	17,000	NA
Clarithromycin	70	929	0	250,000	NA	NA
Chlortetracycline	12	0	0	105,000	NA	NA
Erythromycin	23	21	0	17,500	4,900	NA
Isochlortetracycline	13	0	0	NA	NA	NA
Sulfamethazine	24.2	15.6	0	35,000	NA	NA
Sulfamethoxazole	87	2,010	0	35,000	35,000	5,000
Trimethoprim	32	696	0	70,000	61,000	NA
Anticoagulant						
Warfarin	6.9	171	0	NA	2,300	NA
Anticonvulsant						
Carbamazepine	39.6	398	0	100,000	1,000	50,000

Pharmaceutical	FNFNES Max concentration (ng/L)			Australian guideline (ng/L)	California monitoring trigger level (ng/L)	New York State standard (ng/L)
	Surface Water	Wastewater	Drinking Water			
Antidepressant						
Fluoxetine	50.7	0	0	10,000	10,000	NA
Antidiabetic						
Metformin	5,880	17,700	0	250,000	NA	NA
Pentoxifylline	26.9	0	0	NA	NA	NA
Antihistamine						
Diphenhydramine	56	838	0	NA	NA	NA
Antihypertensive						
Diltiazem	73.1	61	0	60,000	NA	5,000
Antihypertensive (Beta-blocker)						
Atenolol	245	165	0	NA	70,000	NA
Metoprolol	77	26	0	25,000	25,000	NA
Diuretic						
Furosemide	30.7	128	0	NA	NA	NA
Hydrochlorothiazide	85.9	45	0	NA	NA	NA
Lipid regulator						
Atorvastatin	8.8	5.6	0	5,000	5,000	NA
Bezafibrate	11.2	0	0	300,000	NA	NA
Clofibric Acid	8.6	6	0	750,000	30,000	NA
Gemfibrozil	16.8	9	0	600,000	45,000	50,000
Nicotine metabolite (smoking cessation)						
Cotinine	90	1,860	0	10,000	NA	50,000
Oral contraceptive						
17-α-Ethinylestradiol	0.74	0	0	1.5	280	NA
Stimulant						
Caffeine	4,018	12,600	0	350	350	50,000

CHAPTER 6

Traditional Food and Contaminants

Traditional Food

The traditional food analysis component of FNFNES aimed to generate a database on contaminants that may be present in the traditional foods that are often consumed or regarded by the communities to be important component of their traditional food systems at the regional and ecozone level. The data are used to estimate the contaminant intake based on the reported consumption level. The risk of contaminant exposure can be estimated by comparing the estimated intake levels to the tolerable intake level established by regulatory agencies such as Health Canada. As the study design includes a component on measuring hair mercury concentration, the dietary contaminant intake estimate can be validated with the biomonitoring data.

Of particular concern are metals of human health concern (cadmium, lead, arsenic, mercury, and methylmercury) and the persistent organic pollutants, p,p'-dichlorodiphenyldichloroethylene (p,p'-DDE) and the polychlorinated biphenyls (PCBs), due to their long half-life in the environment or potential adverse effects on human health. The objectives of this chapter were to document the concentrations of these contaminants in traditional foods, to quantify the levels of daily contaminant intake from traditional food, and to study the association of dietary mercury intake with hair mercury concentrations, across all ecozones.

Over the course of the study, the sampling strategy was to collect up to 30 foods from each participating community. The community was to identify the most commonly consumed food; the foods that are of the most concern from a nutrition or environmental perspective; and, based on existing knowledge, foods that are known to accumulate higher concentrations of contaminants. Each food sample analysed was a composite of tissues from up to five different animals or plants. In total, 250 species and 2,062 food samples were collected by local hunters or fishermen and/or obtained from household freezers and analysed. While the approach has the advantage of providing the contaminant concentrations found in the traditional foods as consumed by the First Nations, it did not fully account for biological and environmental factors, such as age, gender, locations and time of harvest, that are known to affect the variations of contaminant concentrations in the plants or animals. Moreover, some foods (e.g., beaver kidney, bison kidney, dandelion roots) do not have statistically significant sample sizes which

The objectives of this chapter were to document the concentrations of these contaminants in traditional foods, to quantify the levels of daily contaminant intake from traditional food, and to study the association of dietary mercury intake with hair mercury concentrations, across all ecozones.

ESKASONI FIRST NATION HERITAGE SITE, PHOTO BY KATHLEEN LINDHORST

limits the confidence on the representativeness of the reported range of concentrations.

Foods were analysed for trace elements, metals of human health concern and persistent organic pollutants. Foods collected in the AFN British Columbia and Manitoba regions were analysed by MAXXAM Analytics, in Burnaby, BC while foods collected in the other AFN regions were analysed by ALS Global in Burlington, Ontario. The choice of these two accredited contract laboratories was based on a rigorous performance evaluation and a formal bidding process.

For this report, the mean concentrations of cadmium, lead, arsenic, mercury, methylmercury, p,p'-DDE, and PCBs in traditional food items were calculated for all ecozones combined (termed all ecozones analyses) and stratified by ecozone. Concentrations of metals are presented in micrograms per gram (µg/g) 'as received' or on a 'wet weight', and p,p'-DDE and PCBs are in units of nanograms per gram (ng/g) "wet weight". Traditional foods found to have the highest concentrations of contaminants by region (top 20) are listed in descending order in Table 6.1. Ecozone level information is provided in Appendix K.

Survey sample weights were used to calculate the mean intake of traditional foods and bootstrap weights were used to estimate the associated 95% confidence intervals. The contribution of traditional foods to intake of cadmium, lead, arsenic, mercury, methylmercury, p,p'-DDE and PCBs was calculated by multiplying the mean contaminant concentration in a particular food item with the population-weighted mean grams of intake per day of that food item. Lower and upper bounds were calculated by multiplying the mean contaminant concentration with the lower and upper 95% confidence interval of mean grams of intake. The analyses were performed for all regions combined and stratified by ecozone. Analyses were performed for all participants (i.e., consumers and non-consumers of traditional foods), for consumers of traditional foods only, and for consumers who were women of childbearing age (WCBA) (19-50 years).

Among consumers, total intake of cadmium, lead, arsenic, mercury, methylmercury, p,p'-DDE, and PCBs through traditional foods was calculated by summing the contaminant concentrations that were available for the food items consumed, as identified in the food frequency questionnaire, and dividing by body weight (BW). For each traditional food item consumed by a participant, contaminant levels were imputed with the mean contaminant concentration of that food item in the community where the participant lives. If contaminant concentration in the participant's community was not available, then contaminant levels were imputed with the mean contaminant concentration of that food items collected by all other communities located in the same ecozone as the participant's community. If contaminant concentration in the participant's ecozone was not available, then the contaminant levels were imputed with the mean ALL REGIONS contaminant concentration of that food item. The median, range and 95th percentile were calculated for each contaminant for all regions combined and stratified by ecozone, and are presented in tabular format (Table 6.3). Analyses were performed separately for WCBA who were consumers of traditional foods (Table 6.4). The metals and methylmercury concentrations are presented in units of µg/kg BW/d, and p,p'-DDE and PCBs in units of ng/kg BW/d.

For most of the contaminants, we compared the current intake from traditional food against the tolerable daily intake levels (TDIs) found within the Health Canada (2010) guidance document *"Federal Contaminated Site Risk Assessment in Canada, Part II: Health Canada Toxicological Reference Values (TRVs) and Chemical-Specific Factors, Version 2.0."* TDIs represents the daily exposure to a contaminant that is unlikely to have an adverse health effect over a lifetime. For lead, the current understanding is that there is no threshold or no observable effect level. Therefore, there is not possible establish a TDI that would be considered health protective (WHO 2011). Therefore, we used the Point of Departure level (1.3 µg/kg/day) associated with adverse outcomes (1 mmHg increase in blood pressure in adults) as used in a recent assessment by Juric et al. (2017).

The number of participants who exceeded a provisional tolerable daily intake (pTDI) of 1 µg/kg/d for cadmium and arsenic, 1.3 µg/kg/d for lead, 0.5 µg/kg/d for mercury (0.2 µg/kg/d for WCBA), 20 µg/kg/d for DDE, and 1 µg/kg/d for PCBs was determined. Hazard quotients (HQs) were calculated by dividing the median with the pTDI and the 95th percentile with the pTDI. An HQ <1 suggests that contaminant exposure does not pose an intolerable risk.

The association between mercury in hair and mercury intake for all participants and stratified by ecozone was calculated using linear regression models.

GRILLING SMOKED WHITEFISH, PHOTO BY REBECCA HARE

Cadmium

As shown in Table 6.1, the highest concentration of cadmium was found in kidneys analysed (beaver, moose, rabbit or hare, caribou, deer) and seaweed. When stratified by ecozone (Appendix K), kidney (primarily from moose) had the highest concentration of cadmium in all except the Boreal Cordillera. In this ecozone, moose liver had the highest concentration.

Moose kidney was the primary contributor to cadmium intake among traditional food consumers (Figure 6.1). When stratified by ecozone for all adults (consumers and non-consumers), moose kidney was the main contributor to cadmium intake in the Montane Cordillera, Taiga Plains, Boreal Plains, Prairies, Boreal Shield, and Hudson Plains (Appendix L). Caribou kidney was the main contributor in the Taiga Shield and moose liver in the Boreal Cordillera. In the Atlantic Maritime, however, seafood (lobster, oyster, mussel and scallop) contributed most to cadmium intake, and the contribution of moose kidney ranked fifth. In the Pacific Maritime, oyster was the highest contributor to cadmium intake, followed by seaweed. Similar results were obtained when analyses were stratified by ecozone in consumers only (Appendix M).

Among consumers, cadmium intake ranged from 0.00-15.72 µg/kg/d (Table 6.3). The pTDI of 1 µg/kg/d was exceeded by 118 (1.9%) participants. The HQs based on the median and 95th percentile was less than one at the ALL REGIONS level. When stratified by ecozone, none of the HQs based on

TRADITIONAL FOOD SAMPLES, PHOTO BY SUE HAMILTON

the median intake exceeded one. However, in the Boreal Cordillera, the 95th percentile was 2.85 and in the Taiga Plains, the 95th percentile HQ was 1.99. Among WCBA, cadmium intake ranged from 0.00-10.42 µg/kg/d while 39 (1.5%) women exceeded the pTDI (Table 6.4). At the ALL REGIONS level, the HQ for WCBA was less than one for both average and high consumers, however, when stratified by ecozone, the HQ was above one for WCBA at the 95th percentile in the Boreal Cordillera at 1.46 and in the Taiga Plains which was 1.30.

Lead

Higher concentrations of lead were detected in samples of meat from bison, squirrel, grouse and rabbit and duck heart (Table 6.1). At the ecozone level, the highest concentrations were found in samples of grouse meat in the Pacific Maritime, Taiga Plains, Boreal Shield and Hudson Plains; deer meat in the Montane Cordillera and Mixedwood Plains; bison meat in the Boreal Plains; rabbit/hare meat in the Prairies; caribou heart and muskrat meat in the Taiga Shield; and squirrel meat in the Atlantic Maritime (Appendix K). The finding of lead is likely due to residuals from lead-containing ammunition.

At the all ecozone level, the largest traditional food contributors to lead intake were bison meat, deer meat, moose meat, grouse meat, and beaver meat (see Figure 6.2, consumers only). In ecozone analyses, deer meat was the highest contributor in the Pacific Maritime, Montane Cordillera, Prairies, Mixedwood Plains, and Atlantic Maritime, grouse meat in the Taiga Plains, Taiga Shield and Hudson Plains, bison meat in the Boreal Plains, moose meat in the Boreal Shield, and Canada goose in the Hudson Plains (Appendix L). Similar results were obtained when analyses were stratified by ecozone in consumers only (Appendix M).

Lead intake ranged from 0.00-37.25 µg/kg/d (Table 6.3). The pTDI of 1.3 µg/kg/d was exceeded by 225 (3.7%) participants. The HQs, based on the median and 95th percentile, were less than one. The Boreal Plains and Prairies had the largest number of exceedances (5.3 and 12.3%, respectively) and the 95th percentile HQs in these ecozones exceeded one (1.11 and 2.36, respectively). Lead intake in WCBA ranged from 0.00-23.70 µg/kg/d and 82 (3.2%) exceeded the pTDI (Table 6.4). The 95th percentile HQs exceeded one for WCBA in the Montane Cordillera (HQ = 1.18) and Prairies (HQ = 1.93).

Arsenic

The highest concentrations of arsenic were found in seaweed, crab, octopus, prawn, and shad (Table 6.1). The highest concentrations of arsenic were found in fish samples in several ecozones (i.e., salmon in the Boreal Cordillera, halibut in the Montane Cordillera, Atlantic salmon in the Taiga Shield, cisco in the Hudson Plains, sturgeon in the Mixedwood Plains, and yellow perch in the Atlantic Maritime) (Appendix K). Seaweed had the highest concentration in the Pacific Maritime and lobster in the Boreal Shield.

The main contributor to arsenic intake was prawn, followed by halibut, seaweed, lobster and eulachon grease (Figure 6.3). In ecozone analyses, prawn in the Pacific Maritime resulted in the highest arsenic intake (Appendix L). Species of fish contributed most to arsenic intake in the Boreal Cordillera (salmon), Montane Cordillera (salmon), Prairies (walleye/pickerel), Taiga Shield (whitefish), Hudson Plains (whitefish) and Mixedwood Plains (salmon). Lobster was the main contributor in the Atlantic Maritime and mussel in the Boreal Shield. Similar results were obtained when analyses were stratified by ecozone in consumers only (Appendix M).

Arsenic intake ranged from 0.00-12.96 µg/kg/d (Table 6.3). The pTDI of 1 µg/kg/d was exceeded by 320 (5.24%) participants. The median HQs were less than one, however the 95th percentile HQ was slightly over 1. The 95th percentile HQ was 4.73 in the Pacific Maritime, 1.01 in the Montane Cordillera, and 1.81 in the Atlantic Maritime. All HQs in other ecozones were less than one. Among women of childbearing age, the pTDI was exceeded by 112 (4.3%) and, except for the Pacific Maritime and the Atlantic Maritime, the HQs were less than one (Table 6.4).

Mercury

Harp seal meat, Arctic char, caribou kidney, carp and northern pike/jackfish had the highest concentrations of mercury (Table 6.1). In ecozone analyses, fish often had highest mercury concentrations, such as lake trout in the Boreal Cordillera, Arctic char in the Montane Cordillera, Northern pike or jackfish in the Taiga Plains and Hudson Plains, walleye or pickerel in the Boreal Plains and Prairies, and bass in the Atlantic Maritime (Appendix K). In the Pacific Maritime, similar concentrations of mercury were found in samples of mushrooms and halibut. The highest concentration of mercury in food samples from the Taiga Shield and Boreal Shield were caribou kidney and harp seal meat respectively.

Across ecozones, among consumers, consumption of walleye/pickerel resulted in the highest intake of mercury, followed by Northern pike/jackfish, halibut, rockfish, and salmon (Figure 6.5). Similar findings were observed for the highest contributors to methylmercury intake (Figure 6.6). The greatest contributors to mercury intake were fish in most ecozones, except in the Prairies and Atlantic Maritime where duck and lobster, respectively, were the highest contributors (Appendix L). Similar results were obtained when analyses were stratified by ecozone in consumers only (Appendix M).

Mercury intake ranged from 0.00-1.27 µg/kg/d (Table 6.3). For all ecozones, the pTDI of 0.5 µg/kg/d was exceeded by 41 (0.7%) participants and the HQs were less than one. By ecozone, all HQs were less than one. Among WCBA, mercury intake ranged from 0.00-0.82 µg/kg/d and 50 (1.9%) exceeded the pTDI of 0.2 µg/kg/d (Table 6.4). The 95th percentile HQ for WCBA was 1.00 in the Boreal Shield and 1.40 in the Taiga Shield. All HQs in other regions were less than one.

KATELIND NAISTUS, ALICIA OLIVER, ONION LAKE FIRST NATION, PHOTO BY LINDSAY KRAITBERG

Correlation of Hair Mercury with Mercury Intake

Figure 6.6 shows the relationship between the estimated mercury intake from traditional foods and hair mercury. There was a positive correlation, and an increase of each 1 µg/kg/d in mercury intake was associated with a 3.8 µg/g increase in hair mercury. However, the R-square was only 0.09, meaning that only 9% of the variance of hair mercury can be explained by the estimated mercury intake from traditional food. Moreover, many of the participants who showed higher hair concentrations of up to 10 µg/g had estimated intake of less than 0.5 µg/kg/d. These results suggest that the dietary estimate may be underestimated or there may be other sources of mercury. Appendix N shows the correlations for each ecozone.

Methylmercury

Harp seal meat, Arctic char, bass, walleye/pickerel and Northern pike/jackfish had the highest concentrations of methylmercury (Table 6.1). In ecozone analyses, fish had the highest concentration of methylmercury, except for harp seal meat in the Boreal Shield (Appendix K).

Fish was the main contributor to methylmercury intake (i.e., walleye or pickerel, Northern Pike/jackfish, halibut, rockfish, and salmon) (Figure 6.4). In ecozone analyses, fish was the main contributor in all regions except for the Atlantic Maritime, where lobster led to the highest intake (Appendix L). Similar results were obtained when analyses were stratified by ecozone in consumers only (Appendix M).

p,p'-DDE

The highest concentration of p,p'-DDE was in harp seal meat, followed by eulachon grease, beaver kidney, beaver liver, duck meat, catfish and trout (Table 6.2). In ecozone analyses, eulachon grease had the highest concentration in the Pacific Maritime and Montane Cordillera, salmon in the Boreal Cordillera, goose meat in the Taiga Plains and Hudson Plains, beaver kidney in the Boreal Plains, deer liver in the Prairies, duck meat in the Taiga Shield, salmon eggs in the Boreal Shield, trout in the Mixedwood Plains, and bass in the Atlantic Maritime (Appendix K).

The main contributors to p,p'-DDE intake were eulachon grease, salmon eggs, goose meat and walleye/pickerel (Figure 6.7). Eulachon grease was the largest contributor in the Pacific Maritime while salmon was the highest contributor to p,p'-DDE in the Boreal Cordillera, Montane Cordillera, Mixedwood Plains and the Atlantic Maritime (Appendix L). Walleye/pickerel was the highest contributor in the Boreal Shield and trout was the highest contributor in the Taiga Shield. Goose meat was the greatest contributor in the Taiga Plains and Hudson Plains, moose meat in the Boreal Plains, and deer liver in the Prairies. Similar results were obtained when analyses were stratified by ecozone in consumers only (Appendix M).

The intake of p,p'-DDE ranged from 0.00-86.86 ng/kg/d. No participant exceeded the pTDI and HQs were less than one (Table 6.3 and 6.4).

PCBs

PCBs were highest in harp seal meat, carp, catfish, sturgeon, and duck meat (Table 6.2). In ecozone analyses, PCBs were highest in herring in the Pacific Maritime, Arctic char in the Montane Cordillera, salmon in the Taiga Plains, duck meat in the Boreal Plains and Taiga Shield, whitefish in the Prairies, harp seal meat in the Boreal Shield, black bear fat in the Hudson Plains, sturgeon in the Mixedwood Plains, and bass in the Atlantic Maritime (Appendix K).

Salmon, salmon eggs, walleye/pickerel, sturgeon and ptarmigan meat were the main contributors to PCB intake (Figure 6.8). Fish was the main contributor to PCB intake in most ecozones (Appendix L and M).

PCB intake ranged from 0.00-111.14 ng/kg/d. No participant exceeded the pTDI and HQs were less than one (Table 6.3 and 6.4).

Table 6.1 Traditional foods analysed and found to have the highest concentrations of metals of human health concern (cadmium, lead, arsenic, mercury and methylmercury)

Traditional Food	Number of communities/ pooled samples	Mean	SD	Median	Minimum	Maximum
CADMIUM (µg/g) Detection Limit <0.001)						
Beaver kidney	1	21.60	NA	21.60	21.60	21.60
Moose kidney	40	11.22	8.85	9.80	0	31.10
Rabbit kidney	2	6.34	7.01	6.34	1.38	11.30
Seaweed	5	3.99	2.10	4.81	0.61	5.76
Caribou kidney	4	3.89	2.78	4.57	0.02	6.42
Deer kidney	9	3.61	3.13	3.55	0.05	8.83
Moose liver	49	2.17	1.94	1.75	0.01	8.46
Mussels	6	2.03	3.19	0.56	0.04	8.20
Beaver liver	2	1.89	2.20	1.89	0.33	3.44
Oysters	4	1.85	1.17	1.45	0.95	3.56
Caribou weeds	1	1.54	NA	1.54	1.54	1.54
Sea snails	1	1.47	NA	1.47	1.47	1.47
Bison kidney	1	1.21	NA	1.21	1.21	1.21
Rabbit or hare liver	5	1.16	1.50	0.66	0.08	3.75
Willow bark	2	1.14	1.61	1.14	0.00	2.28
Caribou liver	3	0.82	0.30	0.93	0.49	1.06
Elk kidney	3	0.75	1.19	0.10	0.03	2.13
Duck liver	1	0.46	NA	0.46	0.46	0.46
Bison liver	1	0.39	NA	0.39	0.39	0.39
Tobacco	1	0.39	NA	0.39	0.39	0.39
LEAD (µg/g) Detection Limit <0.004)						
Bison meat	5	26.25	58.56	0.01	0.00	131.00
Squirrel meat	5	18.57	39.54	1.46	0.02	89.30
Grouse meat	82	4.99	18.77	0.09	0.00	152.00
Duck heart	2	4.67	6.60	4.67	0.00	9.34

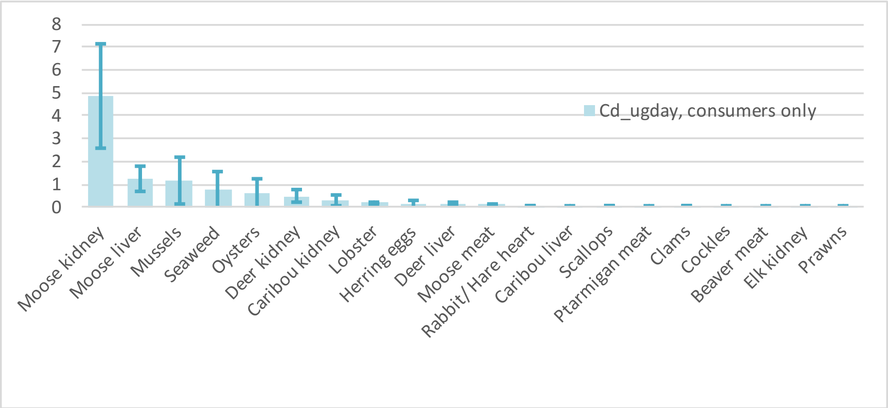
Traditional Food	Number of communities/ pooled samples	Mean	SD	Median	Minimum	Maximum
Rabbit or hare meat	58	4.10	22.15	0.01	0.00	163.00
Dandelion roots	1	3.79	NA	3.79	3.79	3.79
Beaver heart	1	2.69	NA	2.69	2.69	2.69
Duck meat	73	1.92	12.20	0.03	0.00	104.00
Deer meat	65	1.90	6.77	0.01	0.00	42.40
Beaver meat	29	1.88	9.19	0.01	0.00	49.49
Caribou heart	5	1.10	2.45	0.01	0.00	5.48
Tobacco	1	1.10	NA	1.10	1.10	1.10
Onions	1	1.07	NA	1.07	1.07	1.07
Duck gizzard	5	1.07	1.61	0.07	0.00	3.70
Black bear meat	15	1.00	3.50	0.01	0.00	13.60
Cascara bark	1	0.90	NA	0.90	0.90	0.90
Beaver fat	1	0.77	NA	0.77	0.77	0.77
Bear liver	1	0.73	NA	0.73	0.73	0.73
Devil's Club bark	1	0.70	NA	0.70	0.70	0.70
Goose meat	39	0.64	2.57	0.01	0.00	16.00
ARSENIC (µg/g) Detection Limit <0.004)						
Seaweed	5	25.27	13.37	31.00	3.45	35.10
Crabs	14	9.56	6.54	7.83	3.48	25.90
Octopus	1	9.07	NA	9.07	9.07	9.07
Prawns	3	8.91	1.13	8.48	8.06	10.20
Shad	1	7.44	NA	7.44	7.44	7.44
Sole	2	5.78	6.11	5.78	1.46	10.10
Lobster	12	5.75	3.47	4.68	1.61	13.80
Sea cucumber	1	5.13	NA	5.13	5.13	5.13
Flounder	2	3.74	0.22	3.74	3.58	3.89
Shrimp	2	3.60	0.60	3.60	3.17	4.02

Traditional Food	Number of communities/ pooled samples	Mean	SD	Median	Minimum	Maximum
Eulachon grease	5	3.53	2.53	4.28	0.08	6.68
Sea Snails	1	3.31	NA	3.31	3.31	3.31
Mussels	6	3.25	2.09	3.15	0.60	6.30
Clams	13	3.05	1.50	3.25	0.86	4.96
Halibut	9	3.01	1.63	2.67	1.50	6.99
Cod	8	2.86	2.26	2.35	0.62	6.78
Squid	2	2.71	1.29	2.71	1.80	3.62
Northern abalone	1	2.57	NA	2.57	2.57	2.57
Cod eggs	1	2.50	NA	2.50	2.50	2.50
Haddock	2	2.46	0.82	2.46	1.88	3.04
MERCURY (µg/g) Detection Limit <0.001)						
Harp seal meat	1	1.06	NA	1.06	1.06	1.06
Arctic char	1	0.92	NA	0.92	0.92	0.92
Caribou kidney	4	0.59	0.40	0.72	0.01	0.91
Carp	2	0.54	0.25	0.54	0.37	0.72
Northern pike or jackfish	37	0.44	0.47	0.29	0.04	2.75
Bass	11	0.40	0.30	0.33	0.11	1.07
Walleye or pickerel	49	0.38	0.25	0.34	0.07	1.27
Sturgeon	13	0.24	0.19	0.19	0.04	0.63
Mushrooms	15	0.22	0.46	0.02	0.00	1.72
Walleye or pickerel pemmican	1	0.21	NA	0.21	0.21	0.21
Ling cod or mariah or burbot	6	0.21	0.13	0.18	0.09	0.43
Trout	82	0.19	0.19	0.12	0.00	1.00
Perch	11	0.18	0.08	0.16	0.09	0.30
Sauger	1	0.17	NA	0.17	0.17	0.17
Halibut	9	0.17	0.10	0.17	0.02	0.33
Rockfish	6	0.17	0.13	0.16	0.01	0.38

Traditional Food	Number of communities/ pooled samples	Mean	SD	Median	Minimum	Maximum
Striped bass	7	0.16	0.09	0.12	0.03	0.32
Mooneye or goldeye	2	0.14	0.09	0.14	0.07	0.20
Caribou liver	3	0.13	0.11	0.20	0.00	0.20
Catfish	6	0.13	0.09	0.10	0.05	0.26
METHYLMERCURY (µg/g) Detection Limit <0.001)						
Harp seal meat	1	1.39	NA	1.39	1.39	1.39
Arctic char	1	0.74	NA	0.74	0.74	0.74
Bass	9	0.33	0.46	0.15	0.05	1.53
Walleye or pickerel	41	0.30	0.31	0.17	0.03	1.49
Northern pike or jackfish	34	0.27	0.20	0.21	0.04	0.72
Rockfish	6	0.24	0.13	0.19	0.11	0.41
Ling cod or mariah or burbot	4	0.24	0.15	0.25	0.09	0.36
Halibut	8	0.21	0.11	0.19	0.02	0.38
Trout	74	0.19	0.20	0.11	0.01	0.95
Sturgeon	10	0.18	0.15	0.15	0.02	0.54
Carp	2	0.16	0.03	0.16	0.14	0.18
Duck liver	1	0.14	NA	0.14	0.14	0.14
Striped bass	6	0.13	0.10	0.10	0.03	0.32
Lobster	10	0.12	0.13	0.08	0.03	0.49
Eel	9	0.11	0.05	0.12	0.04	0.18
Perch	9	0.10	0.05	0.12	0.03	0.15
Catfish	6	0.09	0.04	0.08	0.06	0.16
Mooneye or goldeye	1	0.08	NA	0.08	0.08	0.08
Sucker	12	0.08	0.06	0.06	0.01	0.22
Walleye or pickerel pemmican	1	0.07	NA	0.07	0.07	0.07

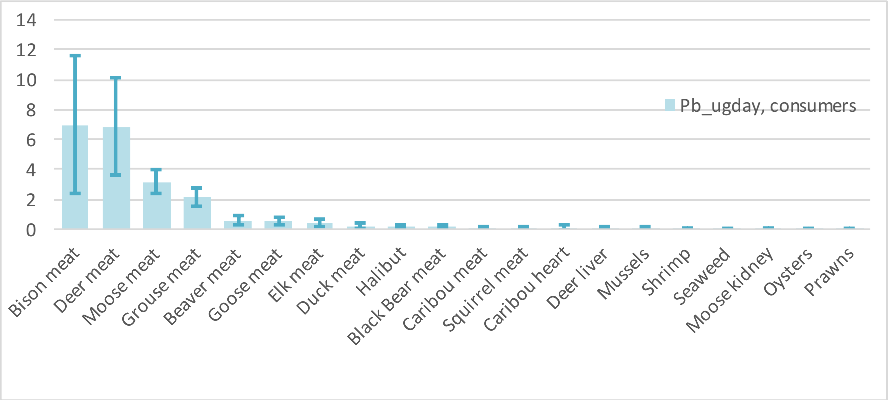
Notes: All original values below the detection limit were changed to zero for the contaminant analyses. Each community sample is a pooled sample composed of 1-5 replicates.

Figure 6.1 Principal traditional food contributors of cadmium among First Nations, consumers only*



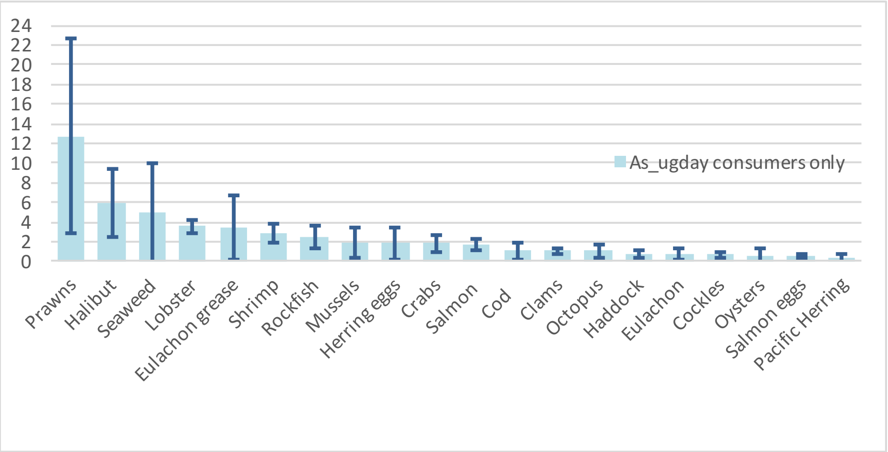
*Note: µg/day estimated by multiplying calculated based on mean contaminant concentrations in a particular food item with the population-weighted mean grams of intake per day of that food item.

Figure 6.2 Principal traditional food contributors for exposure to lead among First Nations consumers only*



*Note: µg/day estimated by multiplying calculated based on mean contaminant concentrations in a particular food item with the population-weighted mean grams of intake per day of that food item.

Figure 6.3 Principal traditional food contributors for exposure to arsenic among First Nations consumers only*



*Note: µg/day estimated by multiplying calculated based on mean contaminant concentrations in a particular food item with the population weighted mean grams of intake per day of that food item.

Figure 6.4 Principal traditional food contributors for exposure to mercury among First Nations consumers only

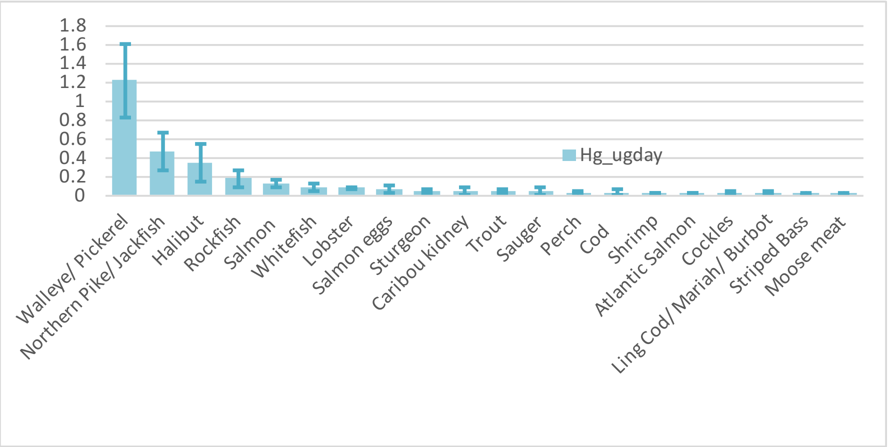


Figure 6.5 Principal traditional food contributors for exposure to methylmercury among First Nations consumers only

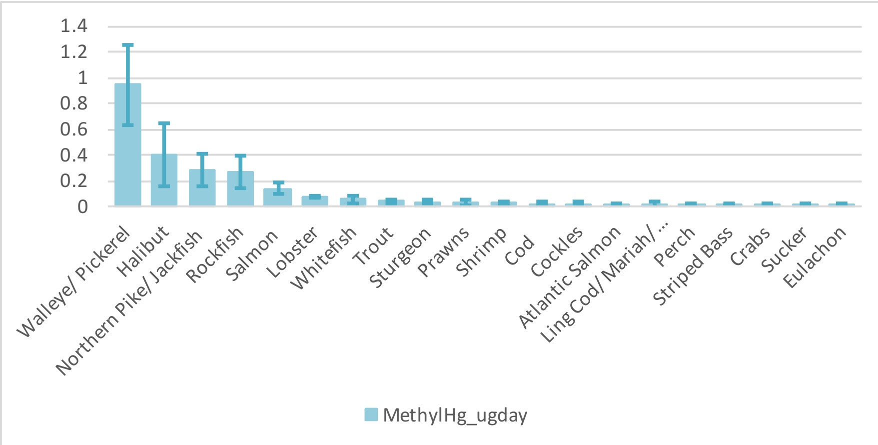


Figure 6.6 All Ecozones Correlation of Hair Mercury and Mercury Intake from Traditional Foods (n = 3,392)

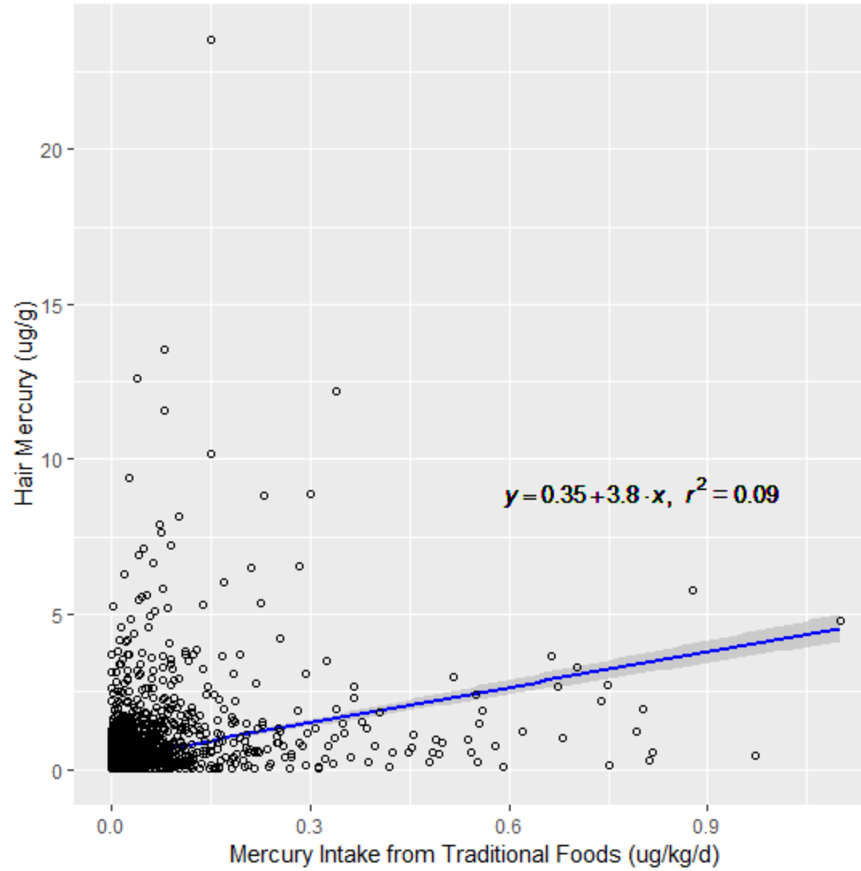


Table 6.2 Traditional foods analysed and found to have the highest concentrations of organochlorine concentrations

Traditional Food	Number of communities	Mean	SD	Median	Minimum	Maximum
p,p'-DDE (ng/g) Detection Limit <0.0062)						
Harp Seal meat	1	28.50	-	28.50	28.50	28.50
Eulachon grease	5	21.12	6.22	19.60	15.00	30.30
Beaver kidney	1	16.10	-	16.10	16.10	16.10
Beaver liver	1	13.80	-	13.80	13.80	13.80
Duck meat	25	10.36	25.14	1.57	0.00	102.00
Catfish	6	9.74	6.58	12.75	0.26	16.30
Trout	75	9.34	19.71	2.00	0.00	109.00
Bass	9	9.22	17.43	2.43	0.00	53.90
Eel	8	8.98	11.18	4.38	1.10	35.10
Salmon eggs	11	7.88	18.88	2.17	0.00	64.30
Sturgeon	13	6.16	7.71	2.91	0.77	26.20
Salmon	56	5.57	10.63	2.36	0.00	61.10
Atlantic Salmon	15	5.30	3.28	5.30	1.48	11.70
Goose meat	26	4.86	9.17	1.25	0.00	42.90
Smelt	14	4.79	7.21	3.25	0.51	28.35
Elk liver	2	4.70	6.64	4.70	0.00	9.39
Shad	1	4.54	-	4.54	4.54	4.54
Striped Bass	6	4.07	4.22	2.59	0.51	11.50
Sucker eggs	2	3.46	2.25	3.46	1.87	5.05
Cisco	4	3.42	2.84	3.12	0.29	7.18

Traditional Food	Number of communities	Mean	SD	Median	Minimum	Maximum
PCBs (ng/g) Detection Limit <0.2)						
Harp Seal meat	1	265.40	-	265.40	265.40	265.40
Carp	2	63.26	89.46	63.26	0.00	126.52
Catfish	6	59.72	89.89	11.91	2.60	231.17
Sturgeon	13	54.11	120.45	4.62	0.00	351.95
Duck meat	25	39.51	120.33	0.64	0.00	582.01
Perch	10	20.66	45.57	7.17	0.00	149.38
Trout	75	18.06	53.86	2.34	0.00	298.51
Bass	8	17.86	15.86	18.77	0.44	39.88
Ptarmigan meat	1	14.75	-	14.75	14.75	14.75
Black Bear fat	9	12.85	25.43	0.00	0.00	78.15
Salmon Eggs	11	10.84	33.36	0.34	0.00	111.34
Eel	8	9.42	9.71	6.30	1.83	31.61
Salmon	56	9.27	29.01	0.48	0.00	161.20
Smelt	12	8.44	17.88	3.12	0.21	64.47
Pacific Herring	1	8.24	-	8.24	8.24	8.24
Mackerel	7	7.82	3.62	7.21	3.28	13.39
Cisco	4	7.10	5.22	8.22	0.00	11.96
Atlantic Salmon	14	6.60	3.88	5.62	2.81	15.36
Shad	1	6.22	-	6.22	6.22	6.22
Duck liver	1	5.65	-	5.65	5.65	5.65
Harp Seal meat	1	265.40	-	265.40	265.40	265.40

Note: All original values that were less than the detection limit were changed to zeroes for the contaminant analyses.

Figure 6.7 Principal traditional food contributors for exposure to DDE among First Nations consumers only

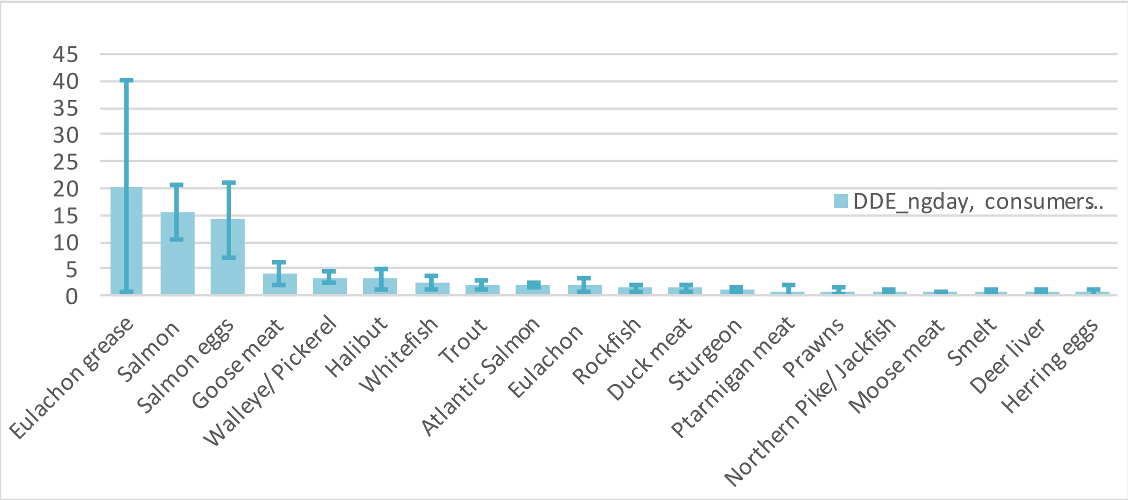


Figure 6.8 Principal traditional food contributors for exposure to PCBs among First Nations consumers only

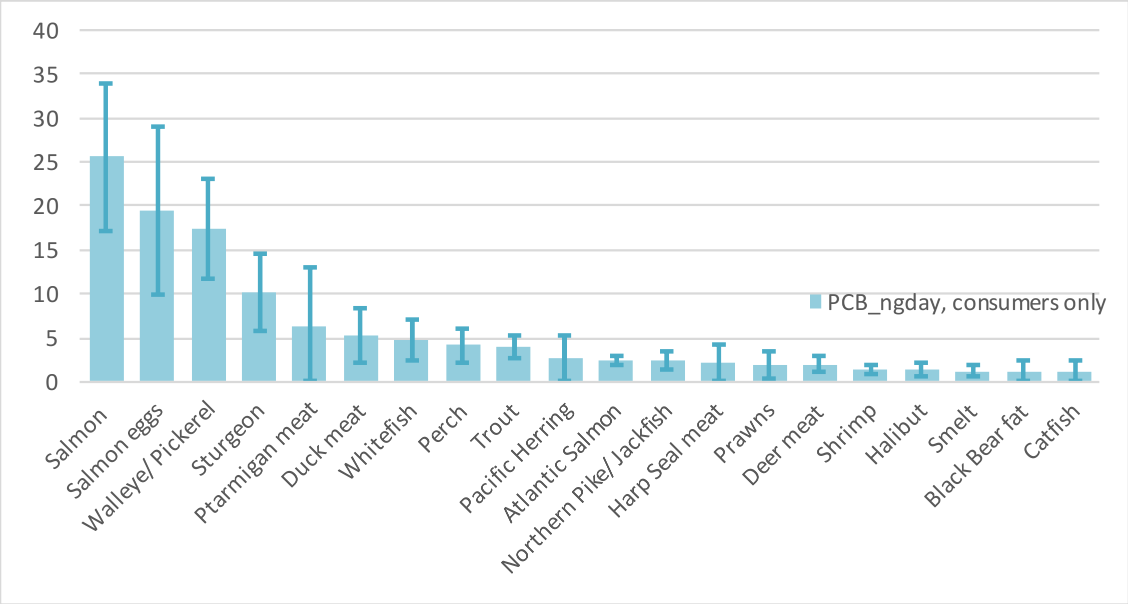


Table 6.3 Intake and exposure estimates (Hazard Quotients) for contaminants of human health concern (metals and POPs) from traditional food for consumers only by ecozone

Ecozone	N	Median	Range	95th Percentile	N (percent) > pTDI	HQ (median/pTDI)	HQ (95th percentile/ pTDI)
Cadmium (μg/kg/d), pTDI = 1							
All ecozones	6,105	0.003	0.00 – 15.72	0.39	118 (1.9)	0.003	0.39
Pacific Maritime	483	0.018	0.00 – 4.82	0.35	6 (1.2)	0.018	0.35
Boreal Cordillera	80	0.33	0.001 – 6.97	2.85	11 (13.8)	0.33	2.85
Montane Cordillera	312	0.007	0.00 – 4.31	0.63	12 (3.8)	0.007	0.63
Taiga Plains	150	0.010	0.00 – 4.68	2.00	20 (13.3)	0.010	**2.00**
Boreal Plains	1,203	0.001	0.00 – 15.72	0.42	20 (1.7)	0.001	0.42
Prairies	530	0.000	0.00 – 5.41	0.08	4 (0.8)	0.000	0.08
Boreal Shield	1,249	0.003	0.00 – 12.36	0.44	31 (2.5)	0.003	0.44
Taiga Shield	269	0.07	0.00 – 5.06	0.72	10 (3.7)	0.07	0.72
Hudson Plains	320	0.004	0.00 – 2.22	0.37	4 (1.3)	0.004	0.37
Mixedwood Plains	605	0.000	0.00 – 0.20	0.01	0 (0)	0.000	0.01
Atlantic Maritime	904	0.004	0.00 – 0.85	0.08	0 (0)	0.004	0.08
Lead (μg/kg/d), pTDI = 1.3							
All ecozones	6,105	0.01	0.00 – 37.25	0.95	225 (3.7)	0.008	0.73
Pacific Maritime	483	0.03	0.00 – 11.85	1.04	19 (3.9)	0.023	0.80
Boreal Cordillera	80	0.02	0.00 – 0.82	0.34	0 (0)	0.015	0.26
Montane Cordillera	312	0.008	0.00 – 8.18	0.91	14 (4.5)	0.005	0.70
Taiga Plains	150	0.013	0.00 – 5.08	1.07	7 (4.7)	0.01	0.82
Boreal Plains	1,203	0.009	0.00 – 17.94	1.44	64 (5.3)	0.007	**1.11**
Prairies	530	0.00	0.00 – 37.25	4.14	65 (12.3)	0.00	**2.36**
Taiga Shield	269	0.010	0.00 – 29.79	0.99	45 (3.6)	0.008	0.76
Boreal Shield	1,249	0.03	0.00 – 0.98	0.25	0 (0)	0.02	0.19
Hudson Plains	320	0.018	0.00 – 0.93	0.22	0 (0)	0.01	0.17
Mixedwood Plains	605	0.002	0.00 – 11.23	0.18	9 (1.5)	0.0015	0.14
Atlantic Maritime	904	0.002	0.00 – 3.40	0.09	2 (0.2)	0.0015	0.07

Ecozone	N	Median	Range	95th Percentile	N (percent) > pTDI	HQ (median/pTDI)	HQ (95th percentile/ pTDI)
Arsenic (μg/kg/d), pTDI = 1							
All ecozones	6,105	0.013	0.00 – 12.96	1.04	320 (5.2)	0.013	1.04
Pacific Maritime	483	0.54	0.00 – 12.96	4.73	164 (34.0)	0.54	**4.73**
Boreal Cordillera	80	0.11	0.00 – 2.62	0.82	4 (5.0)	0.11	0.82
Montane Cordillera	312	0.075	0.00 – 6.72	1.01	17 (5.4)	0.075	1.01
Taiga Plains	150	0.01	0.00 – 1.37	0.24	2 (1.3)	0.01	0.24
Boreal Plains	1,203	0.003	0.00 – 3.14	0.12	8 (0.7)	0.003	0.12
Prairies	530	0.0009	0.00 – 0.30	0.04	0 (0)	0.0009	0.04
Taiga Shield	269	0.015	0.00 – 3.37	0.42	24 (1.9)	0.015	0.42
Boreal Shield	1,249	0.03	0.00 – 0.84	0.26	0 (0)	0.03	0.26
Hudson Plains	320	0.03	0.00 – 1.56	0.34	5 (1.6)	0.03	0.34
Mixedwood Plains	605	0.001	0.00 – 0.50	0.06	0 (0)	0.001	0.06
Atlantic Maritime	904	0.11	0.00 – 12.00	1.81	96 (10.6)	0.11	**1.81**
Mercury (μg/kg/d), pTDI = 0.5							
All ecozones	6,105	0.007	0.00 – 1.27	0.13	41 (0.7)	0.014	0.26
Pacific Maritime	483	0.015	0.00 – 0.74	0.10	1 (0.2)	0.03	0.20
Boreal Cordillera	80	0.01	0.00 – 0.20	0.06	0 (0)	0.02	0.12
Montane Cordillera	312	0.004	0.00 – 0.32	0.06	0 (0)	0.008	0.12
Taiga Plains	150	0.003	0.00 – 0.33	0.08	0 (0)	0.006	0.16
Boreal Plains	1,203	0.004	0.00 – 0.97	0.09	4 (0.3)	0.008	0.18
Prairies	530	0.0006	0.00 – 0.23	0.03	0 (0)	0.0012	0.06
Taiga Shield	269	0.02	0.00 – 1.27	0.29	28 (2.2)	0.04	0.58
Boreal Shield	1,249	0.04	0.00 – 0.89	0.31	7 (2.6)	0.08	0.62
Hudson Plains	320	0.01	0.00 – 0.68	0.21	1 (0.3)	0.02	0.42
Mixedwood Plains	605	0.002	0.00 – 0.44	0.07	0 (0)	0.004	0.14
Atlantic Maritime	904	0.003	0.00 – 0.23	0.03	0 (0)	0.006	0.06

Ecozone	N	Median	Range	95th Percentile	N (percent) > pTDI	HQ (median/pTDI)	HQ (95th percentile/ pTDI)
p,p'-DDE (ng/kg/d), pTDI = 20,000							
All ecozones	6,105	0.11	0.00 – 86.86	3.07	0 (0)	5.5×10^{-6}	1.5×10^{-4}
Pacific Maritime	483	0.79	0.00 – 19.03	5.15	0 (0)	4.0×10^{-5}	2.6×10^{-4}
Boreal Cordillera	80	0.02	0.00 – 1.39	0.77	0 (0)	1.0×10^{-6}	3.9×10^{-5}
Montane Cordillera	312	0.05	0.00 – 10.57	2.51	0 (0)	2.5×10^{-6}	1.3×10^{-4}
Taiga Plains	150	0.06	0.00 – 6.59	2.47	0 (0)	3.0×10^{-6}	1.2×10^{-4}
Boreal Plains	1,203	0.06	0.00 – 10.94	1.58	0 (0)	3.0×10^{-6}	7.9×10^{-5}
Prairies	530	0.00	0.00 – 10.43	0.80	0 (0)	0	4.0×10^{-5}
Taiga Shield	269	0.19	0.00 – 25.87	3.93	0 (0)	9.5×10^{-6}	2.0×10^{-4}
Boreal Shield	1,249	0.43	0.00 – 13.87	3.61	0 (0)	2.2×10^{-5}	1.8×10^{-4}
Hudson Plains	320	1.07	0.00 – 86.86	21.05	0 (0)	5.4×10^{-5}	1.1×10^{-3}
Mixedwood Plains	605	0.02	0.00 – 36.99	2.42	0 (0)	1.0×10^{-6}	1.2×10^{-4}
Atlantic Maritime	904	0.08	0.00 – 6.32	1.14	0 (0)	4.0×10^{-6}	5.7×10^{-5}
PCBs (ng/kg/d), pTDI = 1,000							
All ecozones	6,105	0.08	0.00 – 111.14	4.72	0 (0)	8.0×10^{-5}	4.7×10^{-3}
Pacific Maritime	483	0.21	0.00 – 10.91	1.79	0 (0)	2.1×10^{-4}	1.8×10^{-3}
Boreal Cordillera	80	0.006	0.00 – 0.69	0.62	0 (0)	6.0×10^{-6}	6.2×10^{-4}
Montane Cordillera	312	0.000	0.00 – 8.52	0.49	0 (0)	0	4.9×10^{-4}
Taiga Plains	150	0.01	0.00 – 9.84	1.26	0 (0)	1.0×10^{-5}	1.3×10^{-3}
Boreal Plains	1,203	0.00	0.00 – 51.98	3.08	0 (0)	0	3.1×10^{-3}
Prairies	530	0.000	0.00 – 9.11	0.51	0 (0)	0	5.1×10^{-4}
Taiga Shield	269	0.47	0.00 – 101.41	10.69	0 (0)	4.7×10^{-4}	1.1×10^{-2}
Boreal Shield	1,249	0.64	0.00 – 20.47	5.90	0 (0)	6.4×10^{-4}	5.9×10^{-3}
Hudson Plains	320	0.11	0.00 – 7.61	1.19	0 (0)	1.1×10^{-4}	1.2×10^{-3}
Mixedwood Plains	605	0.09	0.00 – 111.14	13.38	0 (0)	9.0×10^{-5}	0.01
Atlantic Maritime	904	0.085	0.00 – 8.88	1.55	0 (0)	8.5×10^{-5}	1.6×10^{-3}

HQ = hazard quotient; pTDI = provisional tolerable daily intake; DDE = dichlorodiphenyldichloroethylene; HQ = hazard quotient; PCB = polychlorinated biphenyl.

Table 6.4 Intake and exposure estimates (Hazard Quotients) for contaminants of human health concern (metals and POPs) from traditional food for First Nation WCBA (consumers only, N=2,585) by ecozone

Ecozone	N	Median	Range	95th Percentile	N (percent) > pTDI	HQ (median/pTDI)	HQ (95th percentile/ pTDI)
Cadmium (µg/kg/d), pTDI = 1							
All ecozones	2,585	0.002	0.00 – 10.42	0.29	39 (1.5)	0.002	0.29
Pacific Maritime	202	0.01	0.00 – 3.72	0.24	2 (1.0)	0.01	0.24
Boreal Cordillera	46	0.32	0.001 – 2.83	1.46	4 (8.7)	0.32	1.46
Montane Cordillera	135	0.005	0.00 – 4.31	0.61	5 (3.7)	0.005	0.61
Taiga Plains	75	0.007	0.00 – 3.50	1.30	7 (9.3)	0.007	1.30
Boreal Plains	560	0.001	0.00 – 4.53	0.17	3 (0.5)	0.001	0.17
Prairies	205	0.0002	0.00 – 2.30	0.04	3 (1.5)	0.0002	0.04
Boreal Shield	500	0.002	0.00 – 10.42	0.35	9 (1.8)	0.002	0.35
Taiga Shield	135	0.06	0.00 – 5.06	0.79	6 (4.4)	0.06	0.79
Hudson Plains	149	0.003	0.00 – 0.56	0.14	0 (0)	0.003	0.14
Mixedwood Plains	195	0.0003	0.00 – 0.20	0.007	0 (0)	0.0003	0.007
Atlantic Maritime	383	0.003	0.00 – 0.85	0.09	0 (0)	0.003	0.09
Lead (µg/kg/d), pTDI = 1.3							
All ecozones	2,585	0.006	0.00 – 23.70	0.79	82 (3.2)	0.005	0.61
Pacific Maritime	202	0.03	0.00 – 4.65	1.04	8 (4.0)	0.02	0.80
Boreal Cordillera	46	0.009	0.00 – 0.62	0.36	0 (0)	0.007	0.28
Montane Cordillera	135	0.004	0.00 – 7.95	1.53	8 (5.9)	0.003	1.18
Taiga Plains	75	0.004	0.00 – 2.48	0.89	2 (2.7)	0.003	0.68
Boreal Plains	560	0.007	0.00 – 17.94	1.14	22 (3.9)	0.005	0.88
Prairies	205	0.003	0.00 – 23.70	2.51	25 (12.2)	0.002	1.93
Boreal Shield	500	0.009	0.00 – 15.90	0.76	13 (2.6)	0.007	0.58
Taiga Shield	135	0.03	0.00 – 0.98	0.17	0 (0)	0.02	0.13
Hudson Plains	149	0.01	0.00 – 0.86	0.18	0 (0)	0.008	0.14
Mixedwood Plains	195	0.002	0.00 – 3.31	0.17	3 (1.5)	0.0015	0.13
Atlantic Maritime	383	0.001	0.00 – 3.40	0.06	1 (0.3)	0.0008	0.05

Ecozone	N	Median	Range	95th Percentile	N (percent) > pTDI	HQ (median/pTDI)	HQ (95th percentile/pTDI)
Arsenic (µg/kg/d), pTDI = 1							
All ecozones	2,585	0.009	0.00 – 12.00	0.82	112 (4.3)	0.009	0.82
Pacific Maritime	202	0.38	0.00 – 10.18	3.82	51 (25.2)	0.38	3.82
Boreal Cordillera	46	0.10	0.00 – 2.62	0.62	2 (4.3)	0.10	0.62
Montane Cordillera	135	0.06	0.00 – 3.21	0.71	5 (3.7)	0.06	0.71
Taiga Plains	75	0.005	0.00 – 0.56	0.22	0 (0)	0.005	0.22
Boreal Plains	560	0.002	0.00 – 1.94	0.10	5 (0.9)	0.002	0.10
Prairies	205	0.0007	0.00 – 0.13	0.02	0 (0)	0.0007	0.02
Boreal Shield	500	0.008	0.00 – 2.62	0.29	8 (1.6)	0.008	0.29
Taiga Shield	135	0.03	0.00 – 0.84	0.14	0 (0)	0.03	0.14
Hudson Plains	149	0.01	0.00 – 1.49	0.21	1 (0.7)	0.01	0.21
Mixedwood Plains	195	0.0008	0.00 – 0.21	0.06	0 (0)	0.0008	0.06
Atlantic Maritime	383	0.09	0.00 – 12.00	1.86	40 (10.4)	0.09	1.86
Mercury (µg/kg/d), pTDI = 0.2							
All ecozones	2,585	0.004	0.00 – 0.82	0.10	50 (1.9)	0.02	0.50
Pacific Maritime	202	0.01	0.00 – 0.21	0.07	2 (1.0)	0.05	0.35
Boreal Cordillera	46	0.007	0.00 – 0.07	0.05	0 (0)	0.035	0.25
Montane Cordillera	135	0.003	0.00 – 0.32	0.04	1 (0.7)	0.015	0.20
Taiga Plains	75	0.002	0.00 – 0.33	0.06	1 (1.3)	0.01	0.30
Boreal Plains	560	0.002	0.00 – 0.42	0.08	7 (1.3)	0.01	0.40
Prairies	205	0.0002	0.00 – 0.20	0.01	1 (0.5)	0.001	0.05
Boreal Shield	500	0.02	0.00 – 0.82	0.20	25 (5.0)	0.10	1.00
Taiga Shield	135	0.03	0.00 – 0.78	0.28	9 (6.7)	0.15	1.40
Hudson Plains	149	0.007	0.00 – 0.29	0.07	3 (2.0)	0.035	0.35
Mixedwood Plains	195	0.0007	0.00 – 0.35	0.06	1 (0.5)	0.0035	0.30
Atlantic Maritime	383	0.002	0.00 – 0.19	0.03	0 (0)	0.01	0.15

Ecozone	N	Median	Range	95th Percentile	N (percent) > pTDI	HQ (median/pTDI)	HQ (95th percentile/ pTDI)
p,p'-DDE (ng/kg/d), pTDI = 20,000							
All ecozones	2,585	0.07	0.00 – 86.86	2.06	0 (0)	3.5×10^{-6}	1.0×10^{-4}
Pacific Maritime	202	0.60	0.00 – 8.01	2.99	0 (0)	3.0×10^{-5}	1.5×10^{-4}
Boreal Cordillera	46	0.004	0.00 – 1.10	0.77	0 (0)	2.0×10^{-7}	3.9×10^{-5}
Montane Cordillera	135	0.05	0.00 – 9.48	1.47	0 (0)	2.5×10^{-6}	7.4×10^{-5}
Taiga Plains	75	0.016	0.00 – 6.58	2.19	0 (0)	8.0×10^{-7}	1.1×10^{-4}
Boreal Plains	560	0.05	0.00 – 3.59	1.26	0 (0)	2.5×10^{-6}	6.3×10^{-5}
Prairies	205	0.00	0.00 – 4.10	0.31	0 (0)	0	1.6×10^{-5}
Boreal Shield	500	0.11	0.00 – 17.71	2.09	0 (0)	5.5×10^{-6}	1.0×10^{-4}
Taiga Shield	135	0.31	0.00 – 4.80	2.30	0 (0)	1.6×10^{-5}	1.2×10^{-4}
Hudson Plains	149	0.83	0.00 – 86.86	8.65	0 (0)	4.2×10^{-5}	4.3×10^{-4}
Mixedwood Plains	195	0.01	0.00 – 36.99	1.29	0 (0)	5.0×10^{-7}	6.5×10^{-5}
Atlantic Maritime	383	0.05	0.00 – 3.10	0.88	0 (0)	2.5×10^{-6}	4.4×10^{-5}
PCBs (ng/kg/d), pTDI = 1,000							
All ecozones	2,585	0.04	0.00 – 111.14	3.06	0 (0)	4.0×10^{-5}	3.1×10^{-3}
Pacific Maritime	202	0.15	0.00 – 3.05	1.18	0 (0)	1.5×10^{-4}	1.2×10^{-3}
Boreal Cordillera	46	0.000	0.00 – 0.67	0.15	0 (0)	0	1.5×10^{-4}
Montane Cordillera	135	0.000	0.00 – 3.66	0.24	0 (0)	0	2.4×10^{-4}
Taiga Plains	75	0.004	0.00 – 2.45	0.87	0 (0)	4.0×10^{-6}	8.7×10^{-4}
Boreal Plains	560	0.00	0.00 – 18.60	1.82	0 (0)	0	0.002
Prairies	205	0.00	0.00 – 4.78	0.095	0 (0)	0	9.5×10^{-5}
Boreal Shield	500	0.24	0.00 – 77.39	6.01	0 (0)	2.4×10^{-4}	0.006
Taiga Shield	135	0.49	0.00 – 15.08	5.06	0 (0)	4.9×10^{-4}	0.005
Hudson Plains	149	0.07	0.00 – 7.61	0.67	0 (0)	7.0×10^{-5}	6.7×10^{-4}
Mixedwood Plains	195	0.03	0.00 – 111.14	12.76	0 (0)	3.0×10^{-5}	0.01
Atlantic Maritime	383	0.06	0.00 – 8.88	1.33	0 (0)	6.0×10^{-5}	0.001

HQ = hazard quotient; pTDI = provisional tolerable daily intake; DDE = dichlorodiphenyldichloroethylene; HQ = hazard quotient; PCB = polychlorinated biphenyl

Mercury in Hair

Mercury is a metal of human health concern that is present in the environment through natural and anthropogenic pathways. Methylmercury is one of the most toxic forms which affects the central nervous system, particularly in developing fetuses and young children. It also disturbs immune function, alters genetic and enzyme systems, and is linked to increased risk of cardiovascular diseases (Bjørklund et al. 2017; Ha et al. 2016). The concentrations of mercury tend to be higher in predatory fish (such as mackerel, orange roughy, walleye and pike) and marine mammals (Health Canada 2008; Driscoll et al. 2013). Humans are primarily exposed to mercury through their diets of fish and seafood (Ha et al. 2016). Indigenous people, including First Nations, are particularly vulnerable to higher exposure due to the consumption of traditional foods, including fish and seafood, which may contain higher levels of methylmercury (Kuhnlein and Chan 2000). Indeed, elevated mercury exposure has been well documented among the Inuit populations in Canada (Donaldson et al. 2010; Curren et al. 2014). Although traditional food may contribute to mercury exposure, it has significant nutritional, social, cultural and economic benefits which should always be weighed against the risk of mercury exposure (Kuhnlein and Receveur 2007).

In Canada, mercury exposures in term of dietary intake and biomonitoring levels have been monitored for decades among Indigenous and non-Indigenous population. In the 1970s, the Medical Services Branch of Health Canada, (currently First Nations and Inuit Health Branch of Indigenous Services Canada, hereafter FNIHB) was involved in the initial investigations of blood and hair mercury levels among First Nations residents in Ontario and Quebec (Health Canada 1979). In 1973, a Task Force on Organic Mercury in the Environment was established by the Minister of National Health and Welfare (currently known as Health Canada) "in order to respond to the problem of high and unusual mercury levels in relation to the health and well-being of residents of Grassy Narrows and Whitedog, Ontario" (Health Canada or NHW 1979, cited from Legrand et al. 2010).

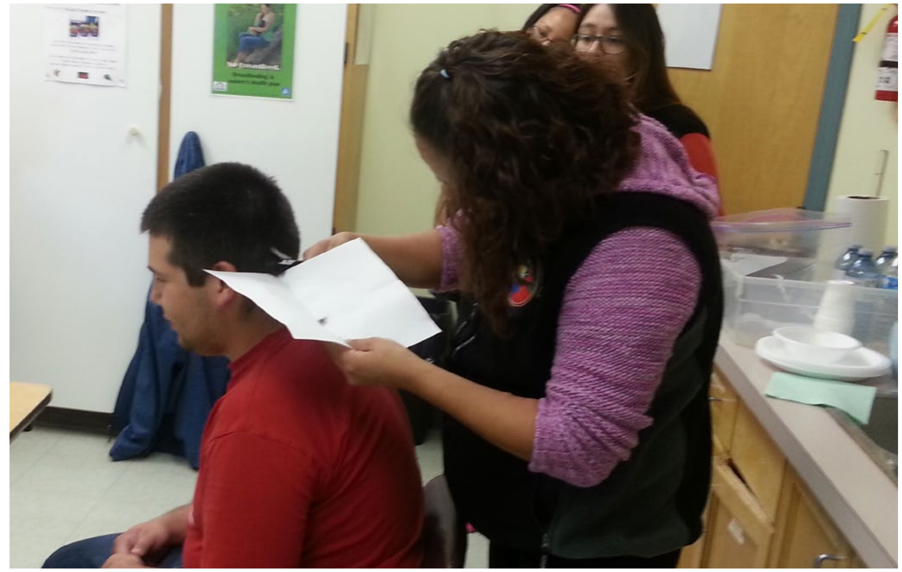
On the recommendation of the Task Force, FNIHB expanded a systematic mercury biomonitoring program among First Nations and Inuit in the early 1970s to make it national in scope. Between 1970 and December 1992, 71,842 hair and blood tests for MeHg on 38,571 individuals were carried out in 514 Indigenous communities across Canada (Wheatley and Paradis 1995). To identify "at risk" individuals and provide appropriate preventive action, FNIHB established a set of biomonitoring guidance values applicable to the general population of high fish consumers (e.g., First Nations and Inuit) (Health Canada 1979). The guidance values were based on the recommendations of the 1971 Swedish Expert Group (SEG) report (Legrand et al. 2010), which concluded that the lowest blood concentration associated with adverse clinical effects was approximately 200 µg/L. This analysis was based on the findings from investigations of large outbreaks of organic mercury poisoning — in Japan in the 1950s-1960s and in Iraq in the 1970s. The expert group recommended applying a safety factor of 10 to derive "safe" levels in human populations (SEG 1971, cited from Legrand et al. 2010).

Indigenous people, including First Nations, are particularly vulnerable to higher exposure due to the consumption of traditional foods, including fish and seafood, which may contain higher levels of methylmercury.

These guidelines remained unchanged in their applicability up until 2010, when Health Canada adopted additional biomonitoring guidelines, applicable specifically to women of childbearing age (WCBA) and children. The new proposed level of concern was set at 2 mg/kg in hair (8 µg/L in blood) (Legrand et al. 2010). In essence, this new blood guidance for mercury harmonized the biomonitoring guidance with the provisional Tolerable Daily Intake (pTDI) developed by Health Canada for pregnant women, women of reproductive age and infants, set at 0.2 µg/kg BW/day (Feeley and Lo 1998). The analysis of mercury in hair of First Nations undertaken through FNFNES use both sets of guidelines to assess the potential health risk of current levels of mercury among First Nations people.

The FNFNES includes a non-invasive bio-monitoring component relying on a sampling of human hair for analysis for mercury. The sampling was done in order to use this information for additional validation of dietary assessments and to develop estimates of mercury exposure First Nations populations living on-reserve across the AFN regions south of the 60th parallel. The participation in hair sampling was voluntary and based on informed written consent after a verbal and written explanation of the project component. The hair was collected in the early fall of each study year (from 2008 to 2016). In essence, a 5-mm bundle of hair was isolated and cut from the occipital region (the back of the head), ensuring a minimal and most often unnoticeable effect on participants' aesthetics. The hair bundle (full length, as cut from the scalp) was placed in a polyethylene bag and fastened to the bag with staples near the scalp end of the hair bundle. For participants with short hair, a short hair sampling procedure was followed. For this procedure, approximately 10 milligrams of hair were trimmed from the base of the neck onto a piece of paper. The paper was then folded, stapled, and placed in a polyethylene bag.

All hair samples, accompanied by a duly filled in chain of custody form, were sent by the national study coordinator to Health Canada/Indigenous Services Canada co-investigator who entered the participants' identification number in a spreadsheet and then sent them to the certified First Nations and Inuit Health Branch (FNIHB) Laboratory in Ottawa, Ontario (for British Columbia, Manitoba and Ontario regions) or to the Health Canada Quebec Region Laboratory in Longueuil, Quebec (for Alberta, Atlantic, Saskatchewan and Quebec regions) for analysis. No information that could be used to identify the participant was included in the package sent to Health Canada/Indigenous Services Canada. In the laboratory, each hair bundle was cut into 1 cm segments, starting from the scalp end. Three segments were analyzed to provide the level of mercury in participants' hair for approximately the last three months. For short hair samples (less than 1 cm), the level of mercury is only available for less than one month (as hair grows approximately 1 cm per month). Total mercury (all samples) and inorganic mercury (all segments with levels greater than 1.0 ppm (or



ANDREW PICHE AND KATELIND NAISTUS, ONION LAKE FIRST NATION, PHOTO BY LINDSAY KRAITBERG

μg/g) in the hair were analyzed. The limit of quantitation is 0.06 ppm (or μg/g) for total and 0.02 ppm (or μg/g) for inorganic mercury in hair.

In total, 3,404 First Nations adults (2,432 women and 972 men) living on reserve across the AFN regions (British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec and Atlantic) agreed to have their hair sampled and tested for mercury. This represents about 52.5% of the respondents to the household surveys. At the regional level, the participation rates ranged from 33.4% to 66.5%. Mercury component estimation weights were calculated for each region based on the data on hair mercury samples. All estimates on hair mercury concentrations were weighted unless otherwise stated. The majority of respondents to the mercury component were females (71.4%) while a higher proportion of females (66.1%) were of childbearing age, i.e., 19-50 years. Among men, the lowest participation rate (16.1%) was observed in Manitoba. This was explained by the unavailability of males at the time of the survey and sampling, the high prevalence of very short haircuts among males that did not allow the application of the FNFNES sampling protocol and the lack of interest in sampling among male community members. Sample characteristics by region are presented in Table 6.5.

Health Canada has a mercury guideline of 2 µg/g in hair (8 µg/L (or ppb) mercury in blood) for WCBA and children from birth to 18 years. The guideline is higher at 6 µg/g in hair for adult males and women aged 51+ (20 µg/L mercury in blood). There is also an "action level" of mercury exposure at 30 µg/g in hair or 100 µg/L in blood that applies to the general population and requires medical consultation and potential intervention (Legrand et al. 2010). Overall, there were 64 exceedances of Health Canada's mercury biomonitoring guidelines (44 WCBA, 8 women aged 51+, 3 men aged 19-50, and 9 men aged 51+). An exceedance was reported if at least one of the three hair segments sampled was above the guidelines. At the regional level, the highest number of participants with hair mercury concentrations exceeding the Health Canada's mercury biomonitoring guidelines was in Quebec (n=23) which represented 6.0% of the total sample and 8.3% of WCBA. In Ontario, a total of 18 respondents (2.4%) with 10 WCBA (3.3%) exceeded the hair mercury guidelines while in Manitoba, 9 WCBA (4.5%) exceeded the hair mercury guideline of 2 µg/g (Table 6.6).

The concentrations of total mercury in hair among First Nations adults varied between regions (Table 6.6). The highest arithmetic means of hair mercury concentration were observed among First Nations living in Quebec (1.45 µg/g), British Columbia (0.59 µg/g) and Ontario (0.41 µg/g) (while the geometric means for the corresponding regions were 0.42 µg/g, 0.36 µg/g and 0.19 µg/g respectively). First Nations living in the Atlantic region had the lowest level of hair mercury with the arithmetic mean at 0.18 µg/g and the geometric mean at 0.10 µg/g. Among WCBA, the highest average concentrations of hair mercury were reported in Quebec (0.85µg/g), British Columbia (0.43 µg/g) and Ontario (0.29 µg/g). Overall, men tend to have higher concentrations of mercury in hair compared to women (total sample, by age and sex groups). Also, mercury exposure increased with age among both men and women across all regions.

The distribution of mercury in hair at the 95th percentile indicates that overall, mercury body burden is below the established Health Canada's mercury guidelines of 6 µg/g in hair (ranging from 0.16 µg/g to 3.3 µg/g across age and sex groups) in all regions except Quebec. In the Quebec region, the weighted estimate at the 95th percentile for the total population was 6.92 µg/g, which suggests exceedances of the Health Canada's mercury guideline. For WCBA, the hair mercury concentration at the 95th percentile was 3.21 µg/g which indicates that exceedances of the biomonitoring guideline (2 µg/g) are present.

The proportions of respondents with hair mercury concentration below the level of detection (LOD) significantly vary between age and sex categories within and between regions (from 4.2% to 47.2%). Therefore, it should be noted that if more than 40% of the sample is below the LOD, which was observed in several age and sex groups, the means are biased and should not be used. Furthermore, results should be used with caution in the case when the coefficient of variation (CV) is between 15% and 35%; and estimates are considered unreliable if the CV is greater than 35% (Table 6.6).

The analysis by ecozone demonstrated significant differences in the profiles of mercury exposure among the study participants by ecozone (Figure 6.9 and 6.10). The northern ecozones are characterized by a greater frequency of higher exposures to mercury. In fact, out of 23 exceedances of the Health Canada's biomonitoring guideline for the general population (6 µg/g), 22 were in the northern ecozones such as Taiga Shield (n=9), Boreal Shield (n=11) and Hudson Plains (n=2) which represented 8.7%, 1.7% and 1.1% of the total population in each ecozone, respectively. The greater number of exceedances were among participants aged 51 years and older. Among WCBA, the majority of exceedances of the Health Canada's mercury guideline (2 µg/g) were found in Taiga Shield (n=17 or 29.3%) followed by Boreal Shield (n=16 or 5.0%), Hudson Plains (n=5 or 5.0%) and Pacific Maritime (n=3 or 2.9%). These results illustrate a strong south-north gradient of increasing exposures and should be considered in risk communication and public health education. In particular, mercury risk communication should be focused on the First Nations WCBA residing in northern ecozones and the Quebec region.

In general, the FNFNES results suggest that mercury exposure is not a significant health issue in the First Nations population south of the 60th parallel across Canada. However, WCBA and older individuals (51 years and over) living in northern ecozones tend to have a higher mercury exposure that exceeds Health Canada's guidelines. Therefore, community-based/intervention studies in northern ecozones may be beneficial to investigate the prevalence of higher mercury exposures and to provide coherent risk communication and nutrition advice on the importance of traditional food and on how to reduce exposure to mercury.

The comparison of mercury exposure among First Nations who participated in FNFNES (2008-2016) to the historical mercury biomonitoring data in the Canadian First Nations population (1970-1996) (Wheatley and Paradis 1995; Health Canada 1999) is presented in Figure 6.11 (A-C). It should be noted that the methodologies of the collection of biomonitoring data differ between surveys. The key difference was in the purpose of the biomonitoring investigation undertaken in 1972-1999, which was to estimate the extent of mercury exposure among high consumers of fish in First Nations communities. The sampling was not random and was based on volunteers in First Nations communities, who had self-identified as fishing guides and/or high consumers fish (Wheatley and Paradis 1995). The results of the Methylmercury Biomonitoring Program (1972-1996) primarily demonstrated high levels of exposure to mercury (the highest level observed was 660 µg/L in Ontario) among the sub-population of high fish consumers living on First Nations reserves, described the seasonal cycle of exposure and steady decrease of mean mercury levels in decades post 1970s.

In this context, the purpose of the mercury biomonitoring component of FNFNES was to provide the first large scale follow up to the national biomonitoring program that concluded in 1999 and to do so in a manner that would be statistically representative at the population level in order to compare results to the general population of Canada. Therefore, the participation in FNFNES was based on systematic random sampling and is representative at the regional level.

This methodological difference suggests that we cannot draw direct comparisons between historical and current results. Nevertheless, with this limitation in mind, we must highlight key differences in levels of population exposure using these large samples. One of the most important conclusions

LAC LA RONGE, PREPARING FISH, PHOTO BY REBECCA HARE

we can draw is that the levels of mercury exposure continued to decrease since 1996 and reached the level reasonably comparable to the general population. The analysis undertaken (Figure 6.11 A-C) demonstrates that across all participating regions the percentage of First Nations exposed to methylmercury above the acceptable level (20 µg/L or 6 µg/g) dropped by 20% (from 21.4% to 1.4%), when combining results across all regions.

In FNFNES, not a single individual tested in the range above 30 µg/g in hair, while 1.5% of the entire population sampled from 1971 to 1996 tested above this 'at risk' level which requires clinical (public health and medical toxicology specialists) follow up (Legrand et al. 2010).

To further highlight the differences, if we apply the new biomonitoring guideline for WBCA to the latest results (Figure 6.11 C), we would see that 95.5% of the participants had levels of mercury below 2 µg/g, which highlights the level of magnitude change in our frame of reference in regard to mercury exposure of First Nations people. Nevertheless, we still had observed exceedances of the acceptable level guidelines for the general population and women of childbearing age and we would direct the reader to the regional reports for specific details.

Comparison of FNFNES results in mercury biomonitoring with general population results derived from various phases of the Canadian Health Measures Survey (CHMS) (Statistics Canada n.d.) is illustrated in Table 6.7. There are several observations that are imperative in this context. The total First Nations population means are notably exceeding general Canadian population means in two regions of Canada — British Columbia and Quebec. At the same time, the First Nations population means are below the general Canadian population in the Atlantic and Alberta Regions with not much difference noted in Manitoba, Ontario and Saskatchewan.

It is important to point that the results of comparative analysis between CHMS and FNFNES (Table 6.7) highlight the need for increased public health attention to relatively high levels of exposure to mercury in subgroups (95th percentile) of First Nations population (BC and QC). In Quebec, the study found generally higher exposures to mercury among First Nations people than in any other region. Here the concern starts at the 75th percentile, particularly in regard to women's exposure, and it gets more pronounced in the 90th and 95th percentiles of the sample (Table 6.7). The mercury body burden of First Nations male participants in Quebec at the 95th percentile was 10 times higher than the 95th percentile in general Canadian population, and five times higher for women at the same level.

In general, the FNFNES results suggest that mercury exposure is not a significant health issue in First Nations population south of the 60th parallel across Canada. However, WCBA and older individuals (51 years and over) living in northern ecozones tend to have higher mercury exposure that exceeds Health Canada's guidelines. Therefore, community-based/intervention studies in northern ecozones may be beneficial to investigate the prevalence of higher mercury exposures and to provide coherent risk communication and nutrition advice on the importance of traditional food and on how to reduce exposure to mercury.

Table 6.5 Sample characteristics by regions: number of communities and hair mercury sampling participants

	TOTAL	British Columbia	Manitoba	Ontario	Alberta	Atlantic	Saskatchewan	Quebec & Labrador
Year(s) of data collection		2008-2009	2010	2011-2012	2013	2014	2015	2016
First Nations Communities, n	93	21	9	18	10	11	14	10
FNFNES Participants, n	6,487	1,103	706	1,429	609	1,025	1,042	573
Hair Mercury Sample Participants, n	3,404	487	236	744	369	632	555	381
Participation rate, %	52.5	44.2	33.4	52.1	60.6	61.7	53.3	66.5
Males, n	972	141	38	236	121	191	157	88
Females, n	2,432	346	198	508	248	441	398	293
WCBA (19-50), n	1,607	246	138	302	176	296	269	180

WCBA — women of childbearing age

Table 6.6 Arithmetic mean (A.M.), geometric mean (G.M.), 95th percentile and exceedances of total mercury in hair concentration (µg/g or ppm) for First Nations living on reserve, by region*

	Age group	Sample size	A.M.	Lower 95% CI	Upper 95%CI	G.M.	Lower 95% CI	Upper 95%CI	95th	Lower 95% CI	Upper 95%CI	exceed	
												n	%
British Columbia													
Total	19-30	94	0.42	0.09	0.76	0.27	0.16	0.46	1.57	<LOD	3.12	0	0
	31-50	240	0.48	0.35	0.61	0.31	0.24	0.41	1.25	0.76	1.75	3	1.3
	51+	153	0.79	0.27	1.30	0.54	0.23	1.28	2.07	0.53	3.61	0	0
	Total	**487**	**0.58**	**0.39**	**0.76**	**0.37**	**0.26**	**0.53**	**1.57**	**1.24**	**1.91**	**3**	**0.6**
Males	19-30	25	0.23	0.15	0.30	0.19	0.14	0.25	0.50	0.30	0.69	0	0
	31-50	63	0.73	0.48	0.97	0.50	0.27	0.91	1.98	1.04	2.92	0	0
	51+	53	0.83	0.16	1.51	0.47	0.18	1.27	2.19	0.35	4.04	0	0
	Total	**141**	**0.70**	**0.40**	**1.01**	**0.43**	**0.25**	**0.77**	**2.07**	**1.43**	**2.72**	**0**	**0**
Females	19-30	69	0.46	0.08	0.84	0.29	0.16	0.52	1.57	<LOD	3.13	0	0
	31-50	177	0.40	0.32	0.48	0.27	0.23	0.32	1.19	0.73	1.65	3	1.7
	51+	100	0.78	0.29	1.26	0.56	0.24	1.33	1.50	0.73	2.27	0	0
	Total	**346**	**0.54**	**0.36**	**0.72**	**0.35**	**0.25**	**0.51**	**1.50**	**1.27**	**1.73**	**3**	**0.9**
WCBA	**19-50**	**246**	**0.42**	**0.35**	**0.49**	**0.28**	**0.26**	**0.30**	**1.57**	**0.86**	**2.29**	**3**	**1.2**
Manitoba													
Total	19-30	46	0.23	0.08	0.38	0.11	<LOD	0.27	0.79	0.17	1.41	6	13.0
	31-50	119	0.55	<LOD	1.38	0.15	<LOD	0.40	3.63	<LOD	7.25	3	2.5
	51+	71	0.34	0.15	0.53	0.19	0.09	0.39	1.40	0.53	2.28	0	0
	Total	**236**	**0.42**	**<LOD**	**0.80**	**0.15**	**0.08**	**0.29**	**3.02**	**0.07**	**5.96**	**9**	**3.8**
Males	19-30	6	0.21	<LOD	0.41	0.14	<LOD	0.47	0.49	0.17	0.80	0	0
	31-50	21	1.28	<LOD	2.88	0.33	<LOD	2.26	3.63	<LOD	7.34	0	0
	51+	11	0.37	<LOD	0.70	0.18	<LOD	0.57	1.60	0.06	3.14	0	0
	Total	**38**	**0.76**	**<LOD**	**1.53**	**0.22**	**0.07**	**0.70**	**3.63**	**<LOD**	**7.34**	**0**	**0**
Females	19-30	40	0.24	0.08	0.40	0.10	<LOD	0.19	0.79	<LOD	1.57	6	15.0
	31-50	98	0.20	0.15	0.25	0.10	0.08	0.13	0.83	0.38	1.28	3	3.1
	51+	60	0.32	0.16	0.49	0.19	0.10	0.36	1.14	0.45	1.82	0	0
	Total	**198**	**0.24**	**0.14**	**0.34**	**0.12**	**0.08**	**0.18**	**0.83**	**0.40**	**1.25**	**9**	**4.5**
WCBA	**19-50**	**138**	**0.21**	**0.12**	**0.30**	**0.10**	**0.07**	**0.15**	**0.79**	**0.33**	**1.25**	**9**	**6.5**

	Age group	Sample size	A.M.	Lower 95% CI	Upper 95%CI	G.M.	Lower 95% CI	Upper 95%CI	95th	Lower 95% CI	Upper 95%CI	exceed	
												n	%
Ontario													
Total	19-30	127	0.30	0.08	0.52	0.14	0.10	0.21	1.16	0.33	2.00	5	3.9
	31-50	303	0.37	0.13	0.60	0.17	0.13	0.23	1.35	<LOD	2.70	8	2.6
	51+	314	0.48	0.29	0.66	0.24	0.19	0.30	1.74	0.49	2.99	5	1.6
	Total	**744**	**0.40**	**0.25**	**0.55**	**0.19**	**0.16**	**0.23**	**1.35**	**0.53**	**2.16**	**18**	**2.4**
Males	19-30	38	0.35	<LOD	0.75	0.15	0.08	0.28	1.29	<LOD	3.76	1	2.6
	31-50	90	0.51	0.17	0.85	0.23	0.17	0.32	2.15	<LOD	4.29	2	2.2
	51+	108	0.56	0.34	0.78	0.30	0.20	0.45	1.91	0.53	3.29	2	1.9
	Total	**236**	**0.51**	**0.28**	**0.73**	**0.24**	**0.17**	**0.34**	**1.78**	**0.56**	**3.01**	**5**	**2.1**
Females	19-30	89	0.27	0.18	0.37	0.14	0.10	0.21	0.96	0.59	1.34	4	4.5
	31-50	213	0.31	0.24	0.38	0.16	0.13	0.19	1.18	0.85	1.51	6	2.8
	51+	206	0.42	0.25	0.59	0.21	0.17	0.26	1.54	0.20	2.88	3	1.5
	Total	**508**	**0.34**	**0.26**	**0.43**	**0.17**	**0.15**	**0.20**	**1.18**	**0.85**	**1.50**	**13**	**2.6**
WCBA	**19-50**	**302**	**0.30**	**0.23**	**0.37**	**0.15**	**0.12**	**0.19**	**1.16**	**0.88**	**1.44**	**10**	**3.3**
Alberta													
Total	19-30	68	0.07	<LOD	0.11	<LOD	<LOD	0.07	0.27	0.12	0.42	0	0
	31-50	176	0.19	0.13	0.24	0.11	0.09	0.13	0.77	0.27	1.26	1	0.6
	51+	125	0.35	<LOD	0.69	0.13	<LOD	0.25	1.49	<LOD	3.76	1	0.8
	Total	**369**	**0.21**	**0.13**	**0.30**	**0.10**	**0.07**	**0.12**	**0.83**	**0.37**	**1.30**	**2**	**0.5**
Males	19-30	16	<LOD	<LOD	0.12	<LOD	<LOD	0.08	0.16	<LOD	0.43	0	0
	31-50	52	0.21	0.12	0.30	0.13	0.10	0.18	1.04	0.27	1.82	0	0
	51+	53	0.59	<LOD	1.24	0.21	<LOD	0.67	2.21	<LOD	6.65	1	1.9
	Total	**121**	**0.31**	**0.13**	**0.49**	**0.12**	**0.07**	**0.20**	**1.06**	**0.39**	**1.72**	**1**	**0.8**
Females	19-30	52	0.08	<LOD	0.11	<LOD	<LOD	<LOD	0.27	0.11	0.43	0	0
	31-50	124	0.18	0.11	0.24	0.10	0.08	0.12	0.77	<LOD	1.56	1	0.8
	51+	72	0.17	0.10	0.24	0.09	<LOD	0.13	0.81	0.44	1.17	0	0
	Total	**248**	**0.15**	**0.11**	**0.20**	**0.08**	**<LOD**	**0.10**	**0.54**	**0.28**	**0.81**	**1**	**0.4**
WCBA	**19-50**	**176**	**0.15**	**0.09**	**0.20**	**0.08**	**0.06**	**0.10**	**0.43**	**0.18**	**0.68**	**1**	**0.6**

	Age group	Sample size	A.M.	Lower 95% CI	Upper 95%CI	G.M.	Lower 95% CI	Upper 95%CI	95th	Lower 95% CI	Upper 95%CI	exceed	
												n	%
Atlantic													
Total	19-30	110	0.09	<LOD	0.13	<LOD	<LOD	0.08	0.39	0.15	0.64	0	0
	31-50	298	0.16	0.12	0.20	0.10	0.07	0.13	0.51	0.42	0.59	0	0
	51+	224	0.31	0.23	0.39	0.18	0.14	0.23	0.86	0.34	1.39	0	0
	Total	**632**	**0.18**	**0.15**	**0.21**	**0.10**	**0.08**	**0.12**	**0.57**	**0.47**	**0.68**	**0**	**0**
Males	19-30	32	0.11	<LOD	0.18	0.07	<LOD	0.10	0.39	<LOD	0.82	0	0
	31-50	80	0.19	0.14	0.25	0.11	0.08	0.17	0.52	0.29	0.74	0	0
	51+	76	0.38	0.25	0.51	0.21	0.15	0.29	1.37	0.17	2.56	0	0
	Total	**188**	**0.21**	**0.17**	**0.26**	**0.11**	**0.09**	**0.14**	**0.72**	**0.54**	**0.90**	**0**	**0**
Females	19-30	78	0.08	<LOD	0.11	<LOD	<LOD	<LOD	0.29	<LOD	0.51	0	0
	31-50	218	0.13	0.10	0.16	0.08	<LOD	0.10	0.39	0.26	0.52	0	0
	51+	148	0.25	0.19	0.31	0.16	0.12	0.20	0.82	0.59	1.05	0	0
	Total	**444**	**0.15**	**0.11**	**0.18**	**0.09**	**<LOD**	**0.10**	**0.48**	**0.36**	**0.61**	**0**	**0**
WCBA	**19-50**	**296**	**0.11**	**0.08**	**0.13**	**<LOD**	**<LOD**	**0.08**	**0.39**	**0.26**	**0.52**	**0**	**0**
Saskatchewan													
Total	19-30	139	0.22	<LOD	0.37	0.08	<LOD	0.15	1.38	0.27	2.49	0	0
	31-50	227	0.27	0.20	0.33	0.10	0.08	0.14	1.19	0.79	1.58	6	2.6
	51+	189	0.45	0.25	0.65	0.13	0.09	0.18	1.58	<LOD	3.77	3	1.6
	Total	**555**	**0.29**	**0.23**	**0.34**	**0.10**	**0.07**	**0.13**	**1.29**	**1.07**	**1.51**	**9**	**1.6**
Males	19-30	35	0.23	0.07	0.39	0.08	<LOD	0.14	1.50	0.77	2.23	0	0
	31-50	62	0.26	0.19	0.33	0.10	0.07	0.14	0.94	0.29	1.58	0	0
	51+	60	0.61	0.24	0.97	0.14	0.09	0.23	3.30	<LOD	7.24	3	5
	Total	**157**	**0.33**	**0.25**	**0.40**	**0.10**	**0.07**	**0.13**	**1.50**	**1.18**	**1.82**	**3**	**1.9**
Females	19-30	104	0.20	<LOD	0.37	0.08	<LOD	0.16	1.14	<LOD	2.25	0	0
	31-50	165	0.27	0.18	0.36	0.10	0.08	0.14	1.27	0.88	1.66	6	3.6
	51+	129	0.28	0.20	0.37	0.11	0.08	0.15	1.47	0.49	2.45	0	0
	Total	**398**	**0.24**	**0.18**	**0.31**	**0.10**	**<LOD**	**0.14**	**1.27**	**0.82**	**1.73**	**6**	**1.5**
WCBA	**19-50**	**269**	**0.23**	**0.15**	**0.31**	**0.09**	**<LOD**	**0.14**	**1.27**	**0.70**	**1.84**	**6**	**2.2**

	Age group	Sample size	A.M.	Lower 95% CI	Upper 95%CI	G.M.	Lower 95% CI	Upper 95%CI	95th	Lower 95% CI	Upper 95%CI	exceed	
												n	%
Quebec													
Total	19-30	65	0.59	<LOD	1.17	0.24	0.09	0.67	2.61	0.53	4.70	4	6.2
	31-50	162	0.64	0.36	0.92	0.35	0.23	0.54	2.50	0.65	4.36	11	6.8
	51+	154	2.95	0.82	5.07	0.63	0.27	1.51	12.21	<LOD	27.72	8	5.2
	Total	**381**	**1.39**	**0.60**	**2.18**	**0.39**	**0.23**	**0.69**	**6.92**	**<LOD**	**14.84**	**23**	**6.0**
Males	19-30	8	0.88	<LOD	2.01	0.38	0.08	1.78	2.61	0.15	5.08	0	0
	31-50	39	0.42	0.30	0.53	0.30	0.18	0.51	1.42	0.75	2.09	0	0
	51+	41	4.56	<LOD	9.50	0.85	0.18	4.06	23.52	<LOD	47.51	3	7.3
	Total	**88**	**1.76**	**0.29**	**3.23**	**0.43**	**0.22**	**0.85**	**12.21**	**1.78**	**22.63**	**3**	**3.4**
Females	19-30	57	0.45	0.09	0.81	0.20	0.08	0.46	1.87	0.19	3.56	4	7.0
	31-50	123	0.97	0.35	1.58	0.45	0.30	0.69	3.59	<LOD	7.61	11	8.9
	51+	113	1.56	0.60	2.51	0.49	0.25	0.95	7.63	3.29	11.97	5	4.4
	Total	**293**	**1.02**	**0.46**	**1.59**	**0.36**	**0.20**	**0.65**	**4.97**	**2.50**	**7.44**	**20**	**6.8**
WCBA	**19-50**	**180**	**0.74**	**0.28**	**1.19**	**0.31**	**0.17**	**0.56**	**3.21**	**1.23**	**5.19**	**15**	**8.3**

Use with caution, CV between 15% and 35%.

CV greater than 35% or the estimate is thought to be unstable.

If >40% of sample were below the LOD, means are thought to be meaningless and should not be used.

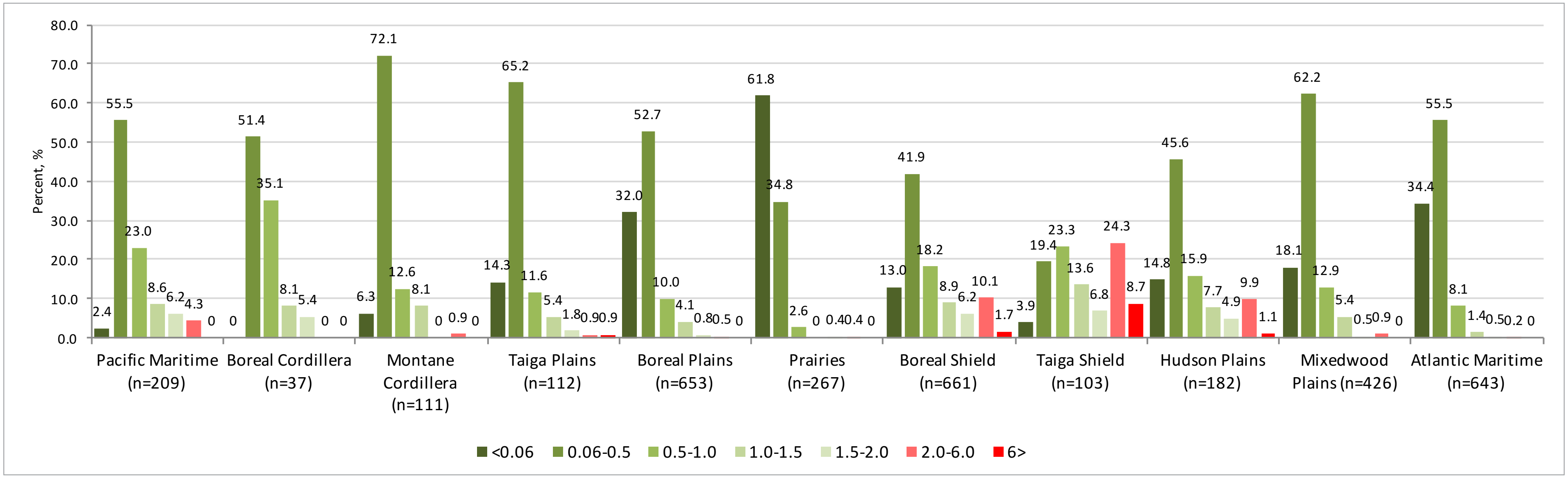
*Estimates have been adjusted for non-response and are post-stratified to population counts within age/sex group. Bootstrap weights were adjusted for population changes over a 10-year period of data collection (2008-2017).

Estimates should be used with caution due to high CVs. Note that CV does not reflect bias, only sampling error: Good (CV is up to 15%), Use with caution (CV is between 15% and 35%), Unreliable (over 35%).

All shaded figures would not normally be released due to high CVs or the high percentage of respondents below the limit of detection. Variance estimation for non-linear statistics such as percentiles is itself subject to variability, particularly with small sample sizes. Confidence intervals that are inconsistent for percentages typically imply all such percentages should only be used with extreme caution.

Due to small sample size of adults aged 71+, the data was combined into the 51+ age group.

Figure 6.9 Mercury concentration in hair of participants, by ecozone (percent, %)



Notes: <2 µg/g in hair – no risk for women of childbearing age (WCBA); 2-6 µg/g in hair – increased risk for WCBA; >6 µg/g in hair – increased risk.

Figure 6.10 Mercury concentration in hair of women of childbearing age (WCBA), by ecozone (percent, %)

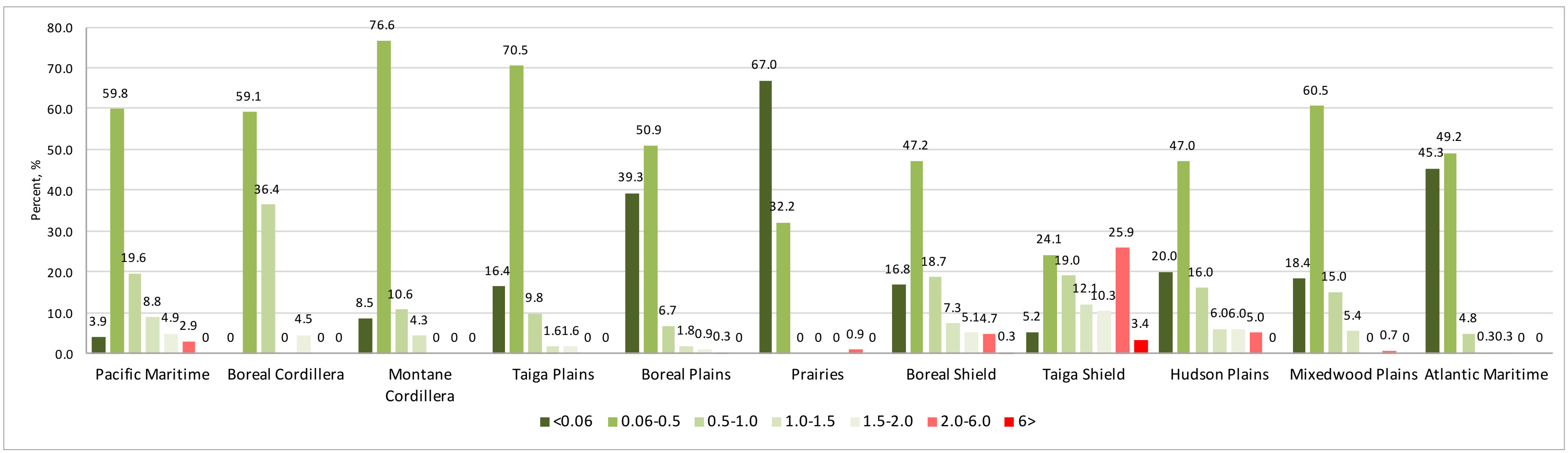
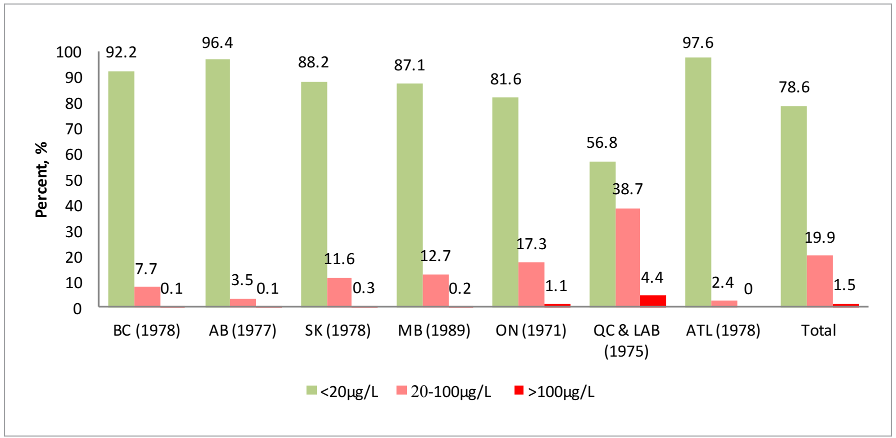


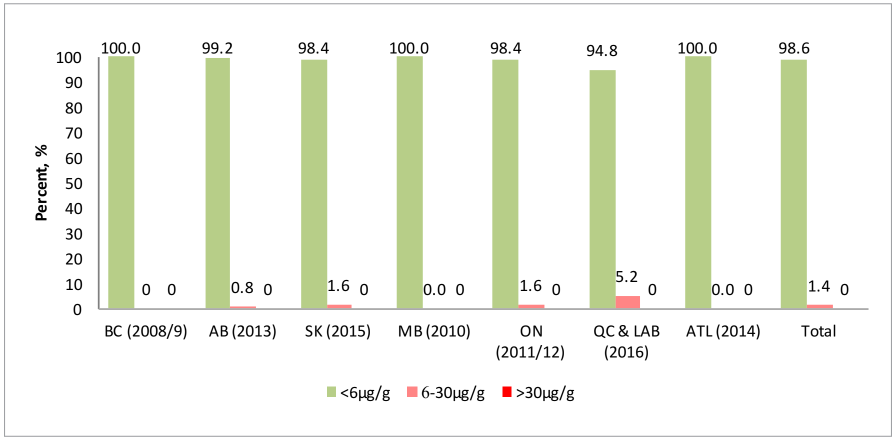
Figure 6.11 Comparison of mercury exposure in the FNFNES First Nations participants (2008-2016) to the historical levels of methylmercury exposure in First Nations in Canada (1970-1996)

A. Blood methylmercury concentrations in First Nations in Canada, by region (1970-1996) (Health Canada 1999)



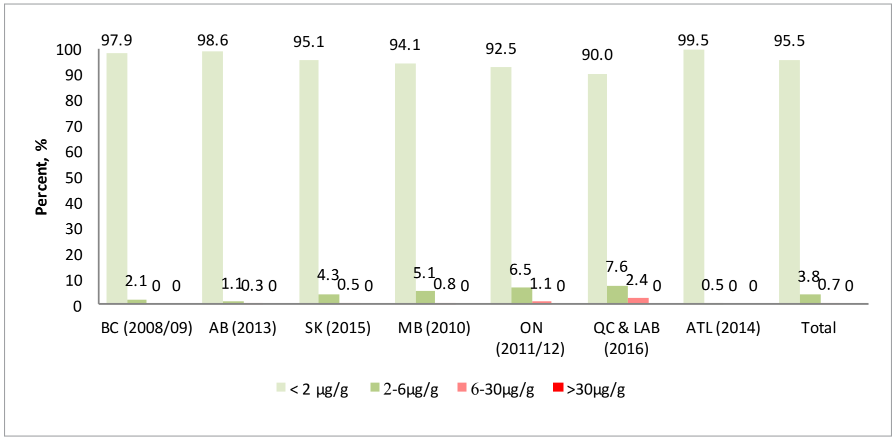
<20µg/L in blood –acceptable; 20-100µg/L in blood-increased risk; >100µg/L in blood – at risk.

B. Hair mercury concentrations in First Nations aged 51 years and older, by region, FNFNES (2008-2016)



<6µg/L in hair –acceptable; 6-30µg/L in hair – increased risk; >30µg/L in hair – at risk.

C. Hair mercury concentrations in First Nations (total population) by region, FNFNES (2008-2016)



<2µg/L in hair –no risk for WCBA; 2- 6µg/L in hair – increased risk for WCBA; 6-30µg/L in hair – increased risk; >30µg/L in hair – at risk.

Table 6.7 Comparison of estimates on whole blood mercury concentrations* (µg/L) of the First Nations populations living on reserve south of 60th parallel (FNFNES 2008-2016) and the Canadian population (Canadian Health Measures Survey (CHMS) cycle 1 (2007-2009), cycle 2 (2009-2011), cycle 3 (2012-2013) and cycle 4 (2014-2015) aged 19-79 years by sex

Population	Sex	Count (n)	%<LOD[a]	A.M (95% CI)	G.M (95% CI)	10th (95% CI)	25th (95% CI)	50th (95% CI)	75th (95% CI)	90th (95% CI)	95th (95% CI)
FNFNES, BC (2008/2009)	Total	487	5.1	2.37 (1.44-3.3)	1.46 (0.99-2.14)	0.24 (0.13-0.35)	0.56 (0.41-0.71)	1.37 (0.6-2.13)	2.98 (1.05-4.92)	6.00 (3.2-8.79)	8.08 (5.48-10.68)
	Female	346	5.5	2.16 (1.5-2.81)	1.39 (1.01-1.91)	0.28 (0.15-0.41)	0.56 (0.38-0.74)	1.29 (0.86-1.73)	2.88 (1.3-4.46)	5.19 (3.8-6.58)	6.16 (5.09-7.23)
	Male	141	4.2	2.57 (1.16-3.98)	1.52 (0.86-2.69)	0.24 (0.04-0.44)	0.56 (0.28-0.84)	1.51 (0.13-2.88)	3.30 (0.65-5.94)	7.82 (2.32-13.31)	8.24 (3.52-12.95)
CHMS Cycle 1 (2007-2009)	Total	3,567	5.8	1.6 (1.1-2.0)	0.82 (0.66-1.0)	0.17 (0.13-0.21)	0.42 (0.33-0.50)	0.92 (0.73-1.1)	1.8 (1.3-2.3)	3.3[E] (1.8-4.7)	5.2[E] (2.4-8.1)
	Female	1,888	5.7	1.5 (1.0-1.9)	0.82 (0.64-1.1)	0.18 (0.13-0.23)	0.41 (0.30-0.52)	0.93 (0.71-1.1)	1.8 (1.2-2.3)	3.2[E] (1.9-4.5)	4.9[E] (1.9-8.0)
	Male	1,679	5.9	1.7 (1.1-2.2)	0.82 (0.67-1.0)	0.16 (0.12-0.20)	0.43 (0.34-0.51)	0.90 (0.74-1.1)	1.8 (1.3-2.4)	3.3[E] (1.8-4.9)	5.4[E] (3.0-7.9)
FNFNES, MB (2010)	Total	236	28.4	1.32 (0.34-2.29)	0.53 (0.31-0.9)	.	.	0.56 (0.26-0.87)	1.30 (0.41-2.18)	2.68 (-0.08-6.59)	6.27 (0.51-12.02)
	Female	198	28.3	0.86 (0.6-1.13)	0.45 (0.33-0.63)	.	.	0.51 (0.26-0.76)	0.85 (0.57-1.14)	2.14 (1.37-2.9)	2.93 (1.45-4.41)
	Male	38	28.9	1.75F (-0.01-3.57)	0.61F (0.27-1.38)	.	.	0.57 (0.1-1.04)	1.23 (-0.28-2.74)	4.18 (-0.02-8.59)	6.40 (-0.1-14.37)
FNFNES, ON (2011/2012)	Total	744	13.3	1.62E (1.03-2.22)	0.75 0.63-0.9)	0.14F (0.13-0.15)	0.35F (0.29-0.41)	0.67F (0.51-0.84)	1.75F (1.32-2.19)	3.42F (1.74-5.1)	5.39F (1.98-8.81)
	Female	508	14.4	1.35 (1.01-1.7)	0.67 (0.57-0.79)	0.14E (0.14-0.14)	0.32E (0.15-0.49)	0.62E (0.51-0.74)	1.46E (0.93-1.99)	3.22E (2.4-4.03)	4.60E (3.24-5.96)
	Male	236	11.0	1.89E (0.96-2.83)	0.85E (0.61-1.17)	0.14F (-0.01-0.37)	0.38F (0.27-0.5)	0.80F (0.44-1.17)	1.86F (0.97-2.75)	4.00F (1.25-6.75)	6.95F (1.91-11.99)

Population	Sex	Count (n)	%<LOD[a]	A.M (95% CI)	G.M (95% CI)	10th (95% CI)	25th (95% CI)	50th (95% CI)	75th (95% CI)	90th (95% CI)	95th (95% CI)
CHMS Cycle 2 (2009-2011)	Total	3,706	7.4	1.80 (1.3-2.3)	0.86 (0.68-1.1)	0.16^{E} (<LOD-0.23)	0.29 (0.29-0.51)	0.94 (0.72-1.2)	2.0 (1.6-2.4)	4.0 (2.7-5.3)	6.4^{E} (3.9-9.0)
	Female	1,988	7.7	1.60 (1.2-2.1)	0.8 (0.64-1.0)	0.18^{E} (0.10-0.26)	0.40 (0.29-0.51)	0.88 (0.69-1.1)	1.8 (1.3-2.3)	3.4 (2.3-4.5)	5.4^{E} (2.5-8.3)
	Male	1,718	7.0	2.00 (1.4-2.7)	0.92 (0.7-1.2)	0.16^{E} (<LOD-0.24)	0.42 (0.30-0.55)	1.0 (0.75-1.3)	2.2 (1.6-2.8)	4.2^{E} (2.4-6.0)	7.6^{E} (3.2-12)
FNFNES, AB (2013)	Total	369	40.7	0.74 (0.41-1.08)	0.33 (<LOD-0.42)	<LOD	<LOD	<LODF (<LOD-0.37)	0.70E (0.42-0.99)	1.35F (<LOD-2.65)	3.07E (1.41-4.72)
	Female	248	47.2	0.55 (0.41-0.69)	0.29 (<LOD-0.34)	<LOD	<LOD	<LOD	0.52E (<LOD-0.78)	1.20E (0.83-1.56)	1.91E (0.82-3)
	Male	121	27.3	0.94F (0.29-1.59)	0.38E (<LOD-0.59)	<LOD	<LOD	<LODF (<LOD-0.62)	0.80E (<LOD-1.33)	2.16F (<LOD-4.28)	4.18F (0.81-7.54)
CHMS Cycle 3 (2012-2013)	Total	3,249	24.1	1.6 (1.1-2.1)	0.91 (0.73-1.1)	<LOD	0.44 (<LOD-0.60)	0.92 (0.71-1.1)	1.8 (1.2-2.3)	3.8^{E} (1.9-5.7)	6.0^{E} (2.8-9.2)
	Female	1,642	24.6	1.6 (1.1-2.2)	0.93 (0.77-1.1)	<LOD	0.46^{E} (<LOD-0.64)	0.95 (0.77-1.1)	1.8 (1.3-2.3)	3.8^{E} (1.4-6.3)	F
	Male	1,607	23.7	1.6 (1.1-2.2)	0.89 (0.68-1.2)	<LOD	0.42 (<LOD-0.57)	0.90 (0.64-1.2)	1.7^{E} (0.77-2.6)	3.8^{E} (2.0-5.7)	5.9^{E} (2.6-9.2)
FNFNES, AT (2014)	Total	632	41.0	0.72 (0.58-0.85)	0.39 (0.32-0.48)	<LOD	<LOD	0.38E (<LOD-0.56)	0.87 (0.64-1.1)	1.65E (1.3-2.00)	2.31E (1.89-2.73)
	Female	444	46.4	0.58 (0.45-0.72)	0.34 (<LOD-0.42)	<LOD	<LOD	<LOD	0.76E (0.51-1.00)	1.36 (0.96-1.76)	1.94 (1.43-2.45)
	Male	188	28.2	0.85 (0.67-1.03)	0.45 (0.35-0.58)	<LOD	<LOD	0.48E (0.29-0.68)	1.03 (0.76-1.30)	1.90 (1.62-2.19)	2.89 (2.17-3.61)
FNFNES, SK (2015)	Total	555	43.4	1.20 (0.95-1.45)	0.39 (0.28-0.54)	<LOD	<LOD	<LOD (<LOD-0.36)	0.94 (0.29-1.59)	3.42 (2.09-4.75)	5.32 (4.38-6.26)
	Female	398	42.7	1.10 (0.73-1.46)	0.39 (<LOD-0.57)	<LOD	<LOD	<LOD (<LOD-0.42)	0.88 (0.34-1.42)	3.18 (1.43-4.93)	5.08 (3.42-6.75)
	Male	157	45.2	1.30 (0.99-1.61)	0.39 (0.28-0.54)	<LOD	<LOD	<LOD (<LOD-0.34)	1.10 (<LOD-1.94)	3.61 (2.61-4.60)	5.99 (4.69-7.29)
CHMS Cycle 4 (2014-2015)	Total	3,224	32.1	1.20 (0.98-1.5)	0.7 (0.6-0.82)	<LOD	<LOD	0.72 (0.57-0.88)	1.5 (1.2-1.7)	3.0 (2.2-3.8)	3.8 (2.8-4.8)
	Female	1,628	32.5	1.10 (0.89-1.4)	0.68 (0.57-0.81)	<LOD	<LOD	0.72 (0.55-0.90)	1.4 (1.2-1.7)	2.4 (1.7-3.2)	3.6 (3.0-4.3)
	Male	1,596	31.6	1.30 (1.1-1.6)	0.72 (0.63-0.84)	<LOD	<LOD	0.76 (0.62-0.91)	1.6 (1.3-1.9)	3.2 (2.4-4.0)	4.2 (3.0-5.4)

Population	Sex	Count (n)	%<LOD[a]	A.M (95% CI)	G.M (95% CI)	10th (95% CI)	25th (95% CI)	50th (95% CI)	75th (95% CI)	90th (95% CI)	95th (95% CI)
FNFNES, QC (2016)	Total	381	22.6	5.80E (2.43-9.17)	1.66E (0.89-3.1)	<LODF (<LOD-0.42)	0.68F (<LOD-1.38)	1.56E (0.83-2.3)	3.86F (0.75-6.97)	13.53F (<LOD-28.82)	27.68F (<LOD-58.34)
	Female	293	22.2	4.43E (1.77-7.09)	1.58F (0.79-3.16)	<LOD (<LOD-0.45)	0.60F (<LOD-1.2)	1.61F (<LOD-3.08)	4.24F (<LOD-9.95)	12.84E (4.62-21.06)	19.88E (10.76-29.00)
	Male	88	23.9	7.21F (1.42-13.00)	1.75E (0.90-3.42)	<LOD (<LOD-0.5)	0.68F (<LOD-1.47)	1.56E (0.95-2.17)	3.06F (<LOD-6.64)	27.68F (<LOD-62.99)	48.83F (7.21-90.45)

*A hair/blood ratio of 250/1 was used to convert hair mercury values to blood mercury concentrations for the FNFNES participants. The equation is as follow: Hair value (mg/kg) = (blood value (µg/L) x 250/1000) (Legrand et al. 2010).

CHMS notes:

The limits of detection (LOD) for the analytical method are 0.1, 0.1, 0.42, and 0.42 for cycles 1, 2, 3, 4, respectively.

E Use data with caution, CV was between 16.6% and 33.3%.

F Data is too unreliable to be published, CV was greater than 33.3%.

FNFNES notes:

The limit of quantitation for total mercury in hair was 0.06 ppm (or µg/g).

E – Use data with caution, CV was between 15% and 35%.

F – Estimates are thought to be unstable, CV was greater than 35%.

"." means that the survey estimates couldn't be calculated.

Mercury (total) – Arithmetic means, geometric means, and selected percentiles of whole blood concentrations (µg/L) for on-reserve and crown land populations aged 20 years old and older, reproduced from Table 7.1 in AFN publication, First Nations Biomonitoring Initiative (2011).

CHAPTER 7

Conclusions

Implications of Results

This is the first comprehensive study addressing the gaps in knowledge about the diet, traditional food and environmental contaminants to which First Nations in Canada south of the 60th parallel are exposed. The overall results indicate that traditional food is safe to eat and contributes important nutrients to the diets of First Nations adults. On days that traditional food was eaten, the intake of almost all nutrients was significantly higher. Among adults reporting traditional food intake on their 24-hour recall, the average daily calories from traditional food was 25%, while adults eating at the 95th percentile derived over half their calories (58.4%) from traditional food.

However, there are disturbing disparities in health and well-being. There are very high rates of food insecurity, obesity, smoking and diabetes along with low rates of self-reported good health. The inadequate intake of several nutrients for the population, including vitamins A, D, and C, folate, calcium, and magnesium, reflects a diet pattern with low amounts of traditional food for the overall population (4.6% of calories for the total population) and a high proportion of store-bought foods with a limited variety.

For too many families, there is insufficient economic and physical access to high quality and diverse traditional and store-bought foods as evidenced by the high income-related food insecurity and insufficiency of traditional food supplies. Almost half of all households (47.9%) were considered food insecure and 47% were also worried that they wouldn't be able to replace their traditional foods when they ran out. While some adults reported having upwards of 1,000 grams a day of traditional food, the average intake among the general population was 61 grams.

For too many families, there is insufficient economic and physical access to high quality and diverse traditional and store-bought foods as evidenced by the high income-related food insecurity and insufficiency of traditional food supplies.

Across the regions, trust in the community water treatment systems varied: approximately one-quarter of adults regularly avoided tap water. This was largely due to exceedances of metals that can impact taste and colour. Regarding trace metals of human health concern, the quality of drinking water is satisfactory. However, elevated levels of lead were found in some First Nations communities. Pharmaceuticals were found in surface water sites in most communities. The levels are similar to those found in other areas tested in Canada, however, the potential health effects of drinking the water from these surface water sites over a prolonged period is unknown.

Beyond addressing individual and household barriers to appropriate access to high quality foods from the market and traditional food system, it is imperative to understand and reduce the threats to the health of ecosystems and the quality and availability of traditional food. Over half of all participants said that their harvesting abilities and amounts of traditional food available are impacted by industrial activities in their territory along with climate change, and many First Nations have reported that they have limited ability to affect decisions around natural resource management and the foods available for purchase in the communities. Self-determination for First Nations and respect for Indigenous and Treaty rights may lead to greater control of food systems in a way that positively affects food security and the environmental health of First Nations. These findings highlight the need to continue to build upon current efforts at the community, regional, provincial and national levels to improve food security and nutrition in First Nations communities through a social determinants of health approach.

Contaminant concentrations found in traditional foods were generally within the expected range previously found in similar regions in Canada. However, elevated levels of lead were found in the meat of a wide range of animal species including grouse, deer, bison, muskrat and squirrel. This finding of lead contamination is likely due to residuals from lead-containing ammunition suggesting a more effective program on phasing out lead ammunition is needed. Based on current consumption patterns, while the average consumers had a low risk of contaminant exposure, between one and five percent of adults eating traditional food did exceed, from traditional food alone, the tolerable daily intake for metals of human health concern. Therefore, closer monitoring of intake levels and more detailed characterization of risk among the high consumers of traditional foods is needed. The results suggest that mercury exposure is currently not a significant health issue in the First Nations population south of 60th parallel across Canada. However, WCBA and older individuals (51 years and over) living in the northern ecozones do tend to have higher mercury exposure that exceeds the Health Canada's guidelines. Therefore, more detailed dietary guidelines may be needed.

Lessons Learned, Best Practices and Next Steps

Community Engagement: Start Early, Stay Committed

Community-based participatory research requires a large investment in social capital — from the first through to the final day — throughout and beyond the scope of the research mandate. The benefits of this include the possibility of more relevant research questions, increased data use and dissemination, and the potential to establish sustainable partnerships for project expansion or future research, all of which can lead to both better policy and health outcomes.

With FNFNES, we learned to engage early and often with Indigenous representatives from community, regional, and national organizations to review and build consensus on proposal ideas, indicators to be measured, and methods to be used. The establishment of a permanent steering committee to review methods and approaches with communities was essential. Key to success for all partners was maintaining collaboration to maximize the coupling of the unique and intimate knowledge of community members with the academic expertise of researchers.

Ongoing evaluation is fundamental to all meaningful research. We strived to regularly monitor how we were approaching communities and regularly assess how well OCAP principles were being followed in each project component. The need to be flexible was essential and challenging. We worked to strike a balance between strictly adhering to study protocols — important for comparing data between regions and years — while adapting to meet the distinct needs of each community. Executive decisions were made at the principal investigator level while the field team needed to function smoothly to practically enact these decisions. Maintaining a seamless flow was not always easy and the focus on personnel management was an ongoing challenge for a study this size and duration.

Steps to Successful Participation and Data Collection

In each region we followed a methodical and cyclical approach. Clear communication of study timelines, methods, and anticipated outcomes were linked to successful, trustworthy partnerships. Six months prior to beginning data collection, leadership from randomly selected communities were invited to a methodology workshop where they had the chance to review protocols and procedures and indicate where changes would be needed. Representatives were asked to return to their communities to share FNFNES methods and outcomes. Communities were encouraged to be visited by a principal investigator for a presentation to leadership shortly after the methodology workshop to facilitate full transparency and address any remaining questions or concerns. Timely follow-up was critical to the development of the research team/community relationship. When this strategy was adhered to, it led to the signing of a mutually suitable research agreement, and community pre-engagement could begin within a couple of months prior to the start of data collection. Some First Nations were well equipped to support the process, having structures and policies in place such as research advisory boards, ethics committees, or band council members with research portfolios. Fulfilling community research criteria ultimately facilitated a smoother flow at the time of data collection.

However, we learned that, even with a couple of months, this timeline was not long enough, placing heavy demands on project staff and a respective community. Though we attempted to open a larger window in the planning and preparatory stages, we were unable to reconcile the fact that not enough resources were apportioned at the onset. Fundamental to CBPR methodology, enough human resources, energy and time must be invested in the early stages of research seeking First Nations' input to enhance the collaborative partnership. The potential benefit of a greater front-end investment of time and resources would likely more than pay itself off in terms of robust research outcomes and results.

CREE NATION OF MISTISSINI, PHOTO BY MAUDE BRADETTE-LAPLANTE

In communities where communication and relationship building were strong, particularly concerning the benefits of the study to each community, then leadership was incredibly supportive, and a community champion would emerge. Locating someone to champion a project is fundamental to successful data collection and, ultimately unique and, meaningful results.

Beyond the benefits of good data and meaningful results, was the commitment by FNFNES to training and capacity building for community members. On average, seven community members were trained in each First Nation to conduct household interviews, collect traditional food samples, and to collect and analyze drinking water samples. The skills acquired were valuable research methods and techniques putting these individuals on track for future research work. It enabled research assistants to demonstrate their capacity to maintain high research standards and keep information confidential, as well as being generally responsible and reliable.

We discovered that the support provided to a community during data collection was fundamental to a positive outcome. Nutrition research coordinators (NRCs) trained local community research assistants (CRAs), maintained a communication bridge between principal investigators and the community, and assured quality data was collected. The regular presence of an NRC allowed for a co-learning experience and the opportunity to build on each community's strengths and resources. This was especially true if the NRC committed to staying in the community for longer periods of time rather than only for a day or two at a time. The NRC could then gain a better appreciation of a community's unique context, become familiar with local protocols, and get to know members of the First Nation in a more personal way thereby increasing the likelihood of a trusting and positive working relationship, particularly with the CRAs.

The completion of household questionnaires was challenging for the research assistant and the participant. We found it effective if CRAs were from a range of age groups and backgrounds. By making it clear to community members how the study would benefit the people and initiate change, this also led to higher rates of community participation. Participants were more likely to agree to be interviewed if they felt they were helping each other and the community. While gifts were also appreciated as an indicator of the time spent completing an interview or providing a food or water sample, the stronger incentive to participate was community improvement. The more time invested in community engagement, collaboration, and partnership, the more positive word-of-mouth created and the easier it was to complete all aspects of the study.

Operation and Organization

Standard Operating Procedures and Safety

A successful collaborative partnership has a clear set of standard operating procedures. The FNFNES team developed an SOP that included culturally appropriate protocols and a well-defined series of guiding principles. This enabled us to have well understood expectations for each party, including different levels of management, coordination of different institutions, and chain of command. A collaborative research team must have clear-cut accountability, structure and management.

Institutional harmonization is vitally important; the FNFNES team was made up of individuals from two universities, Health Canada/Indigenous Services Canada, the Assembly of First Nations and each participating First Nation. The AFN was an essential collaborative partner, and their support and resources were a key bridge.

We developed and adapted fieldwork protocols that considered open communication between partners and safety for all members of the research team. This included study awareness campaigns, training protocols and resources, introducing the members of the research team who will be in community, a clear understanding of how long and how often the research team is expected to be in community, guidelines for working in remote communities, check-in procedures, and how information is shared between team and community partners. While these procedures were developed over time, we felt that there was still room for improvement, including making sure all people working within the project receive adequate cultural and safety training.

Project and Personnel Management

Important factors to consider are the establishment of a management committee (staff) and a principal investigators' committee to oversee operations. Our large research team was dispersed across the country, making mid-level management—which included a national coordinator—to oversee field and data analyses, essential to the study. It was crucial to work with local coordinators; to have a field coordinator and/or regional coordinator, who understood the regional and local context, and was aware of community protocols. A principal lab coordinator would have been an effective research team member to better maintain consistent methodology concerning field samples, however a lack of resources did not allow for this.

Essential to success is to pilot and proof all components before engaging in fieldwork, ensuring that there are appropriate procedures, data collection tools, research equipment, and to facilitate the outlining of specific roles/responsibilities to individuals to complete quality checks throughout fieldwork. Central to evaluation and quality control is the completion of an initial risk assessment and mitigation strategies during the consultation phase with regional partners to minimize adverse outcomes. For FNFNES, this was not formally a part of the study at the outset, as setbacks were encountered, strategies were developed to minimize risk. Although some risks cannot be anticipated and others are beyond anyone's control, it is important to identify strategies in advance to ensure that methodology is flexible according to regional and community contexts. Again, the more time that is taken at the front end of a project, the more smoothly the rest of the research will flow.

Teamwork was key to successful outcomes. Regular communication between community contacts and FNFNES team members began prior to the methodology workshop and continued throughout the duration of the study. However, working together to complete objectives was sometimes challenging. There were so many communities involved in the study and staff and contractors had to take on multiple roles in order to cover all the necessary tasks. At times the research team was overstretched; it may have been more efficient and effective to have more support and more resources at the onset, yet it was difficult to anticipate this at the beginning of FNFNES and we were unsure about what to expect being the first study of this scale. Studies with scopes as large as FNFNES require close attention to budgetary details, ensuring adequate resources for the beginning stages, where feasible. Another approach, if resources are not sufficient, is to reduce the scope of the study at the outset. Despite good intentions to learn as much as possible, priorities may need to be reconsidered given funding constraints.

Data Management and Dissemination of Results

Data management is a huge responsibility and institutional harmonization plays an important role in any successful research project of this scale. It is critical to ensure all data are shared among principal investigators from different institutions. In FNFNES, while various institutions were responsible for distinct aspects of the study, complete copies of all raw and analyzed data were backed up and archived in more than one location to assist further research as needed.

The investment in social capital and community engagement was effective for the partnership as the study moved from data collection and analysis to reporting results and sharing each community's specific data. It was easier to arrange meetings for returning results and to have better, more engaged attendance when effective collaboration, leadership support and a community champion were in place from the beginning.

Following OCAP principles, FNFNES had three objectives when returning results to communities: seek feedback on the draft report, empower the community to take ownership of the data, and facilitate sharing results within the community. Midway through the project we were able to fine-tune an effective feedback questionnaire that elicited the most constructive information.

The reporting back meetings ranged from meetings with leadership and health department staff to broad community events. While most of these meetings were successful, the team was not involved in community wide dissemination of the results beyond the preparation of a plain language infographic summary left with the key contacts. Upon request, the FNFNES team provided additional resources. In hindsight, more attention should have been spent on developing a communication strategy with communities for the various stages of the project.

Final reports and raw data were provided to each First Nation via a community representative at a Data Training Workshop (DTW). Data training workshops created an environment for representatives to work together, brainstorm, share success stories and experiences. This was a worthwhile lesson learned and, as the years went by more and more time was devoted to sharing circles. The DTW did allow for one to two individuals to work directly with their data, but we were limited to the expectation that the representatives would cast a wider net and share key findings after the workshop. It may have been useful to outline a clearer protocol at the DTW as to what specifically could be the trajectory for raw data and final community reports upon leaving the workshop. Follow-up emails and calls immediately after the workshop could help a team better understand where the information was channelled and what steps may be taken to ensure the appropriate community members have access to the results. Over the years, FNFNES has received requests to re-send the datasets or final reports, highlighting the need to ensure that an appropriate third party First Nations data custodian is identified to manage and redistribute the data upon written request by the community. The AFN served this purpose for FNFNES.

Given the importance of OCAP principles and sustainability of salient results regarding policy or program changes, perhaps two community meetings are warranted, post-data collection; the first visit focusing on a formal reporting back meeting with leadership and the second being a structured solicitation of feedback. Bringing community representatives together for the DTW worked well but a final visit to each participating community would facilitate better communication of results. This final community visit would be oriented to distributing the results to as many community members as possible via a strategy decided with leadership.

We witnessed the First Nation's socio-political landscape shift in the 10 years of the study's mandate. This decade of change saw many First Nations begin to better exercise their autonomy and jurisdiction over

TANJA HEAD, SHOAL LAKE, PHOTO BY CAROL ARMSTRONG-MONOHAN

research about, by and for, their communities and territories. The greatest lesson learned was how vital it was to ensure an early investment in resources, time and energy for community collaboration. A concerted focus at the project proposal stage geared towards a realistic allocation of funds will contribute significantly to more effective, valuable, and meaningful outcomes for all project partners.

Next Steps

A critical next step is the contextualization of these results. As many of the analyses conducted for this study from the household survey component were mainly descriptive and measured at the individual level, our understanding remains limited about the magnitude of impact from factors beyond the control of individuals including policies, governance and jurisdiction, location, access to appropriate education, housing, culturally safe health services, as well as social networks on adults' food and lifestyle. At the individual level, access to resources (money, equipment), knowledge, and an impacted environment have a strong influence on behaviours (see predictors of TF intake). Further discussions with representatives from communities and other Indigenous organizations at the upcoming Fall workshop will assist in contextualizing these results.

The food insecurity rates observed in this study were extremely high. FNFNES recorded food prices in outlets, however prices are but one dimension of food access, and the importance of traditional food is not limited to nutrition, but has a myriad of other social, cultural and ceremonial implications. There is an imperative need to investigate a wide array of factors influencing food security and food sovereignty. Future efforts need to be made at supplementing individual data with community and systems level data, including the market and traditional food environment (e.g., market food availability, access, pricing, marketing, the ability of the community to influence food grown and sold within the community, traditional food access, distribution channels, activities, etc).

It has been established that traditional food improves the diet greatly, however many ecosystems are under significant threat from current human activities, as well as climate change. Self-determination, food sovereignty and a general sense of wellness have all been profoundly impacted by colonization, which includes severe strictures that were historically placed on the exercise of jurisdiction over lands and resources. Greater autonomy and self-determination, along with co-management and shared decision-making, have been identified as key to long-term conservation and stewardship of ecosystems.

A greater understanding is required of the feasibility of increasing traditional food in the diet, including the costs, benefits and necessary levers (cultural, resource management, regulations, stakeholders, governments, etc). Nutrient intake optimization by diet modelling could be considered as one of the tools to generate different food use patterns for the communities to explore the feasibility of replacing certain species of traditional foods that are less available with the more readily available alternatives. For example, abundant local food species could be promoted to replace others that are harder to access because of ecological changes or low mercury fish can be promoted in areas where there's a concern about mercury exceedances. Diet optimization could also apply to market food whereby the usual diet forms the basis for dietary recommendations that do not veer too far away from what people are used to consume or have access to.

This study provides a snapshot of the levels of metals typically found in tap waters of houses in First Nation communities. Overall, the quality of drinking water regarding the trace metal levels is satisfactory. However, some First Nation communities need to continue flushing their water before use to reduce the lead levels. It is recommended to replace lead pipes in households with elevated lead levels in drinking water. An alternative approach to minimize exposure to lead could be the implementation of drinking water treatment devices. Other issues related to quality of drinking water identified are usually associated with the aesthetic or taste of the waters. Regular maintenance and improvement of the water treatment and/or delivery system needs to be implemented to improve the quality of the drinking water supply. Ongoing regular inspection programs should be implemented with the support of the regional environmental health professionals.

The identification of the principal traditional foods that contribute to the contaminant intakes by ecozones allows risk assessors to focus future efforts on collecting data for risk assessment purposes. The contaminant database can also be used for preliminary risk assessment to screen for chemicals of potential health concerns if the site-specific data are not available. The information collected by this study also forms the bases and framework for a future regular traditional food monitoring program where key traditional food will be collected and analyzed for contaminants to ensure the safety of the traditional food diet.

This study has identified hot spots of pharmaceutical in surface waters. Surface waters in the vicinity of First Nation communities are generally safe as drinking water sources. However, in some communities there were a variety of pharmaceuticals in surface water detected. Therefore, untreated surface water should not be used as an alternative water source. Future monitoring of both drinking and surface water is recommended as water sources and the level of water treatment vary by community. This should be followed up by more comprehensive environmental studies that will examine the ecological effects of pharmaceuticals in the aquatic ecosystem.

The first regionally-based population level biomonitoring of mercury among First Nations in the last 20 years demonstrated a notable decrease in mercury exposure among First Nations. Current mercury exposure of First Nations people is not a major public health risk. Nevertheless, results show that First Nations women of childbearing age living in northern ecozones in Saskatchewan, Manitoba, Ontario and particularly Quebec would benefit from sustained public health risk-benefit communication efforts aimed to promote the importance of continued reliance on fish as a food source, while decreasing exposure to environmental mercury. Further research is required to improve the quality of existing data on mercury exposure among First Nations men.

Key Findings and Study Recommendations

1. This study offers for the first time a body of coherent evidence on the human dimension of the ongoing environmental degradation affecting First Nation citizens and communities.
2. Traditional food systems remain foundational to First Nations.
3. Traditional food has multiple core values for First Nations. These include cultural, spiritual, and traditional values, along with enhanced nutrition and health, food security, ways of knowing, and an ongoing connection to land and water.
4. Traditional food access does not meet current needs. Over half of all adults reported that harvesting traditional food is impacted by industry-related activities, as well as climate change.
5. Traditional food is generally preferred to store-bought food, is of superior nutritional quality, and its inclusion significantly improves diet quality.
6. While there are two primary exceptions, traditional food is safe for consumption. Exceptions include:
    a. Large predatory fish (such as walleye and northern pike) in some areas have higher levels of mercury, and some women of childbearing age have elevated levels of mercury exposure, particularly in the northern parts of Saskatchewan, Manitoba, Ontario and Quebec.
    b. The use of lead-based ammunition resulted in very high levels of lead in many harvested mammal and bird samples. As a result, there is an elevated risk of exposure to lead for some adults and women of childbearing age. The use of other forms of ammunition can eliminate this exposure to lead.
7. Many First Nations face the challenge of extremely high rates of food insecurity. Overall, almost half of all First Nation families have difficulty putting enough food on the table. Families with children are affected to an even greater degree.
8. The price of healthy foods in many First Nation communities is much higher than in urban centres, and is therefore beyond the reach of many families.
9. The current diet of many First Nation adults is nutritionally inadequate, which is strongly tied to food insecurity and limited access to healthy food options.
10. The health of many First Nation adults is compromised with very high rates of smoking, obesity (double the obesity rate among Canadians), and with one-fifth of the adult population suffering from diabetes (more than double the national average).
11. There continue to be issues with water treatment systems in many communities, particularly exceedances for metals that affect colour and taste, which limit the acceptability and use of tap water for drinking.
12. Pharmaceutical residues were found in surface waters in and around many communities, indicating potential sewage contamination.

The authors of this study urge governments and decision-makers to urgently address systemic problems relating to food, nutrition and the environment affecting First Nations, and to do so in a manner that supports First Nations-led leadership and solutions.

Beyond addressing individual and household barriers to accessing high quality foods from both the market and traditional food systems, it is imperative to reduce threats to the health of ecosystems and the quality and availability of traditional food. Over half of all adults reported that harvesting was impacted by industry-related activities, and climate change. First Nations reported that they have a limited ability to affect decisions relating to natural resource management and the foods available for purchase within a community.

These findings highlight the need to continue to build upon current efforts at the community, regional, provincial and national levels to improve food security and nutrition in First Nations through a social determinants of health approach.

Indigenous priorities and values need to be recognized and included within relevant frameworks that affect decisions around land use, conservation, habitat protection and access to high quality and sufficient traditional food.

New mechanisms need to be co-developed with First Nations to address weaknesses in current policy and program approaches in order to:

Close gaps in nutrition and food insecurity

- Improve access to the traditional food system through a combination of subsidies that support harvesting, growing, sharing, and preservation.
- Improve local availability and access to healthier foods independent of imports (gardens, greenhouses, hydroponic units, agricultural activity and animal husbandry when appropriate).
- Reduce food price differences between major urban centres and First Nations by increasing community eligibility for subsidy programs (such as Nutrition North) and providing financial support to increase First Nation operated and owned food production and distribution businesses/organizations.
- Improve families' financial ability to purchase healthy market food options and engage in local harvesting and food production activities.
- Continue monitoring nutrition and food insecurity, and create appropriate mechanisms to establish accountabilities in progress and reporting.
- Monitor the effectiveness of food access programs for First Nations in curbing food insecurity.

Support sustainable and healthy lifestyles

- The high levels of smoking, obesity and diabetes reflect inequities in access to health-oriented food and built environments (e.g., walkability, recreational opportunities), and sufficient community prevention and health service delivery options.
- Additional investments are needed for communities to provide a healthier environment and culturally appropriate and safe primary prevention, and acute and chronic disease management.
- Develop region and ecozone specific advisories and guidance for fish consumption that would promote the importance of fish in diets, but would also inform sensitive populations such as women of childbearing age (WCBA), about decreasing exposure to mercury.
- First Nations WCBA living in northern ecozones in Saskatchewan, Manitoba, Ontario and particularly Quebec would benefit from sustained public health risk-benefit communication efforts aiming to promote the importance of continued reliance on fish as a food source, while decreasing exposure to environmental mercury.

Support communities to increase their reliance on traditional food systems

- Recognize and include Indigenous values and priorities in all federal, provincial and local government decisions with respect to land use, development, conservation, habitat protection, with an intention to maintain or enhance access to and availability of high quality traditional food.
- Recognize First Nations priority rights to harvest in preferred areas to meet their food needs, and minimize and compensate any potential infringements on these priority rights to harvest.
- Support is needed by all levels of government to monitor, protect and ensure that local ecosystems are healthy and can support First Nations ability to access sufficient traditional food.

STANLEY MISSION HISTORIC SITE, PHOTO BY REBECCA HARE

- Develop a long-term nation-wide traditional food contaminant monitoring program.
- Develop a pan-Canadian programming for the safe and affordable replacement of lead-containing ammunition and fishing weights
- Develop region and ecozone specific advisories and guidance for fish consumption that would promote the importance of fish in diets, but would also inform sensitive populations such as women of childbearing age (WCBA), about decreasing exposure to mercury. First Nations WCBA living in northern ecozones in Saskatchewan, Manitoba, Ontario and particularly Quebec would benefit from sustained public health risk-benefit communication efforts aiming to promote the importance of continued reliance on fish as a food source, while decreasing exposure to environmental mercury.

Ensure good drinking water quality and trust in safety of public water systems

- In order to promote the use of tap water over sugar-sweetened beverages, concerns about the taste and/or appearance of drinking water need to be addressed. Regular maintenance and inspection programs of water treatment and/or delivery systems need to be adequately resourced to improve the quality of the drinking water supply.
- Lead pipes need to be replaced in communities with elevated lead levels in drinking water.

Ensure that pharmaceuticals are not present in levels potentially harmful to humans or animals

- Develop pan-Canadian guidelines and a monitoring program for the protection of aquatic, land and human health to avoid unnecessary exposure to pharmaceuticals and other contaminants.
- Develop detailed planning for appropriate sewage waste treatment and disposal.
- Further support is needed to ensure the return or proper disposal of unused or expired prescription drugs and medications as an alternative to flushing them down the toilet or throwing them into the regular garbage.

In the fall of 2019, a workshop with representatives from participating communities will meet to discuss the results and provide feedback on study recommendations.

References

Adelson, N. 2005. "The embodiment of inequity: health disparities in Aboriginal Canada." *Canadian Journal of Public Health* 96 (Suppl 2): S45-61.

Aga, D.S. 2008. *Fate of Pharmaceuticals in the Environment and Water Treatment Systems.* Boca Raton: CRC Press.

Agunbiade, F.O., and B. Moodley. 2014. "Pharmaceuticals as emerging contaminants in Umgeni River system, KwaZulu-Natal, South Africa." *Environmental Monitoring Assessment* 186: 7273-7291.

Anderson, P., N. Denslow, J.E. Drewes, A. Olivieri, Schlenk, D., and Snyder, S. 2010. *Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water. Recommendations of a Science Advisory Panel.* Final Report, Sacramento: State Water Resources Control Board. http://www.waterboards.ca.gov/water_ issues/programs/water_recycling_policy/docs/cec_monitoring_rpt.pdf.

Archer, E., B. Petrie, B Kasprzyk-Hordern, and G.M. Wolfaardt. 2017. "The fate of pharmaceuticals and personal care products (PPCPs), endocrine disrupting contaminants (EDCs), metabolites and illicit drugs in a WWTW and environmental waters." *Chemosphere* 174: 437-446.

Ashfaq, M., K.N. Kha, M.S.U. Rehman, G. Mustafa, M.F. Nazar, Q. Sun, J. Iqbal, S.I. Mulla, and C-P. Yu. 2017. "Ecological risk assessment of pharmaceuticals in the receiving environment of pharmaceutical wastewater in Pakistan." *Ecotoxicology and Environmental Safety* 136: 31-39.

Assembly of First Nations. 2013. First Nations Biomonitoring Initiative. National Results (2011). Final Report. June.

Aus der Beek, T., T. Weber, A. Bergmann, S. Hickmann, I. Ebert, A. Hein, and A. Küster. 2016. "Pharmaceuticals in the environment-Global occurences and perspectives." *Environmental Toxicology and Chemistry* 35 (4): 823-35.

Ayach, B.B., and H. Korda. 2010. "Commentary: Type 2 diabetes epidemic in First Nations peoples in Canada." *Ethnicity and Disease* 20 (3): 300-303.

Babic, S., D. Mutavdzic, D. Asperger, A. Horvat, and M. Kastelan-Macan. 2007. "Determination of Veterinary Pharmaceuticals in production of wastewater by HPTLC-videodensitometry." *Chromatographia* 65: 105-110.

Bai, X., A. Lutz, R. Carroll, K. Keteles, K. Dahlin, M. Murphy, and D. Nguyen. 2018. "Occurrence, distribution, and seasonality of emerging contaminants in urban watersheds." *Chemosphere* 200: 133-142.

Bartelt-Hunt, S., D.D. Snow, T. Damon, J. Shockley, and K. Hoagland. 2009. "The occurrence of illicit and therapeutic pharmaceuticals in wastewater effluent and surface waters in Nebraska." *Environmental Pollution* 157: 786-91.

Bartelt-Hunt, S., D.D. Snow, T. Damon-Powell, and D. Miesbach. 2011. "Occurrence of steroid hormones and antibiotics in shallow groundwater impacted by livestock waste control facilities." *Journal of Contaminant Hydrology* 123: 94-103.

Batal, M., L. Johnson-Down, J-C. Moubarac, A. Ing, K. Fediuk, T. Sadik, C. Tikhonov, L. Chan, and N. Willows. 2017. "Quantifying associations of the dietary share of ultra-processed foods with overall diet quality in First Nations peoples in the Canadian provinces of British Columbia, Alberta, Manitoba and Ontario." *Public Health Nutrition* 21 (1): 103-113. doi: https://doi.org/10.1017/S1368980017001677.

Batt, A.L., T.M. Kincaid, M.S. Koshtich, J.M. Lazorchak, and A.R. Olsen. 2016. "Evaluating the extent of pharmaceuticals in surface waters of the United States using a National-scale Rivers and Streams Assessment survey." *Environmental Toxicology and Chemistry* 35 (4): 874-94.

Bayen, S., H. Zhang, M.M. Desai, S.K. Ooi, and B.C. Kelly. 2013. "Occurrence and distribution of pharmaceutically active and endocrine disrupting compounds in Singapore's marine environment: influence of hydrodynamics and physical-chemical properties." *Environmental Pollution* 182: 1-8.

Benotti, M., and B. Brownawell. 2007. "Distributions of pharmaceuticals in an urban estuary during both dry- and wet-weather conditions." *Environmental Science and Technology* 41: 5795-5802.

Benotti, M., B. Stanford, and S. Snyder. 2010. "Impact of drought on wastewater contaminants in an urban water supply." *Journal of Environmental Quality* 39: 1196-1200.

Bergh, K. 2000. "Ecological risk assessment of pharmaceuticals and personal care products in surface water." Master's Thesis, Simon Fraser University, Burnaby.

Biel-Maeso, M., C. Corada-Fernandez, and P.A. Lara-Martín. 2018. "Monitoring the occurrence of pharmaceuticals in soils irrigated with reclaimed wastewater." *Environmental Pollution* 235: 312-330.

Bjørklund, G., M. Dadar, J. Mutter, and J. Aaseth. 2017. "The Toxicology of Mercury: Current Research and Emerging Trends." *Environmental Research* 159: 545-54.

Blair, B. D., J. P. Crago, and C. J. Hedman. 2013. "Pharmaceuticals and personal care products found in the Great Lakes above the concentration of environmental concern." *Chemosphere* 93: 2016-2123.

Booker, D., and M. Gardner. 2016. "Atlantic First Nations pharmaceutical use. List of pharmaceuticals from the Non-Insured Health Benefits Directorate (NIHB). First Nations and Inuit Health Branch, Health Canada." *Personal communication.*

—. 2015. "Saskatchewan First Nations pharmaceutical use. List of pharmaceuticals from the Non-Insured Health Benefits Directorate (NIHB). First Nations and Inuit Health Branch, Health Canada." *Personal communication.*

—. 2014. "Alberta First Nations pharmaceutical use. List of pharmaceuticals from the Non-Insured Health Benefits Directorate (NIHB). First Nations and Inuit Health Branch, Health Canada." *Personal Communication*.

—. 2013. "Ontario First Nations pharmaceutical use. List of pharmaceuticals from the Non-Insured Health Benefits Directorate (NIHB). First Nations and Inuit Health Branch, Health Canada. " *Personal Communication.*

Booker, D., and E. Michaud. 2008. List of pharmaceuticals from the Non-Insured Health Benefits Directorate (NIHB). First Nations and Inuit Health Branch, Health Canada." *Personal Communication*.

Booker, D., and J. Menzies. 2017. "First Nations in Quebec pharmaceutical use. List of pharmaceuticals from the Non-Insured Health Benefits Directorate (NIHB). First Nations and Inuit Health Branch, Health Canada." *Personal communication.*

Boxall, A.B.A., L.A. Fogg, D.J. Baird, C. Lewis, T.C. Telfer, D. Kolpin, and A. Gravell. 2005. "Targeted monitoring study for veterinary medicines in the UK environment. Final Report to the UK Environmental Agency." London. http://cdn.environment-agency.gov.uk/scho0806blhh-e-e.pdf.

Bradley, P.M., L.B. Barber, J.W. Duris, W.T. Foreman, E.T. Furlong, L.E. Hubbard, K.J. Hutchinson, S.H. Keefe, and D.W. Kolpin. 2014. "Riverbank filtration potential of pharmaceuticals in a wastewater-impacted stream." *Environmental Pollution* 193: 173-180.

Bruce, G.M., R.C. Pleus, and S.A. Snyder. 2010. "Toxicological relevance of pharmaceuticals in drinking water." *Environmental Science and Technology* 44 (14): 5619-5626.

Brun, G.L., M. Bernier, R. Losier, K. Doe, P. Jackman, and H.B. Lee. 2006. "Pharmaceutically Active Compounds in Atlantic Canadian Sewage Treatment Plant Effluents and Receiving Waters, and Potential for Environmental Effects as Measured by Acute and Chronic Aquatic Toxicity." *Environmental Toxicology and Chemistry* 25 (8): 2163-2176.

Bu, Q., B. Wang, J. Huang, S. Deng, and G. Yu. 2013. "Pharmaceuticals and personal care products in the aquatic environment in China: A review." *Journal of Hazardous Materials* 262: 189-211.

Campagnolo, E.R., K.R. Johnson, A. Karpati, C.S. Rubin, D.W. Koplin, M.T. Meyer, E. Esteban et al. 2002. "Antimicrobial resideues in animal waste and water resources proximal to large-scale swine and poultry feeding operations." *Science of the Total Environment* 299: 89-95.

Canada. Crown-Indigenous Relations and Northern Affairs (CIRNAC). 2018. *Canadian Arctic Contaminants Assessment Report: Human Health Assessment 2017.* Edited by M.S. Curren. Gatineau, Quebec: Government of Canada. http://publications.gc.ca/pub?id=9.834692&sl=0.

Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada. 2010. *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans.* http://www.pre.ethics.gc.ca/pdf/eng/tcps2/TCPS_2_FINAL_Web.pdf.

Cantwell, M.G., D.R. Katz, J.C. Sullivan, D. Shapley, J. Lipscomb, J. Epstein, A.R. Juhl, C. Knudson, and G.D. O'Mullan. 2018. "Spatial patterns of pharmaceuticals and wastewater tracers in the Hudson River Estuary." *Water Research* 137: 335-343.

Chan, H.M., K. Fediuk, S. Hamilton, L. Rostas, A. Caughey, H, Kuhnlein, G. Egeland, and E. Loring. 2006. "Food security in Nunavut, canada: Barriers and recommendations." *International Journal of Circumpolar Health* 65 (5): 416-31. doi: https://doi.org/10.3402/ijch.v65i5.18132.

Chan, L., O. Receveur, D. Sharp, H. Schwartz, A. Ing, and C. Tikhonov. 2011. *First Nations Food, Nutrition and Environment Study (FNFNES): Results from British Columbia (2008/2009).* Prince George: University of Northern British Columbia. www.fnfnes.ca.

Chan, L., O. Receveur, D. Sharp, H. Schwartz, A. Ing, K. Fediuk, A. Black, and C. Tikhonov. 2012. *First Nations Food, Nutrition and Environment Study (FNFNES): Results from Manitoba 2010.* Prince George: University of Northern British Columbia. www.fnfnes.ca.

Chan, L., O. Receveur, M. Batal, T. Sadik, H. Schwartz, A. Ing, K. Fediuk, and C. Tikhonov. 2018. *First Nations Food, Nutrition and Environment Study (FNFNES): Results from Saskatchewan 2015.* Ottawa: University of Ottawa.

Chan, L., O. Receveur, M. Batal, T. Sadik, H. Schwartz, A. Ing, K. Fediuk, C. Tikhonov, and K. Lindhorst. 2019. *First Nations Food, Nutrition and Environment Study (FNFNES): Results from Quebec 2016.* Ottawa: University of Ottawa.

Chan, L., O. Receveur, M. Batal, W. David, H. Schwartz, A. Ing, K. Fediuk, A. Black, and C. Tikhonov. 2014. *First Nations Food, Nutrition and Environment Study (FNFNES): Results from Ontario 2011/2012.* Ottawa: University of Ottawa. www.fnfnes.ca.

Chan, L., O. Receveur, M. Batal, W. David, H. Schwartz, A. Ing, K. Fediuk, and C. Tikhonov. 2016. *First Nations Food, Nutrition and Environment Study (FNFNES): Results from Alberta 2013.* Ottawa: University of Ottawa. www.fnfnes.ca.

Chan, L., O. Receveur, M. Batal, W. David, H. Schwartz, A. Ing, K. Fediuk, and C. Tikhonov. 2017. *First Nations Food, Nutrition and Environment Study (FNFNES): Results from the Atlantic Region 2014.* Ottawa: University of Ottawa.

Chan, M., and D. Dahm. 2000. *Band Classification Manual.* Monograph, Indian and Northern Affairs, Ottawa: Indian and Northern Affairs. Accessed January 8, 2019. http://publications.gc.ca/collections/Collection/R22-1-2000E.pdf.

Chen, M., V.I. Cooper, J. Deng, P.L. Amatya, D. Ambrus, S. Dong, N. Stalker, C. Nadeau-Bonilla, and J. Patel. 2015. "Occurrence of Pharmaceuticals in Calgary's Wastewater and Related Surface Water." *Water Environment research* 87 (5): 414-424.

Chiu, C., and P.K. Westerhoff. 2010. "Trace organics in Arizona surface and waste waters." Chap. 4 in *Contaminants of Emerging Concern in the Environment: Ecological and Human Health Considerations. American Chemical Society Symposium Series*, edited by R. U. Halden, 81-117. Washington, D.C.: American Chemical Society.

Choi, K., Y. Kim, J. Park, C.K. Park, M.Y. Kim, H.S. Kim, and P. Kim. 2008. "Seasonal variations of several pharmaceutical residues in surface water and sewage treatment plants of Han River, Korea." *Science of the Total Environment* 405 (1-3): 120-28.

Clara, M., N. Kreuzinger, B. Strenn, O. Gans, and H. Kroiss. 2005. "The solids retention time- a suitable design parameter to evaluate the capacity of wastewater treatment plants to remove micropollutants." *Water Research* 39: 97-106.

Conley, J.M., S.J. Symes, M.S. Schorr, and S.M. Richards. 2008. "Spatial and temporal analysis of pharmaceutical concentrations in the upper Tennessee River basin." *Chemosphere* 73: 1178-1187.

Conn, K.E., K.S. Lowe, J.E. Drewes, C. Hoppe-Jones, and M.B. Tucholke. 2010. "Occurrence of pharmaceuticals and consumer product chemicals in raw wastewater and septic tank effluent from single-family homes." *Environ. Eng. Sci.* 27 (4): 347-356.

Conn, K.E., L.B. Barber, G.K. Brown, and R.L. Siegrist. 2010. "Occurrence of pharmaceuticals and consumer product chemicals in raw wastewater and septic tank effluent from single family homes." *Environmental Engineering Science* 27 (4): 347-356.

Curren, M.S., K. Davis, C.L. Liang, B. Adlard, W.G. Foster, S.G. Donaldson, K. Kandola, J. Brewster, M. Potyrala, and J. Van Oostdam. 2014. "Comparing plasma concentrations of persistent organic pollutants and metals in primiparous women from northern and southern Canada." *Science of the Total Environment* 479-480: 306-318.

D'Alessio, M., S. Onanong, D.D. Snowa, and C. Ray. 2018. "Occurrence and removal of pharmaceutical compounds and steroids at four wastewater treatment plants in Hawai'i and their environmental fate." *Science of the Total Environment* 631-632: 1360-1374.

Darwano, H., S.V. Duy, and S. Sauve. 2014. "A new protocol for the analysis of pharmaceuticals, pesticides, and hormones in sediments and suspended particulate matter from rivers and municipal wastewaters." *Archives of Environmental Contamination & Toxicology* 66 (4): 582-93.

de Jesus Gaffney, V., W. Cardoso, E. Cardoso, A.P. Teixeira, J. Martins, M.J. Benoliel, and C.M.M. Almeida. 2017. "Occurrence and behaviour of pharmaceutical compounds in a Portuguese wastewater treatment plant: Removal efficiency through conventional treatment processes." *Environmental Science Pollution Research* 24 (17): 1-18.

de Solla, S.R., È.A. Gilroy, J.S. Klinck, L.E. King, R. McInnis, J. Struger, S.M. Backus, and P.L. Gillis. 2016. "Bioaccumulation of pharmaceuticals and personal care products in the unionid mussel Lasmigona costata in a river receiving wastewater effluent." *Chemosphere* 146: 486-96.

Deo, R.P. 2014. “Pharmaceuticals in the surface water of the USA: A review.” *Current Environmental Health Reports* 1 (2): 113-22. doi: https://doi.org/10.1007/s40572-014-0015-y.

Deur, D.E., and N.J. Turner. 2005. *Keeping it living. Traditions of plant use and cultivation on the northwest coast of North America.* Vancouver: UBC Press.

Dewailly, E., P. Ayotte, S. Bruneau, G. Lebel, P. Levallois, and J.P. Weber. 2001. “Exposure of the Inuit population of Nunavik (Arctic Quebec) to lead and mercury.” *Archives of Environmental Health* 56 (4): 350-357.

Donaldson, S.G., J. Van Oostdam, C. Tikhonov, M. Feeley, B. Armstrong, P. Ayotte, O. Boucher et al. 2010. “Environmental contaminants and human health in the Canadian Arctic.” *The Science of the Total Environment* 408 (22): 5165-234. http://www.ncbi.nlm.nih.gov/pubmed/20728918.

Driscoll, C.T., R.P. Mason, H.M. Chan, D.J. Jacob, and N. Pirrone. 2013. “Mercury as a global pollutant: sources, pathways, and effects.” *Environmental Science and Technology* 47 (10): 4967-83. doi: 10.1021/es305071v.

Durhan, E., C. Lambright, E. Makynen, J. Lazorchak, P. Hartig, V. Wilson, E. Gray, and G. Ankley. 2006. “Identification of metabolites of trenbolone acetate in androgenic runoff from a beef feedlot.” *Environmental Health Perspectives* 114: 65-68.

Egeland, G., and G.G. Harrison. 2013. “Health Disparities: Promoting Indigenous Peoples’ health through traditional food systems and self-determination.” In *Indigenous Peoples’ food systems and well-being: interventions and policies*, edited by H. V. Kuhnlein, B. Erasmus, D. Spigelski and B. Burlingame, 9-21. Rome: Food and Agricultural Organization.

Environment Canada. 2012. “Drug cocktail in the St. Lawrence River offers no relief to aquatic organisms.” *Environment Canada. Water Sources. Rivers. St. Lawrence River.* http://www.ec.gc.ca/stl/default.asp?lang=En&n=27b606bd-1.

Environment Protection and Heritage Council. 2008. “Australian guidelines for water recycling: Managing health and environmental risks (Phase 2) – Augmentation of drinking water supplies.”

Environmental Protection and Heritage Council; the National Health and Medical Research Council; National Resource Management Management Ministerial Council. 2008. *Australian Guidelines for Water Recycling: Augmentation of Drinking Water Supplies.* Environmental Protection and Heritage Council, the National Health and Medical Research Council, National Resource Management Management Ministerial Council.

Fang, Y., A. Karnjanapiboonwong, D.A. Chase, J. Wang, A.N. Morse, and T.A. Anderson. 2012. “Occurrence, fate, and persistence of gemfibrozil in water and soil.” *Environmental Toxicololgy and Chemistry* 31: 550-555.

Feeley, M.M., and M.T. Lo. 1998. “Risk Assessment for Mercury in Health Canada – Development of the Provisional Tolerable Daily Intake (pTDI) Value.” Edited by W. Pilgrim, N. Burgess and M.-F. Giguère. *Proceedings of the Conference on Mercury in Eastern Canada and the Northeast States, 21-23 September.* Unpublished.

Fernandez, C., M. Gonzalez-Doncel, J. Pro, G. Carbonell, and J.V. Tarazona. 2010. “Occurrence of pharmaceutically active compounds in surface waters of the Henares-Jarama-Tajo river system (Madrid, Spain) and a potential risk characterization.” *Science of the Total Environment* 408: 543-551.

First Nations Information Governance Centre (FNIGC). 2018a. *National Report of the First Nations Regional Health Survey Phase 3: Volume One.* Ottawa: FNIGC, 200. www.ccl-cca.ca/RHS3report.

First Nations Information Governance Centre (FNIGC). 2018b. *National Report of the First Nations Regional Health Survey. Phase 3: Volume Two.* Ottawa: FNIGC.

Fono, J., E. Kolodziej, and D. Sedlak. 2006. “Attenuation of wastewater-derived contaminants in an effluent- dominated river.” *Journal of Environmental Science and Technology* 40: 7257-62.

Food and Agricultural Organization (FAO). 2012. FAO/INFOODS Density Database Version 2.0. 2012. Prepared by: U. Ruth Charrondiere, David Haytowitz and Barbara Stadlmayr. E-ISBN 978-92-5-107346-9 (PDF). http://www.fao.org/3/ap815e/ap815e.pdf

Forrest, L., K. Lorenz, T. Thompson, J. Keenliside, J. Kendall, and J. Charest. 2011. “A scoping study of livestock anti-microbials in agricultural streams of Alberta.” *Canadian Water Resources Journal* 36 (1): 1-16.

Frey, S.K., E. Topp, I.U.H. Khan, B.R. Ball, M. Edwards, N. Gottschall, M. Sunohara, and D.R. Lapen. 2015. “Quantitative Campylobacter spp., antibiotic resistance genes, and veterinary antibiotics in surface and ground water following manure application: influence of tile draingage control.” *Science of the Total Environment* 532: 138-153.

Frohlich, K. L., N. Ross, and C. Richmond. 2006. “Health disparities in Canada today: some evidence and a theoretical framework.” *Health Policy* 79 (2-3): 132-143.

Gagne, F., C. Blaise, and C. Andre. 2006. "Occurrence of pharmaceutical products in a municipal effluent and toxicity to rainbow trout (Oncorhynchus mykiss) hepatocytes." *Ecotoxicology and Environmental Safety* 64: 329-336.

Garriguet, D. 2009. "Diet quality in Canada." *Health Reports.* Vol. 20. Ottawa. 41-52.

Ghoshdastidar, A.J., S. Fox, and A.Z. Tong. 2015. "The presence of the top prescribed pharmaceuticals in treated sewage effluents and receiving waters in Southwest Nova Scotia, Canada." *Environmental Science and Pollution Research:* 22: 689-700.

Ginebreda, A., I. Munoz, M.L. De Alda, R. Brix, J. Lopez-Doval, and D. Barcelo. 2010. "Environmental risk assessment of pharmaceuticals in rivers: relationships between hazard indexes and aquatic macroinvertebrate diversity indexes in the Llobregat River (NE Spain)." *Environment International* 36: 153-162.

Glassmeyer, S.T., E.T. Furlong, D.W. Kolpin, J.D. Cahill, S.D. Zaugg, S.L. Werner, M.T. Meyer, and D.D. Kryak. 2005. "Transport of chemical and microbial compounds from known wastewater discharges: potential for use as indicators of human fecal contamination." *Environmental Science & Technology* (American Chemical Society) 39 (14): 5157-5169. doi: 10.1021/es048120k.

Godfrey, E., W.W. Woessner, and M.J. Benotti. 2007. "Pharmaceuticals in on-site sewage effluent and groundwater, western Montana." *Groundwater* 45 (3): 263-71.

Gomez, M.J., M. Petrovic, A.R. Fernandez-Alba, and D. Barcelo. 2006. "Determination of pharmaceuticals of various therapeutic classes by solid-phase extraction and liquid chromatography-tandem mass spectrometry analysis in hospital effluent wastewaters." *Journal of Chromatography A* 1114: 224-233.

Gross, B., J. Montgomery-Brown, A. Naumann, and M. Reinhard. 2004. "Occurrence and fate of pharmaceuticals and alkylphenol ethoxylate metabolites in an effluent dominated river and wetland." *Environmental Toxicology and Chemistry* 23 (9): 2074-83.

Guerra, P., M. Kim, A. Shah, M. Alaee, and S.A. Smyth. 2014. "Occurrence and fate of antibiotic, analgesic/anti-inflammatory and antifungal compounds in five wastewater treatment processes." *Science of the Total Environment* 473-474: 235-243.

Gumbi, B.P., B. Moodley, G. Birungi, and P.G. Ndungu. 2017. "Detection and quantification of acidic drug residues in South African surface waters using gas chromatography mass spectrometry." *Chemosphere* 168: 1042-1050.

Ha, E., N. Basu, S. Bose-O'Reilly, J.G. Dórea, E. McSorley, M. Sakamoto, and H.M. Chan. 2016. "Current progress on understanding the impact of mercury on human health." *Environmental Research.* doi: http://dx.doi.org/10.1016/j.envres.2016.06.042.

Hao, C., X. Zhao, S. Tabe, and P. Yang. 2008. "Optimization of a Multi-residual method for the determination of waterborne emerging organic pollutants using solid-phase extraction and liquid chromatography/tandem mass spectrometry and isotope dilution mass spectrometry." *Environmental Science and Technology* 42: 4068-4075.

Health Canada. 2019. "Guidelines for Canadian Drinking Water Quality: Guideline Technical Document — Lead." Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario. Catalogue No H144-13/11-2018E-PDF.

—. 2019. "Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Manganese." Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario. Catalogue No H144-39/2017E-PDF.

—. 2017. "Guidelines for Canadian Drinking Water Quality – Summary Table." *Health Canada. Environmental and Workplace Health.* https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/sum_guide-res_recom-eng.pdf.

—. 2014. *A Statistical Profile on the Health of First Nations in Canada. Vital Statistics for Atlantic and Western Canada 2003-2007.* Ottawa: Health Canada. http://publications.gc.ca/collections/collection_2014/sc-hc/H34-193-3-2014-eng.pdf.

—. 2010. "Federal Contaminated Site Risk Assessment in Canada: Supplemental Guidance on Humans." Ottawa.

—. 2010. "Federal Contaminated Site Risk Assessment in Canada, Part II: Health Canada Toxicological Reference Values (TRVs) and Chemical-Specific Factors, Version 2.0. Cat.: H128-1/11-638E-PDF. ISBN: 978-1-100-17925-4

—. 2009a. "Canadian Total Diet Study." *Health Canada. Food and Nutrition. Food and Nutrition Surveillance.* https://www.canada.ca/en/health-canada/services/food-nutrition/food-nutrition-surveillance/canadian-total-diet-study.html.

—. 2009b. "Do Canadian adults Meet their nutrient requirements through food intake alone?" Ottawa: Health Canada. http://publications.gc.ca/collections/collection_2010/sc-hc/H164-112-3-2009-eng.pdf.

—. 2009c. “National Nutritious Food Basket.” *Health Canada. Food and Nutrition. Food and Nutrition Surveillance.* https://www.canada.ca/en/health-canada/services/food-nutrition/food-nutrition-surveillance/national-nutritious-food-basket.html.

—. 2008. “Mercury and Human Health.” *Health Canada.* Accessed May 16, 2019. https://www.canada.ca/en/health-canada/services/healthy-living/your-health/environment/mercury-human-health.html.

—. 2007a. “Eating Well with Canada’s Food Guide: First Nations, Inuit and Métis.” *Health Canada. Food and Nutrition.* https://www.canada.ca/en/health-canada/services/canada-food-guides.html.

—. 2007b. *Canadian Community Health Survey Cycle 2.2, Nutrition (2004). Income-Related Household Food Security in Canada.* Ottawa: Health Canada. https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/fn-an/alt_formats/hpfb-dgpsa/pdf/surveill/income_food_sec-sec_alim-eng.pdf.

—.1999. *Methylmercury in Canada: Exposure of First Nations and Inuit residents to methylmercury in the Canadian environment. Volume 3.* Ottawa, Canada.

—. 1984. *Methylmercury in Canada: Exposure of Indian and Inuit Residents to Methylmercury in the Canadian Environment, Volume 2.* Ottawa: Department of National Health and Welfare, Medical Services Branch.

—. 1979. *Methylmercury in Canada: Exposure of Indian and Inuit Residents to Methylmercury in the Canadian Environment.* Ottawa: Department of National Health and Welfare, Medical Services Branch.

—. 1975. *Nutrition Canada – The Indian Survey report.* Ottawa: Bureau of Nutritional Sciences. Department of Health and Welfare.

Hectors, T.L.M., C. Vanparys, K. van der Ven, G.A. Martens, P.G. Jorens, L.F. Van Gaal, A. Covaci, W. De Coen, and R. Blust. 2011. “Environmental pollutants and type 2 diabetes: A review of mechanisms that can disrupt beta cell function.” *Diabetologia* 54: 1273-1290.

Hinkle, S.R., Weick, R.J., J.M. Johnson, J.D. Cahill, S.G. Smith, and Rich. BJ. 2005. “Organic wastewater compounds, pharmaceuticals, and coliphage in ground water receiving discharge from onsite wastewater treatment systems near La Pine, Oregon-Occurrence and implications for transport.” U.S. Geological Survey Scientific Investigations Report.

Hoa, P.T.P., S. Managaki, N. Nakada, H. Takada, A. Shimizu, D.H. Anh, P.H. Viet, and S. Suzuki. 2011. “Antibiotic contamination and occurrence of antibiotic-resistant bacteria in aquatic environments of northern Vietnam.” *Science of the Total Environment* 409: 2894-2901.

Hou, J., C. Wang, D. Mao, and Y. Luo. 2016. “The occurrence and fate of tetracyclines in two pharmaceutical wastewater treatment plants of Northern China.” *Environmental Science and Pollution Research* 23 (2): 1722-31.

Houtman, C.J., J. Kroesbergen, K. Lekkerkerker-Teunissen, and J.P. van der Hoek. 2014. “Human health risk assessments of the mixture of pharmaceuticals in Dutch drinking water and its sources based on frequent monitoring data.” *Science of the Total Environment* 496: 54-62.

Hu, F.B., and V.S. Malik. 2010. “Sugar-sweetened beverages and risk of obesity and type 2 diabetes.” *Physiology & Behavior* 100: 47-54. doi: 10.1016/j.physbeh.2010.01.036.

Hua, W.Y., E.R. Bennett, X.S. Maio, C.D. Metcalfe, and R.J. Letcher. 2006. “Seasonality effects on pharmaceuticals and s-triazine herbicides in wastewater effluent and surface water from the Canadian side of the upper Detroit River.” *Environmental Toxicology and Chemistry* 25 (9).

Huerta-Fontela, M., M.T. Galceran, J. Martin-Alonso, and F. Ventura. 2008. “Occurrence of psychoactive stimulatory drugs in wastewaters in north-eastern Spain.” *Science of the Total Environment* 297 (1-3).

Huerta-Fontela, M., M.T. Galcerna, and F. Ventura. 2011. “Occurrence and removal of pharmaceuticals and hormones through drinking water treatment.” *Water Research* 45: 1432-42.

Institute of Medicine. 2011. *Dietary Reference Intakes for Calcium and Vitamin D.* Edited by A Catharine Ross, Christine L Taylor, Ann L Yaktine, and Heather B Del Valle. Washington, District of Columbia: National Academies Press. https://www.ncbi.nlm.nih.gov/books/NBK56070/

—. 2000. *Dietary Reference Intakes. Applications in Dietary Assessment.* Edited by Richard E. Behrman and Adrienne Stith Butler. Washington, District of Columbia: National Academies Press.

—. 2007. *Preterm Birth. Causes, Consequences, and Prevention.* Edited by Richard E. Behrman and Adrienne Stith Butler. Washington, District of Columbia: National Academies Press.

Juric A.K., M. Batal, D.W. Sharp, H. Schwartz, A. Ing, K. Fediuk, A. Black, C. Tikhonov, and H.M. Chan. Risk assessment of dietary lead exposure among First Nations people living on-reserve in Ontario, Canada using a total diet study and a probabilistic approach *Journal of Hazardous Materials 2018 Feb 344 (15): 55-63. Epub 2017 Oct. doi.org/10.1016/j.jhazmat.2017.09.035*

Kanama, K.M., A.P. Daso, L. Mpenyana-Monyatsi, and M.A.A. Coetzee. 2018. "Assessment of pharmaceuticals, personal care products, and hormones in wastewater treatment plants receiving inflows from health facilities in North West Province, South Africa." *Hindawi Journal of Toxicology* 18. https://doi.org/10.1155/2018/3751930.

Karthikeyan, K.G., and M.T. Meyer. 2006. "Occurrence of antibiotics in wastewater treatment facilities in Wisconsin, USA." *Science of the Total Environment* 361: 196-207.

Kasprzyk-Hordern, B., R.M. Dinsdale, and A.J. Guwy. 2008b. "Multiresidue methods for the analysis of pharmaceuticals, personal care products and illicit drugs in surface water and wastewater by solid-phase extraction and ultra-performance liquid chromatography." *Analytical and Bioanalytical Chemistry* 391: 1293-1308.

Kasprzyk-Hordern, B., R.M. Dinsdale, and A.J. Guwy. 2008. "Multiresidue methods for the analysis of pharmaceuticals, personal care products and illicit drugs in surface water and wastewater by solid-phase extraction and ultra-performance liquid chromatography–electrospray tandem mass spectrometry." *Analytical and Bioanalytical Chemistry* 391: 1298-1308.

Kasprzyk-Hordern, B., R.M. Dinsdale, and A.J. Guwy. 2009. "The removal of pharmaceuticals, personal care products, endocrine disruptors and illicit drugs during wastewater treatment and its impact on the quality of receiving waters." *Water Research* 43: 363-380.

Katamay, S.W., K.A. Esslinger, M., Johnston, J.L. Vigneault, B.A. Junkins, L.G. Robbins, I.V. Sirois, E.M. Jones-McLean et al. 2007. "Eating Well with Canada's Food Guide (2007): Development of the Food intake pattern." *Nutrition Reviews* 65 (4): 155-166.

Kennedy, D.G., R.J. McCracken, M.P. Carey, W.J. Blanchflower, and S.A. Hewitt. 1998. "Iso- and epi-iso-chlortetracycline are the principal metabolites of chlortetracycline in the hen's egg." *Journal of Chromatography A* 812: 327-337.

Khan, B., and L. Lee. 2012. "Estrogens and synthetic androgens in manure slurry from trenbolone acetate/estradiol implanted cattle and in waste- receiving lagoons used for irrigation." *Chemosphere* 89: 1443- 1449.

Khan, G.A., B. Berglund, K.M. Khan, P.E. Lindgren, and J. Fick. 2013. "Occurrence and abundance of antibiotics and resistance genes in rivers, canal and near drug formulation facilities – a study in Pakistan." *PLoS One* 8 (6): e62712. doi: 10.1371/journal.pone.0062712.

Kim, B., K. Ji, C. Kim, Kang. H., S. Lee, B. Kwon, Y. Kho, K. Park, K. Kim, and K. Choi. 2019. "Pharmaceutical residues in streams near concentrated animal feeding operations of Korea: occurrences and associated ecological risks." *Science of the Total Environment* 655: 408-413.

Kim, M., P. Guerra, A. Shah, M. Parsa, M. Alaee, and S.S. Smyth. 2014. "Removal of pharmaceuticals and personal care products in a membrane bioreactor wastewater treatment plant." *Water Science Technology* 69 (11): 2221-9.

Kleywegt, S., V. Pileggi, P. Yang, C. Hao, X. Zhao, C. Rocks, S. Thatch, P Cheung, and B. Whitehead. 2011. "Pharmaceuticals, hormones and bisphenol A in untreated source and finished drinking water in Ontario, Canada- occurrence and treatment efficiency." *Science of the Total Environment* 409 (8): 1471-1478.

Kleywegt, S., V. Pileggi, Y.M. Lam, A. Elises, A. Puddicomb, G. Purba, J. Di Caro, and T. Fletcher. 2016. "The contribution of pharmaceutically active compounds from healthcare facilities to a receiving sewage treatment plant in Canada." *Environmental Toxicology and Chemistry* 35 (4): 850-862.

Kolpin, D.W., E.T. Furlong, M.T. Meyer, E.M. Thurman, S.D. Zaugg, L.B. Barber, and H.T. Buxton. 2002. "Pharmaceuticals, hormones and other organic wastewater. Contaminants in U.S. Streams, 1999-2000. A National Reconaissance." *Environmental Science & Technology* 36 (6): 1202-1211.

Kone, M., D.L. Cologgi, W. Lu, D.W. Smith, and A.C. Ulrich. 2013. "Pharmaceuticals in Canadian sewage treatment plant effluents and surface waters: occurrence and environmental risk assessment." *Environmental Technology Reviews* 2 (1): 17-27. doi: https://doi.org/10.1080/21622515.2013.865793.

Kong, L., K. Kadokami, S. Wang, H.T. Duong, and H.T.C. Chau. 2015. "Monitoring of 1300 organic micro-pollutants in surface waters from Tianjin, North China." *Chemosphere* 122: 125-30.

K'oreje, K.O., L. Vergeynst, D. Ombaka, P. DeWispelaere, M. Okoth, H. Van Langenhove, and K. Demeestere. 2016. "Occurence patterns of pharmaceutical residues in wastewater, surface water and groundwater of Nairobi and Kisumu city, Kenya." *Chemosphere* 149: 238-244.

Kostich, M. S., A. L. Batt, and J. M. Lazorchak. 2014. "Concentrations of prioritized pharmaceuticals in effluents from 50 large wastewater treatment plants in the US and implications for risk estimation." *Environmental Pollution* 184: 354-359.

Kotowska, U., J. Kapelewska, and J. Sturgulewska. 2014. "Determination of phenols and pharmaceuticals in municipal wastewaters from Polish treatment plants by ultrasound-assisted emulsification-microextraction followed by GC-MS." *Environment Science & Pollution Research* 21 (1): 660-673.

Kuhnlein, H.V., and H.M. Chan. 2000. "Environment and contaminants in Traditional Food systems of northern Indigenous Peoples." *Annual Reviews in Nutrition* 20: 595-626. doi: 10.1146/annurev.nutr.20.1.595.

Kuhnlein, H.V., B. Erasmus, D. Spigelski, and B. Burlingame. 2013. *Indigenous Peoples' food systems and well-being: interventions and policies for healthy communities.* Rome: Food and Agricultural Organization.

Kuhnlein, H., and O. Receveur. 2007. "Local cultural animal food contributes high levels of nutrients for Arctic Canadian Indigenous adults and children." *The Journal of Nutrition* 137 (4): 1110-14. doi: 10.1093/jn/137.4.1110.

Kuhnlein, H.V., and O. Receveur. 1996. "Dietary change and Traditional Food Systems of Indigenous People." *Annual Review of Nutrition* 16: 417-442.

Kuhnlein, H.V., O. Receveur, and H.M Chan. 2001. "Traditional Food systems research with Canadian Indigenous Peoples." *International Journal of Circumpolar Health* 60 (2): 112-122.

Kurwadkar, S., V. Sickling, B. Lambert, A. McFarland, and F. Mitchell. 2012. "Preliminary studies on occurrence of monensin antibiotic in Bosque River Watershed." *Environmental Science* 25: 268-273.

Laberge, G.V., O. Receveur, F. Girard, and L. Potvin. 2015. "Facilitators and barriers to traditional food consumption in the Cree community of Mistissini, Northern Quebec." *Ecology of Food and Nutrition* 54 (6): 663-92. doi: https://doi.org/10.1080/03670244.2015.1072815.

Laird, B.D., A.B. Goncharov, G.M. Egeland, and H.M. Chan. 2013. "Dietary advice on Inuit traditional food use needs to balance benefits and risks of mercury, selenium and n3 fatty acids." *Journal of Nutrition* 143: 923-930.

Lara-Martin, P.A., E. González-Mazo, M. Petrovic, D. Barceló, and B.J. Brownwell. 2014. "Occurrence, distribution and partitioning of nonionic surfactants and pharmaceuticals in the urbanized Long Island Sound Estuary (NY)." *Marine Pollution Bulletin* 85 (2): 710-19.

Lawrence, J.R., A. Paule, J., Swerhone, G.D.W. Roy, and M.J. Waiser. 2014. "AMR in a small rural/urban/agricultural drainage with recreational, livestock and fish farming activities (Swift Current Creek/Diefenbaker Lake)." *PPCP Research Symposium: an information sharing opportunity.* Environment Canada.

Lee, D., M.W. Steffes, A. Sjodin, R.S. Jones, L.L. Needham, and D.R. Jacobs. 2011. "Low dose organochlorine pesticides and polychlorinated biphenyls predict obesity, dyslipidemia, and insulin resistance among people free of diabetes." *PLoS ONE* 6 (1).

Lee, H.B., T.E. Peart, and M.L. Svoboda. 2005. "Determination of endocrine-disrupting phenols, acidic pharmaceuticals and personal-care products in sewage by solid-phase extraction and gas chromatography–mass spectrometry." *Journal of Chromatography A* 1094: 122-29.

Lee, H.B., T.E. Peart, M.L. Svoboda, and S. Backus. 2009. "Occurrence and fate of rosuvastatain lactone and atorvastatin in Canadian sewage surface water samples." *Chemosphere* 77: 1285-1291.

Legrand, M., M. Freeley, C. Tikhonov, D. Schoen, and A. Li-Muller. 2010. "Methylmercury blood guidance values for Canada." *Canadian Journal of Public Health* 101 (1): 28-31. doi: http://dx.doi.org/10.17269/cjph.101.2181.

Lester, Y., H. Mamane, I. Zucker, and D. Avisar. 2013. "Treating wastewater from a pharmaceutical formulation facility by biological process and ozone." *Water Research* 47: 4349-4356.

Li, D., M. Yang, J. Hu, L. Ren, Y. Zhang, and K. Li. 2008. "Determination and fate of Oxytetracycline and related compounds in Oxytetracycline production wastewater and receiving river." *Environmental Toxicity and Chemistry* 27 (1): 80-86.

Li, Q.Q., A. Loganath, Y.S. Chong, J. Tan, and J.P. Obbard. 2006. "Persistent organic pollutants and adverse health effects in humans." *Journal of Toxicology and Environmental Health, Part A* 69 (21): 1987-2005.

Li, X., W. Zheng, and W.R. Kelly. 2013. "Occurrence and removal of pharmaceutical and hormone contaminants in rural wastewater treatment lagoons." *Science of the Total Environment* 445-446: 22-28.

Lietz, A., and M. Meyer. 2006. *Evaluation of emerging contaminants of concern at the South District Wastewater Treatment Plant based on seasonal events,.* U.S. Geological Survey Scientific Investigations Report 2006-5260, Miami-Dade County, Florida,: U.S. Geological Survey.

Lin, A., and Y. Tsai. 2009. "Occurrence of pharmaceuticals in Taiwan's surface waters: Impact of waste streams from hospitals and pharmaceutical production facilities." *Science of the Total Environment* 407: 3793-3802.

Lin, A.Y.C., T.H. Yu, and C.F. Lin. 2008. "Pharmaceutical contamination in residential, industrial and agricultural waste streams: Risks to aqueous environments in Taiwan." *Chemosphere* 74: 131-141.

Lindberg, R.H., M. Ostman, U. Olofsson, R. Grabic, and J. Fick. 2014. "Occurrence and behaviour of 105 active pharmaceutical ingredients in sewage waters of a municipal sewar collection system." *Water Research* 58: 221-29.

Lindsey, M., M. Meyer, and E. Thurman. 2001. "Analysis of trace levels of sulfonamide and tetracycline antimicrobials in groundwater and surface water using solid-phase extraction and liquid chromatography/mass spectrometry." *Analytical Chemistry* 73: 4640-4646.

Lissemore, L., C. Hao, Yang P., P.K. Sibley, S Mabury, and K.R. Solomon. 2006. "An exposure assessment for selected pharmaceuticals within a watershed in southern Ontario." *Chemosphere* 64 (5): 717-29.

Liu, S., G. Ying, J. Zhou, R. Zhang, Z. Chen, and H. Lai. 2012. "Steroids in a typical swine farm and their release into the environment." *Water Research* 46: 3754-3768.

Lopez-Roldan, R., M. Lopez de Alda, M. Gros, M. Petrovic, J. Martin-Alonso, and D. Barcelo. 2010. "Advanced monitoring of pharmaceuticals and estrogens in the Llobregat River Basin (Spain) by liquid chromatography-triple quadrupole-tandem mass spectrometry in combination with ultra performance liquid chromatography-time of flight-mass spectrometry." *Chemosphere* 80: 1337-44.

Loraine, G.A., and M.E. Pettigrove. 2006. "Seasonal variations in concentrations of pharmaceuticals and personal care products in drinking water and reclaimed wastewater in suthern California." *Environmental Science & Technology* 40 (3): 687-95.

Machado, K. S. 2010. "Determinacao de hormonios sexuais femininos na bacia do alto iguacu, regiao metropolitana de Curitiba-PR. Master's thesis." Universidade Federal do Paraná. Programa de Pós Graduação em Engenharia de Recursos Hídricos e Ambiental. 116.

Meador, J.P., A. Yeh, Y. Graham, and A.P. Gallagher. 2016. "Contaminants of emerging concern in a large temperate estuary." *Environmental Pollution* 213: 254-267.

Metcalfe, C., B.G. Koenig, D.T. Bennie, M. Servos, T.A. Ternes, and R. Hirsch. 2003a. "Occurrence of neutral and acidic drugs in the effluents of Canadian sewage treatment plants." *Environmental Toxicology and Chemistry* 22 (12): 2872-2880.

Metcalfe, C., S. Chu, C. Judt, H. Li, K.D. Oakes, M.R. Servos, and D.M. Andrews. 2010. "Antidepressants and their metabolites in municipal wastewater and downstream exposure in an urban watershed." *Environmental Toxicology and Chemistry* 29 (1): 79-89.

Metcalfe, C., X. Miao, B. Koenig, and J. Struger. 2003b. "Distribution of acidic and neutral drugs in surface waters near sewage treatment plants in the lower Great Lakes, Canada." *Environmental Toxicology and Chemistry* 22 (12): 2881- 2889.

Metcalfe, C., X. S. Miao, W. Hua, R. Letcher, and M. Servos. 2004. "Pharmaceuticals in the Canadian environment." In *Pharmaceuticals in the Environment: Sources, Fate, Effects and Risks.*, by K. Kummerer, 67-90. Berlin: Germany.

Miao, X.S., F. Bishay, M. Chen, and C.D. Metcalfe. 2004. "Occurrence of antimicrobials in the final effluents of wastewater treatment plants in Canada." *Environmental Science & Technology* 38: 3533-3541.

Miege, C., J.M. Choubert, L. Ribiero, Eusebe, M., and M. Coquery. 2009. "Fate of pharmaceuticals and personal care products in wastewater treatment plants – conception of a database and first results." *Environmental Pollution* 157: 1721-1726.

Mikkonen, J., and D. Raphael. 2010. *Social Determinants of Health: The Canadian Facts.* Toronto, ON: York University School of Health Policy and Management. http://www.thecanadianfacts.org/The_Canadian_Facts.pdf.

Mohapatra, S., C.-H. Huang, S. Mukherji, and L.P. Padhye. 2016. "Occurrence and fate of pharmaceuticals in WWTPs in India and comparison with a similar study in the United States." *Chemosphere* 159: 526-535.

Monteiro, C.A., J.C. Moubarac, G. Cannon, S.W. Ng, and B. Popkin. 2013. "Ultra-processed products are becoming dominant in the global food system." *Obesity Reviews* 14 (Suppl 2): 21-28. doi: https://doi.org/10.1111/obr.12107.

Nagarnaik, P.M., A.L. Batt, and B. Boulanger. 2012. "Healthcare facility effluents as point sources of select pharmaceuticals to municipal wastewater." *Water Environment Research* 84 (4): 339-345.

Nagpal, N. K., and C. L. Meays. 2009. *Water Quality Guidelines for Pharmaceutically-active Compounds (PhACs): 17 α-ethinylestradiol (EE2) — Overview Report.* Government report, Ministry of Environment, Government of British Columbia, Victoria: Ministry of Environment.

National Academies of Sciences, Engineering, and Medicine. 2019. *Dietary Reference Intakes for Sodium and Potassium*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25353.

New York City Environment Protection. 2011. "2010 Occurrence of pharmaceuticals and personal care products (PPCPs) in source water of the New York City water supply." Final Report, New York. http://www.nyc.gov/html/dep/pdf/quality/nyc_dep_2010_ppcpreport.pdf.

Nikolaou, A., S. Meric, and D. Fatta. 2007. "Occurrence patterns of pharmaceuticals in water and wastewater environments." *Analytical and Bioanalytical Chemistry* 387: 1225-34.

Non-Insured Health Benefits Directorate (NIHB). 2011. "Manitoba Drug Claim Totals 2006-2010. First Nations and Inuit Health Branch." Ottawa: unpublished. Health Canada.

Oppenheimer, J., A. Eaton, A. Badruzzman, A.W. Haghani, and J.G. Jacangelo. 2011. "Occurrence and suitability of sucralose as an indicator compound of wastewater loading to surface waters in urbanized regions." *Water Research* 45: 4019-4027.

Ortiz de Garcia, S., P.A. García-Encina, and R. Irusta-Mata. 2018. "The potential ecotoxicological impact of pharmaceutical and personal care products on humans and freshwater, based on USEtox™ characterization factors. A Spanish case study of toxicity impact sc." *Science of the Total Environment* 609 (2017): 429-445.

Pais, M., and E. Nascimento. 2018. "Guideline values and human risk assessment for the preence of anti-inflammatory drugs remaining in drinking wate rafter lab scale treatment." *Brazilian Journal of Pharmaceutical Sciences* 54 (1): e17324.

Power, E.M. 2008. "Conceptualizing food security of aboriginal people in Canada." *Canadian Journal of Public Health* 99 (2): 95-7.

Public Health Agency of Canada. 2011. "Diabetes in Canada: Facts and figures from a public health perspective." *Public Health Agency of Canada.* http://www.phac-aspc.gc.ca/cd-mc/publications/diabetes-diabete/facts-figures-faits-chiffres-2011/chap1-eng.php#DIA.

—. 2010. "HIV/AIDS Epi Update. HIV/AIDS Among Aboriginal People in Canada." *Public Health Agency of Canada.* http://www.phac-aspc.gc.ca/aids-sida/publication/epi/2010/8-eng.php.

Public Health Agency of Canada. 2012. *Tuberculosis in Canada 2008.* Report, Ottawa: Minister of Public Works and Government Services Canada, 85. http://www.publications.gc.ca/collections/collection_2012/aspc-phac/HP37-5-2008-eng.pdf.

Reading, C.L., and F. Wein. 2009. *Health Inequalities and Social Determinants of Aboriginal Peoples' Health.* Prince George: National Collaborating Centre for Aboriginal Health.

Reid, J. L., D. Hammond, V. L. Rynard, C.L Madill, and R. Burkhalter. 2017. *Tobacco Use in Canada: Patterns and Trends.* Waterloo: Propel Centre for Population Health Impact, University of Waterloo. https://uwaterloo.ca/tobacco-use-canada/tobacco-use-canada-patterns-and-trends.

Richardson, M.G. 1997. *Compendium of Canadian Human Exposure Factors for Risk Assessment.* Ottawa: O'Connor Associates Environmental Inc.

Roden, N.M. 2013. "The cumulative risk of pharmaceuticals in New Jersey surface water to human health." PhD Thesis. University of Medicine and Dentistry of New Jersey. Graduate School, New Brunswick, Rutgers, The State University of New Jersey.

Sacher, F., M. Ehmann, S. Gabriel, C. Graf, and H.J. Brauch. 2008. "Pharmaceutical residues in the river Rhine-results of a one-decade monitoring programme." *Journal of Environmental Monitoring* 10: 664-670.

Sadezky, A., R.D. Löffle, M. Schlüsener, B. Roig, and T. Ternes. 2010. "Real situation: occurrence of the main investigated PPs in water bodies. European Water Research Series." Chap. 4 in *Pharmaceuticals in the Environment: Current Knowledge and need assessment to reduce presence and impact.*, edited by B. Roig. London: IWA Publishing.

Santos, L., M. Gros, S. Rodriguez-Mozaz, C. Delerue-Matos, A. Pena, and D. Barcelo. 2013. "Contribution of hospital effluents to the load of pharmaceuticals in urban wastewaters: Identification of ecologically relevant pharmaceuticals." *Science of the Total Environment* 461-462: 302-16.

Schlabach, M., C. Dye, L. Kaj, S. Klausen, K. Langford, H. Leknes, M. Moe, M. Remberger, M. Schoyen, and K. and Vogelsang. Thomas. 2008. *Human and hospital- use pharmaceuticals, aquaculture medicines, and personal care products. Environmental Screening of selected organic compounds TA-2508.* Norwegian Pollution Control Authority. http://www.miljodirektoratet.no/old/klif/publikasjoner/2508/ta2508.pdf.

Schnarch, B. 2004. "Ownership, Control, Access and Possession (OCAP) or Self-Determination Applied to Research. A critical analysis of contemporary First Nations research and some options for First Nations communities." *Journal of Aboriginal Health* (January).

Scientific Committee on Health and Environmental Risks (SCHER). 2011. *Opinion on Ethinylestradiol.* Brussels: European Commission (EC).

Segura, P.A., H. Takada, J.A. Correa, K. El Saadi, T. Koike, S. Onwona-Agyeman, J. Ofosu-Anim et al. 2015. "Global occurrence of anti-infectives in contaminated in contamiated surface waters: impact of income inequality between countries." *Environment International* 80: 89-97.

Sim, W.J., J.W. Lee, E.S. Lee, S.K. Shin, S.R. Hwang, and J.E. Oh. 2011. "Occurrence and distribution of pharmaceuticals in wastewater from households, livestock farms, hospitals and pharmaceutical manufacturers." *Chemosphere* 82: 179-86.

Sodré, F.F., P.M. Dutra, and V. Portela dos Santos. 2018. "Pharmaceuticals and personal care products as emerging micropollutants in Brazilian surface waters: a preliminary snapshot on environmental contamination and risks." *Eclética Química Journal* 43: 22-34. doi: http://dx.doi.org/10.26850/1678-4618eqj.v43.1SI.2018.p22-34.

Sosiak, A., and T. Hebben. 2005. *A preliminary survey of pharmaceuticals and endocrine disrupting compounds in treated municipal wastewaters and receiving rivers of Alberta.* Technical Report T/773, Alberta Environment, Government of Alberta, Edmonton: Environmental Monitoring and Evaluation Branch, 52. Accessed April 28, 2014. http://environment.gov.ab.ca/info/library/7604.pdf.

Spongberg, A.L., J.D. Witter, J. Acuna, J. Vargas, M. Murillo, G. Umana, E. Gomez, and G. Perez. 2011. "Reconnaissance of selected PPCP compounds in Costa Rican surface waters." *Water Research* 45: 6709-6717.

Statistical Consultation Group. 2018. "First Nations Food, Nutrition and Environment Study. Report on Weighting Adjustment for National Report." Prepared by Jack Singleton. Statistics Canada, May.

Statistics Canada. 2017. *Canadian Community Health Survey – Nutrition (CCHS).* Accessed January 3, 2019. http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=201486.

Statistics Canada. n.d. *Canadian Health Measures Survey (CHMS).* Ottawa: Statistics Canada.

—. 2013. "Health Fact Sheets (82-625-X), Household food insecurity, 2011-2012. Percentage of households with food insecurity, by province/territory, CCHS 2011-2012." *Statistics Canada.* Accessed 2014. http://www.statcan.gc.ca/pub/82-625-x/2013001/article/11889/c-g/desc/desc04-eng.htm.

—. n.d. (f). "Table 105-2023. Measured adult body mass index (BMI) (World Health Organization classification), by age group and sex, Canada and provinces, Canadian Community Health Survey-Nutrition, occasional, CANSIM (database)." *Statistics Canada.* Accessed 2017. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310079401.

—. n.d. (g). "Table 13-10-0113-01. Canadian health characteristics, two year period estimates. (formerly CANSIM 105-0509)." *Statistics Canada.* Accessed 2018. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310011301.

—. n.d. (i). "Table 13-10-0113-01. Canadian health characteristics, two year period estimates." *Statistics Canada.* Accessed 2018. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310011301.

—. n.d. (h). "Table 13-10-0453-01. Health indicator profile, age-standardized rate, annual estimates." *Statistics Canada.* Accessed 2018. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310045301 &pickMembers%5B0%5D=1.6&pickMembers%5B1%5D=2.1.

—. n.d. (a). "Table 13-10-0772-01. Total energy intake from foods, by dietary reference intake age-sex group, household population aged 1 and over, Canadian Community Health Survey (CCHS) – Nutrition, Canada and provinces." *Statistics Canada.* Accessed 2018. http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=1052020&&pattern=&stByVal=1&p1=1&p2=31&tabMode=dataTable&csid=.

—. n.d. (e). "Table 13-10-0773-01. Nutritional supplements – past month consumption, by age group and sex, household population aged 1 and over, Canadian Community Health Survey (CCHS) – Nutrition, Canada and provinces." *Statistics Canada.* Accessed 2018. https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=1310077301.

—. n.d. (c). "Table: 13-10-0769-01. Percentage of total energy intake from fat, by dietary reference intake age-sex group, household population aged 1 and over, Canadian Community Health Survey (CCHS) – Nutrition, Canada and provinces." Accessed 2018. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310076901.

—. n.d. (d). "Table: 13-10-0770-01. Percentage of total energy intake from carbohydrates, by dietary reference intake age-sex group, household population aged 1 and over, Canadian Community Health Survey (CCHS) – Nutrition, Canada and provinces." *Statistics Canada.* 07 19. Accessed 2018. https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=1310077001.

—. n.d. (b). "Table: 13-10-0771-01. Percentage of total energy intake from protein, by dietary reference intake age-sex group, household population aged 1 and over, Canadian Community Health Survey (CCHS) – Nutrition, Canada and provinces1 2." Accessed 2018. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310077101.

Steinhouse, L. 2017. "The Association between food security and diet quality among First Nations living on-reserve in Canada. M. Sc. thesis." Montreal, Quebec: Université de Montréal.

Tarasuk, V., A. Mitchell, and N. Dachner. 2013. *Household food insecurity in Canada 2011.* Toronto: Research to identify policy options to reduce food inseucrity (PROOF). http://nutritionalsciences.lamp.utoronto.ca/.

Tarasuk, V., A. Mitchell, and N. Dachner. 2016. *Household food insecurity in Canada 2014.* Toronto: Research to identify policy options to reduce food insecurity (PROOF). http://proof.utoronto.ca/resources/proof-annual-reports/annual-report-2014/.

Tarasuk, V., A. Mitchell, and N. Dachner. 2014. *Household food security in Canada 2012.* Toronto: Research to identify policy options to reduce food insecurity (PROOF).

Teerlink, J., A.S. Hering, C.P. Higgins, and J.E. Drewes. 2012. "Variability of trace organic chemical concentrations in raw wastewater at three distinct sewershed scales." *Water Research* 46 (10): 3261-3271.

Ternes, T., M. Bonerz, and T. Schmidt. 2001. "Determination of neutral pharmaceuticals in wastewater and rivers by liquid chromatography-electrospray tandem mass spectrometry." *Journal of Chromatography* 938: 175- 185.

Tran, N.H., J. Li, J. Hu, and S.L. Ong. 2014. "Occurrence and suitability of pharmaceuticals and personal care products as molecular markers for raw wastewater contamination in surface water and groundwater." *Environmental Science and Pollution Research* 21: 4727-4740.

Turner, N.J., M. Plotkin, and H.V. Kuhnlein. 2013. "Global environmental challenges to the integrity of Indigenous Peoples' food systems." In *Indigenous Peoples' food systems and well-being: interventions and policies for healthy communities*, edited by H.V. Kuhnlein, B. Erasmus, D. Spigelski and B. Burlingame, 23-38. Rome: Food and Agricultural Organization.

United States. Environmental Protection Agency (US EPA). 2009. *"Drinking Water Treatability Database."* Accessed 2018. http://iaspub.epa.gov/tdb/pages/contaminant/contaminantOverview.do?contaminantId=10240.

Urtiaga, A.M., G. Pérez, R. Ibáñez, and I. Ortiz. 2013. "Removal of pharmaceuticals from a WWTP secondary effluent by ultrafiltration/reverse osmosis followed by electrochemical oxidation of the RO concentrate." *Desalination* 331: 26-34.

Valcarcel, Y., A.S. Gonzalez, J.L. Rodriguez-Gil, A. Gil, and A. Catala. 2011a. "Detection of pharmaceutically active compounds in the rivers and tap water of the Madrid Region (Spain) and potential ecotoxicological risk." *Chemosphere* 84: 1336-1348.

Valcarcel, Y., A.S. Gonzalez, J.L. Rodriguez-Gil, Romo Maroto R., A. Gil, and M. Catala. 2011b. "Analysis of the presence of cardiovascular and analgesic// anti-inflammatory/antipyretic pharmaceuticals in river- and drinking water of the Madrid Region in Spain." *Chemosphere* 82: 1062-1071.

Valls-Cantenys, C., Schuerer. M., M. Iglesias, F. Sacher, H.-J. Brauch, and V. Salvado. 2016. "A sensitive multi-residue method for the determination of 35 micropollutants including pharmaceuticals, iodinated contrast media and pesticides in water supplementa." *Analytical Bioanalytical Chemistry* 408: 6189-6200.

Van Oostdam, J., A. Gilman, E. Dewailly, P. Usher, B. Wheatley, H. Kuhnlein, S. Neve et al. 1999. "Human Health Implications of Environmental Contaminants in Arctic Canada: a Review." *Science of the Total Environment* 230 (1-3): 1-82.

Vandevijvere, S., C. Monteiro, S.M. Krebs-Smith, A. Lee, B. Swinburn, B. Kelly, W. Snowdon, G. Sacks, and INFORMAS. 2013. "Monitoring and benchmarking population diet quality globally: a step-wise approach." *Obesity Reviews* 14 (Suppl 1): 135-149. doi: https://doi.org/10.1111/obr.12082.

Waiser, M.J., D. Humphries, V. Tumber, and J. Holm. 2011. "Effluent-dominated streams. Part 2: Presence and possible effects of pharmaceuticals and personal care products in Wascana creek, Saskatchewan, Canada." *Environmental Toxicology and Chemistry* 30 (2): 508-519.

Waldram, J.B., D.A. Herring, and T.K. Young. 1995. *Aboriginal Health in Canada. Historical, Cultural and Epidemiological Perspectives.* Toronto: University of Toronto Press.

Wang, X.H., and A.Y.C. Lin. 2014. "Is the phototransformation of pharmaceuticals a natural purification process that decreases ecological and human health risks?" *Environmental Pollution* 186: 203-15.

Watkinson, A.J., E.J. Murby, D.W. Kolpin, and S.D. Costanzo. 2009. "The occurrence of antibiotics in an urban watershed: from wastewater to drinking water." *Science of the Total Environment* 407 (8): 2711-2723.

Wheatley, B., and S. Paradis. 1995. "Exposure of Canadian aboriginal peoples to methylmercury." *Water, Air, and Soil Pollution* 80 (1-4): 3-11. doi: 10.1007/BF01189647.

Wiest, L., T. Chonova, A. Berge, R. Baudot, F. Bessueille-Barbier, L. Ayouni-Derouiche, and E. Vulliet. 2018. "Two-year survey of specific hospital wastewater treatment and its impact on pharmaceutical discharges." *Environmental Science and Pollution Research* 25 (10): 9207-9218.

Wilcox, J.D., Hedman, C.J. Bahr JM., Hemming J.D.C., and M.A.E. Barman. 2009. "Removal of organic wastewater contaminants in septic systems using advanced treatment technologies." *Journal of Environmental Quality* 38: 149-156.

Willows, N. 2005. "Determinants of healthy eating in Aboriginal Peoples in Canada: the current state of knowledge and research gaps." *Canadian Journal of Public Health* 96 (Suppl 3): S32-6, S36-41.

Willows, N., P. Veugelers, K. Raine, and S. Kuhle. 2011. "Associations between household food insecurity and health outcomes in the Aboriginal population (excluding reserves)." *Statistics Canada, Catalogue no. 82-003-XPE, Health Reports*, June.

World Health Organization. 2011. "Evaluations of the Joint FAO/WHO Expert Committee on Food Additives (JECFA). Lead. General information." http://apps.who.int/food-additives-contaminants-jecfa-database/chemical.aspx?chemID=3511.

—. 2010. "Indigenous Peoples & Participatory Health Research: Planning & Management, Preparing Research Agreements." Geneva.

Writer, J., I. Ferrer, L. Barber, and E. Thurman. 2013. "Widespread occurrence of neuro-active pharmaceuticals and metabolites in 24 Minnesota rivers and wastewaters." *Science of the Total Environment* 461-462 : 519-527.

Wu, C., J.D. Witter, A.L. Spongberg, and K.P. Czajkowski. 2009. "Occurence of selected pharmaceuticals in an agricultural landscape, western Lake Erie basin." *Water Research* 43 (15): 3407-3416. http://www.iwaponline.com/wr/default.htm.

Xu, J., W. Chen, L. Wu, R. Green, and A. Chang. 2009. "Leachability of some emerging contaminants in reclaimed municipal wastewater-irrigated turf grass fields." *Environmental Toxicology and Chemistry* 28 (9): 1842-50.

Yang, S., and K. Carlson. 2004. "Routine monitoring of antibiotics in water and wastewater with a radioimmunoassay technique." *Water Research* 38: 3155-3166.

Yang, X., Flowers. R.C., Weinberg. H.S., and Singer. P.C. 2011. "Occurrence and removal of pharmaceuticals and personal care products (PPCPs) in an advanced wastewater reclamation plant." *Water Research* 45: 5218-5228.

Yargeau, V., A. Lopata, and C. Metcalfe. 2007. "Pharmaceuticals in the Yamaska River, Quebec, Canada." *Water Quality Research Journal of Canada* 42 (4): 231-239. http://www.cawq.ca/cgi-bin/journal/abstract.cgi?language=english&pk_article=361.

Yilmaz, G., Y. Vergili, I. Kaya, B.B. Gonder, G. Ozhan, C.B. Ozbek-Celik, S.M. Altinkum, Y. Bagdatli, A. Boergers, and J. Tuerk. 2017. "Characterization and toxicity of hospital wastewaters in Turkey." *Environmental Monitoring and Assessment* 189 (2): 55.

Young, T.A., J. Heidler, C.R. Matos-Perez, A. Sapkota, T. Toler, K.E. Gibson, K.J. Schwab, and R.U. Halden. 2008. "Ab initio and in situ comparison of caffeine, triclosan and triclocarbon as indicators of sewage-derived microbes in surface water." *Environmental Science and Technology* 42 (9): 3335-3340.

Young, T.K. 1994. *The health of Native Americans: towards a bio-cultural epidemiology.* New York: Oxford University Press.

Yu, Y., Wu. L., and A.C. Chang. 2013. "Seasonal variation of endocrine disrupting compounds, pharmaceuticals and personal care products in wastewater treatment plants." *Science of the Total Environment* 442: 310-316.

Zuccato, E., D. Calamari, M. Natangelo, and R. Fanelli. 2000. "Presence of Therapeutic Drugs in the Environment." *The Lancet* 1789-1790. doi: 10.1016/S0140-6736(00)02270-4.

Zurhelle, G., M. Petz, E. Mueller-Seitz, and E. Siewert. 2000. "Metabolites of Oxytetracycline, Tetracycline, and Chlortetracycline and Their Distribution in Egg White, Egg Yolk, and Hen Plasma." *Journal of Agriculture and Food Chemistry* 6392-6396.

Appendices

Derivation of population growth factor

The population growth factor for Community C in AFN Region R is calculated as:

$$Population\_Growth\_Factor_C = \frac{Population\_2017_C}{Population\_Y_C},$$

where $Population\_2017_C$ is the population of Community C on December 31, 2017 and $Population\_Y_C$ is the population of Community C on December 31 of the reference year Y associated with Community C and with all other communities in AFN Region R. Total Population values, the sum of On-Reserve/Crown Land and Off-Reserve, were used. To be consistent with FNFNES weighting, populations of ages 19 and above were used.

Outlier detection

Two methods were employed to detect any communities with extreme population growth. The first method was to detect communities for which the population growth factor, as calculated above, was either greater than 1.5 or less than .67. To account for the differential number of years between Y and 2017, a second method was suggested by FNFNES, to detect communities for which the average annual growth rate exceeded 5%. That is, we search for communities C for which any of the three conditions below are true.

$$\frac{Population\_2017_C}{Population\_Y_C} > 1.5, \frac{Population\_2017_C}{Population\_Y_C} < \frac{2}{3} \; or \left(\frac{Population\_2017_C}{Population\_Y_C}\right)^{1/(2017-Y)} > 1.05$$

Only one community, Douglas (561) satisfied any of these conditions — in fact it satisfied both the first (1.5647) and the third (1.05756) with Y=2009. After review it was decided no modification was necessary. Of note, no community fell in population between its reference year Y and 2017.

Calculation of adjusted weights

For FNFNES record i we calculate the adjusted estimation weight as:

$$weightfinaladj_i^C = Population\_Growth\_Factor_C * weightfinal_i^C$$

We calculate the adjusted replication weights, for X=1, 2, 3, …, 500, as:

$$weightbootadjX_i^C = Population\_Growth\_Factor_C * weightbootX_i^C$$

Thus $weightbootadjX_i^C$ is zero if and only if $weightbootX_i^C$ is zero.

The value of is obtained through linkage by *bandnumber*, where C is the community of record i.

Appendix B. Top ten most consumed foods by number of days by ecozone

Ecozone (# of adults)	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Pacific Maritime (n=486)	Salmon 61.9	Eulachon / grease 22.6	Halibut 15.5	Seaweed 15.2	Fish eggs 13.6	Blackberry 12.7	Moose meat 12.4	Prawn 8.5	Crab 8.4	Deer meat 8.0
Boreal Cordillera (n=80)	Moose meat 109.1	Salmon 55.5	Trout 9.6	Balsam tree inner bark 8.4	Moose kidney 8.0	Caribou meat 7.5	Blueberries 7.3	Soapberry 6.6	Black bear fat 6.2	Moose liver 5.7
Montane Cordillera (=313)	Moose meat 45.7	Deer meat 41.4	Salmon 23.7	Huckleberry 20.0	Soapberry 12.3	Labrador tea leaves 10.9	Elk meat 10.9	Saskatoon berry 5.9	Trout 5.6	Deer liver 4.9
Taiga Plains (n=152)	Moose meat 95.6	Ducks 78.3	Grouse 19.0	Northern pike 15.9	Mint leaves 15.0	Rat root 14.9	Geese 13.3	Rabbit 10.6	Saskatoon berry 9.5	Chokecherry 8.7
Boreal Plains (n=1248)	Moose meat 28.2	Mint leaves 5.8	Deer meat 5.3	Blueberries 4.3	Rat root 4.2	Walleye 4.0	Ducks 3.7	Elk meat 3.4	Saskatoon berry 3.2	Northern pike 3.0
Prairies (n=577)	Saskatoon berry 7.4	Moose meat 7.3	Deer meat 6.9	Elk meat 4.6	Chokecherry 4.5	Blueberry 4.3	Raspberry 4.3	Rat root 3.1	Mint leaves 2.9	Strawberry 2.7
Taiga Shield (n=272)	Labrador tea leaves 54.2	Caribou meat 46.2	Geese 22.3	Trout 14.4	Ptarmigan 12.5	Blueberry 8.5	Whitefish 7.9	Black bear fat 6.8	Grouse 5.7	Moose meat 2.2
Boreal Shield (n=1317)	Moose meat 20.4	Walleye 14.8	Blueberry 9.9	Geese 6.0	Whitefish 6.0	Raspberry 3.6	Ducks 3.6	Caribou meat 3.4	Northern pike 3.2	Strawberry 2.9
Hudson Plains (n=322)	Geese 39.5	Moose meat 21.2	Walleye 5.2	Caribou meat 4.4	Labrador tea 3.9	Northern pike 3.9	Ducks 3.8	Blueberries 3.1	Rabbit 3.0	Whitefish 2.9
Mixedwood Plains (n=681)	Corn 12.5	Beans 9.0	Deer meat 7.2	Squash 6.5	Maple syrup 6.2	Strawberry 4.3	Raspberry 3.9	Blueberry 3.8	Bird eggs 3.1	Walleye 2.6
Atlantic Maritime (n=1039)	Moose meat 12.1	Blueberry 6.6	Strawberry 4.7	Salmon 3.0	Raspberry 2.9	Fiddleheads 2.9	Haddock 2.9	Beans 2.6	Maple syrup 2.5	Trout 2.4
Across ecozones	Moose meat 19.3	Salmon 9.4	Deer meat 7.2	Blueberry 6.5	Walleye 5.7	Labrador tea leaves 3.5	Geese 3.3	Raspberry 3.3	Strawberry 2.9	Ducks 2.8

Appendix C. Five most frequently eaten foods within traditional food major categories in each ecozone for all adults

	FISH		SEAFOOD		LAND ANIMAL		BIRD		BERRY		PLANTS		MUSHROOM		CULTIVATED PLANTS	
	Food	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**
Across ecozones																
1	Salmon	9.3	Seaweed	1.8	Moose meat	19.3	Ducks	2.79	Blueberry	6.5	Labrador tea leaves	3.5	Pine	0.3	Corn / hominy	1.5
2	Walleye	5.78	Prawn	1.2	Deer meat	7.20	Grouse	1.40	Raspberry	3.3	Mint leaves	2.2	Chanterelle	0.2	Beans	1.1
3	Eulachon/ grease	2.8	Crab	1.1	Elk meat	2.7	Ptarmigan	0.70	Strawberry	2.9	Rat root	1.9	Cottonwood	0.1	Squash	0.7
4	Whitefish	2.4	Clams	1.0	Caribou meat	2.2	Bird eggs	0.38	Saskatoon berry	2.3	Maple syrup	0.9	Morel	0.1		
5	Trout	2.1	Shrimp	1.0	Moose liver	1.2	Gray partridge	0.18	Huckleberry	2.1	Wild rice	0.7				
Pacific Maritime (n=486)																
1	Salmon	61.9	Seaweed	15.2	Moose meat	12.4	Grouse	0.4	Blackberry	12.7	Balsam tree inner bark	3.8	Pine	1.6		
2	Eulachon/ grease	22.6	Prawn	8.5	Deer meat	8.0	Ducks	0.1	Blueberry	7.9	Labrador tea	1.8	Chanterelle	1.0		
3	Halibut	15.5	Crab	8.4	Elk meat	3.8	Geese	0.1	Salmonberry	7.1	Berry shoots	0.7	Oyster	0.1		
4	Fish eggs	13.6	Clams	7.9	Deer liver	1.2			Huckleberry	4.5	Stinging nettle leaves	0.6	Morel	0.1		
5	Rockfish	3.9	Shrimp	6.4	Moose liver	0.7			Soapberry	3.3	Balsam root	0.4	Cottonwood	0.0		
Boreal Cordillera (n=80)																
1	Salmon	55.5	Seaweed	1.3	Moose meat	109.1	Grouse	4.6	Blueberry	7.3	Labrador tea leaves	0.8	Pine	1.3		
2	Trout	9.6	Crab	1.1	Moose kidney	8.0	Ptarmigan	1.1	Soapberry	6.6	Balsam root	0.8				
3	Fish eggs	4.7	Clams	0.8	Caribou meat	7.5	Geese	0.2	Huckleberry	4.2	Fireweed shoots	0.1				
4	Eulachon/ grease	1.5	Oysters	0.6	Black bear fat	6.2	Ducks	0.1	Cranberry (low, bog)	2.9	Cow-parsnip shoots	0.0				
5	Halibut	1.3	Prawn	0.5	Moose liver	5.7	Bird eggs	0.0	Highbush cranberry	2.8	Stinging nettle leaves	0.0				

	FISH		SEAFOOD		LAND ANIMAL		BIRD		BERRY		PLANTS		MUSHROOM		CULTIVATED PLANTS	
	Food	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**
Montane Cordillera (n=313)																
1	Salmon	23.7	Shrimp	2.2	Moose meat	45.7	Grouse	3.0	Huckleberry	20.0	Labrador tea leaves	10.9	Cottonwood	1.8		
2	Trout	5.6	Prawn	2.1	Deer meat	41.4	Geese	0.1	Soapberry	12.3	Bitterroot	0.9	Morel	1.3		
3	Fish eggs	4.4	Oysters	1.5	Elk meat	10.9	Duck	0.0	Saskatoon berry	5.9	Stinging nettle leaves	0.7	Pine	1.1		
4	Ling Cod	2.7	Crab	1.1	Deer liver	4.9	Ptarmigan	0.0	Blueberry	4.7	Indian potato (Spring beauty)	0.6	Chanterelle	0.7		
5	Eulachon/ grease	1.7	Mussels	0.8	Moose liver	2.3	Bird eggs	0.0	Strawberry	4.2	Wild onion	0.5	Oyster	0.4		
Taiga Plains (n=152)																
1	Northern pike	15.9	Oysters	0.1	Moose meat	95.6	Ducks	78.3	Saskatoon berry	9.5	Mint leaves	15.0				
2	Walleye	6.5	Crab	0.1	Rabbit/hare	10.6	Grouse	19.0	Chokecherry	8.7	Rat root	14.9				
3	Whitefish	3.1			Black bear meat	5.3	Geese	13.3	Raspberry	6.1	Spruce pitch	0.6				
4	Salmon	2.0			Beaver meat	4.9	Ptarmigan	2.4	Strawberry	6.0	Cow-parsnip shoots	0.6				
5	Trout	1.6			Moose liver	3.8	Bird eggs	2.3	Blueberry	4.6	Balsam pitch	0.4				
Boreal Plains (n=1,248)																
1	Walleye	4.0			Moose meat	28.2	Ducks	3.7	Blueberry	4.3	Mint leaves	5.8			Corn/ hominy	0.2
2	Northern pike	3.0			Deer meat	5.3	Grouse	1.6	Saskatoon berry	3.2	Rat root	4.2				
3	Whitefish	1.6			Elk meat	3.4	Geese	0.8	Raspberry	2.9	Labrador tea leaves	2.8				
4	Sucker	0.6			Moose liver	1.7	Gray partridge	0.2	Strawberry	2.2	Sweetgrass tea	1.6				
5	Trout	0.6			Moose kidney	1.6	Bird eggs	0.1	Chokecherry	0.8	Juniper tea	0.1				

	FISH		SEAFOOD		LAND ANIMAL		BIRD		BERRY		PLANTS		MUSHROOM		CULTIVATED PLANTS	
	Food	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**
Prairies (n=577)																
1	Walleye	2.0			Moose meat	7.3	Ducks	2.6	Saskatoon berry	7.4	Rat root	3.1			Corn/ hominy	1.4
2	Northern pike	0.8			Deer meat	6.9	Geese	1.1	Chokecherry	4.5	Mint leaves	2.9			Beans	0.9
3	Whitefish	0.6			Elk meat	4.6	Grouse	0.4	Blueberry	4.3	Labrador tea leaves	1.9			Squash	0.2
4	Trout	0.4			Rabbit/hare	1.3	Gray partridge	0.1	Raspberry	4.3	Sweetgrass (tea)	1.9				
5	Yellow Perch	0.4			Bison meat	1.1			Strawberry	2.7	Sage	1.4				
Boreal Shield (n=1317)																
1	Walleye (Pickerel)	14.8			Moose meat	20.4	Geese	6.0	Blueberry	9.9	Wild rice	1.8			Corn/ hominy	0.3
2	Whitefish	6.0			Caribou meat	3.4	Ducks	3.6	Raspberry	3.6	Cedar tea	1.6			Beans	0.2
3	Northern pike	3.2			Deer meat	2.6	Grouse	1.6	Strawberry	2.9	Mint leaves	1.5			Squash	0.1
4	Trout, all	2.6			Moose liver	2.0	Ptarmigan	1.3	Cranberry (low, bog)	1.2	Labrador tea leaves	1.3				
5	Sturgeon	1.4			Rabbit/hare	1.7	Partridge	0.4	Crabapple	0.7	Rat root	1.0				
Taiga Shield (n=272)																
1	Trout	14.4	Lobster	0.1	Caribou meat	46.2	Geese	22.3	Blueberry	8.5	Labrador tea leaves	54.2				
2	Whitefish	7.9	Shrimp	0.1	Black bear fat	6.8	Ptarmigan	12.5	Cranberry (low, bog)	2.1	Rat root	0.2				
3	Northern pike	1.6	Mussels	0.1	Moose meat	2.2	Grouse	5.7	Cloudberry	1.9	Wild rice	0.2				
4	Walleye	1.2			Caribou kidney	2.0	Ducks	0.9	Blackberry	0.6	Wild leek	0.2				
5	Sucker	0.8			Black bear meat	1.9	Merganser	0.2	Raspberry	0.5	Tamarack bark tea	0.2				

	FISH		SEAFOOD		LAND ANIMAL		BIRD		BERRY		PLANTS		MUSHROOM		CULTIVATED PLANTS	
	Food	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**	**Food**	**Days**
Hudson Plains (n=322)																
1	Walleye	5.2			Moose meat	21.2	Geese	39.5	Blueberry	3.1	Labrador tea leaves	3.9				
2	Northern pike	3.9			Caribou meat	4.4	Ducks	3.8	Cranberry (low, bog)	1.4	Cedar tea	0.1				
3	Whitefish	2.9			Rabbit/hare	3.0	Grouse	1.0	Raspberry	0.7						
4	Cisco	2.0			Beaver meat	1.9	Ptarmigan	0.8	Highbush cranberry	0.7						
5	Sturgeon	1.1			Moose kidney	0.9	Partridge	0.8	Soapberry	0.7						
Mixedwood Plains (n=681)																
1	Walleye	2.6			Deer meat	7.2	Ducks	0.2	Strawberry	4.3	Maple syrup	6.2			Corn/ hominy	12.5
2	Yellow Perch	2.1			Moose meat	2.4	Wild turkey	0.2	Raspberry	3.9	Rat root	2.0			Beans	9.0
3	Salmon	0.9			Rabbit, hare	0.3	Pheasant	0.1	Blueberry	3.8	Wild leek	1.2			Squash	6.5
4	Bass (small and large mouth)	0.7			Elk meat	0.2	Partridge	0.1	Blackberry	1.4	Labrador tea leaves	0.8				
5	White perch	0.6			Deer liver	0.2			Black raspberry/ caps	1.1	Mint leaves	0.6				
Atlantic Maritime (n=1039)																
1	Salmon	3.0			Moose meat	12.1	Grouse	0.2	Blueberry	6.6	Wild onion	0.7	Beans	2.6		
2	Haddock	2.9			Deer meat	2.1			Strawberry	4.7	Gold thread root tea	0.7	Corn / hominy	2.2		
3	Trout	2.4			Rabbit, hare	0.2			Raspberry	2.9	Mint leaves	0.6	Squash	1.1		
4	Smelt	1.4			Moose liver	0.1			Blackberry	2.0	Dandelions	0.5				
5	Cod	1.3			Deer liver	0.1			Crabapple	0.7	Rat root	0.4				

Appendix D. Portion weight by category by region and total (consumers only)

Traditional food category	Region	Number of mentions on 24hr recalls	Mean (grams)	SD	SE	Median (grams)	Minimum (grams)	Maximum (grams)
Fish	BC	207	124	104	7	98	2	960
	AB	9	161	111	37	119	44	392
	SK	70	231	234	28	153	5	1422
	MB	24	155	157	32	105	32	750
	ON	67	221	184	22	176	32	989
	QC	10	106	47	15	114	33	183
	AT	14	124	59	16	110	30	246
	Average	401	161	157	8	119	2	1422
Seafood (includes shellfish, sea mammals, crustaceans)	BC	23	124	131	27	75	29	650
	QC	1	90	.	.	90	90	90
	AT	18	143	159	38	70	25	590
	Average	42	131	141	22	75	25	650
Seaweed (dried weight)	BC	8	8	7	2	5	2	20
	AT	1	1	.	.	1	1	1
	Average	9	7	7	2	5	1	20
Game meat	BC	291	168	171	10	118	5	1500
	AB	145	151	147	12	119	12	948
	SK	336	164	133	7	120	5	714
	MB	134	203	144	12	178	2	711
	ON	153	207	154	12	184	19	948
	QC	87	137	102	11	119	10	474
	AT	74	196	168	20	133	27	948
	Average	1220	173	150	4	120	2	1500

Traditional food category	Region	Number of mentions on 24hr recalls	Mean (grams)	SD	SE	Median (grams)	Minimum (grams)	Maximum (grams)
Game organs	BC	8	75	59	21	71	1	148
	AB	3	71	27	16	71	44	98
	SK	18	102	70	17	71	22	269
	MB	6	132	89	36	96	49	249
	ON	3	126	31	18	119	100	160
	QC	6	62	41	17	58	18	119
	AT	2	124	93	66	124	58	190
	Average	46	97	66	10	73	1	269
Game fat	BC	6	68	82	34	35	10	225
	AB	3	31	29	16	31	3	60
	SK	5	36	26	12	51	5	60
	MB	3	42	52	30	15	10	103
	ON	1	43	.	.	43	43	43
	QC	1	39	.	.	39	39	39
	Average	19	47	51	12	39	3	225
Wild birds	BC	1	75	.	.	75	75	75
	AB	11	161	200	60	72	9	711
	SK	32	152	106	19	119	22	474
	MB	11	239	260	78	119	76	948
	ON	13	331	557	154	130	10	2119
	QC	21	143	130	28	105	3	593
	AT	2	25	0	0	25	25	25
	Average	91	183	257	27	119	3	2119

Traditional food category	Region	Number of mentions on 24hr recalls	Mean (grams)	SD	SE	Median (grams)	Minimum (grams)	Maximum (grams)
Berries	BC	49	49	53	8	31	3	260
	AB	2	91	45	32	91	59	123
	SK	11	39	48	14	21	2	152
	MB	8	165	138	49	128	2	436
	QC	9	70	63	21	72	2	177
	AT	6	23	7	3	26	12	30
	Average	85	60	72	8	31	2	436
Wild plants	SK	10	106	85	27	79	31	313
	MB	5	279	110	49	329	82	329
	ON	13	123	142	39	103	22	533
	QC	1	205	.	.	205	205	205
	AT	2	213	100	71	213	142	284
	Average	31	151	128	23	103	22	533
Teas (dried weight)	BC	27	1.6	1	0.3	1	1	6
	AB	16	1.1	0	0.1	1	1	2
	SK	17	1.5	1	0.1	1	1	2
	MB	4	2.8	4	2	1	1	8
	ON	9	1.6	1	0.2	2	1	2
	QC	25	1.7	1	0.2	1.5	1	4
	AT	1	2	.	.	2	2	2
	Average	99	1.6	1	0.1	1	1	8
Tree foods	ON	5	82	38	17	82	20	122
	QC	2	138	0	0	138	138	138
	AT	4	38	3	2	38	35	41
	Average	11	76	44	13	82	20	138
Mushrooms	BC	2	45	5	4	45	41	48
	Average	2	45	4	5	45	41	48

Appendix E. Barriers to obtaining traditional food in each ecozone ranked by percentage of all responses*

Pacific Maritime (n=632)		Boreal Cordillera (n=60)		Montane Cordillera (n=346)		Taiga Plains (n=148)	
Barrier	% of total	Barrier	% of total	Barrier	% of total	Barrier	% of total
Lack of resources (money/ equipment)	16.8	No hunter	25.4	Lack of resources (money/ equipment)	28.1	Lack of resources (money/ equipment)	28.1
Availability	15.8	Lack of resources (money/ equipment/transportation)	22.0	Lack of time	18.3	Time	19.4
Time	11.2	Time	11.9	Lack of hunter	15.1	No hunter	14.4
Access issues	10.9	Motivation	8.5	Lack of knowledge	6.8	Govt/FAC regulations	12.2
Govt/FAC regulations	8.9	Govt/FAC regulations	6.8	Govt/FAC regulations	6.5	Access issues	6.5
Knowledge gap	8.4	Access issues	6.8	Availability	5.3	Physical/health reasons	4.3
No hunter	8.1	Availability	6.8	Physical/health reasons	4.7	Availability	2.9
Physical/health reasons	4.8	Knowledge gap	1.7	Access issues	4.7	Knowledge gap	2.2
Lack of money to buy	2.0	Physical/health	1.7	Lack of money to buy	1.2	Industry activity	1.4
Contamination	1.2	Preferences	1.7	Preferences	1.2	Motivation	1.4

*Barriers are based on responses provided to the following question: Can you tell me what prevents your household from using more traditional food?

Boreal Plains (n=1,178)		Prairies (n=620)		Boreal Shield (n=1097)		Taiga Shield (n=211)	
Barrier	% of total	Barrier	% of total	Barrier	% of total	Barrier	% of total
No hunter	25.3	No hunter	29.7	No hunter	18.0	Lack of resources (money/ equipment)	24.4
Lack of resources (money/ equipment)	19.3	Lack of resources (money/ equipment)	17.1	Lack of resources (money/ equipment)	17.7	No hunter	22.6
Time	16.4	Time	11.3	Time	16.4	Time	17.1
Govt/FAC regulations	7.3	Govt/FAC regulations	10.1	Knowledge gap	8.0	Availability	7.3
Availability	6.0	Knowledge gap	6.1	Physical/health reasons	7.9	Physical/health reasons	6.1
Knowledge gap	5.0	Availability	5.1	Availability	5.9	Access issues	4.9
Physical/health reasons	4.9	Access issues	4.5	Access issues	5.5	Govt/FAC regulations	3.0
Access issues	4.6	Physical/health reasons	3.7	Govt/FAC regulations	5.2	Lack of money to buy	2.4
Preference	1.8	Preference	2.7	Preference	3.1	Preference	1.8
Motivation	1.4	Contamination concerns	2.3	Motivation	1.8	Industry activity	1.2

Hudson Plains (n=337)		Mixedwood Plains (n=646)		Atlantic Maritime (n=723)	
Barrier	% of total	Barrier	% of total	Barrier	% of total
Time	27.9	Time	22.6	Time	16.1
Lack of resources (money/ equipment)	25.1	No hunter	12.5	No hunter	15.4
No hunter	18.7	Knowledge gap	11.2	Knowledge gap	10.6
Physical/health reasons	7.1	Availability	10.7	Lack of resources (money/ equipment)	10.4
Access issues	4.9	Pesticides/contamination	6.9	Access issues	8.9
Seasonal	4.2	Access issues	5.5	Availability	8.0
Govt/FAC regulations	2.5	Physical/health reasons	5.2	Physical/health reasons	6.5
Knowledge gap	1.8	Lack of resources (money/ equipment)	4.3	Preference	5.5
Lack of sharing	1.1	Lack of garden space	4.1	Lack of sharing	4.8
Lack of childcare	1.1	Motivation	2.5	Motivation	3

Appendix F. Predictors of traditional food intake

Effect	Parameter	ParamEffect	ParamEffectSE	peffect	Estimate	Standard Error	Average
Region	BC	0.00	0.00	.	13.78	1.30	189.99
	AB	-3.03	1.01	0.00	10.75	1.33	115.59
	SK	-2.01	1.19	0.09	11.77	1.47	138.53
	MB	-3.45	1.24	0.01	10.34	1.43	106.83
	ON	-5.41	1.64	0.00	8.37	1.40	70.10
	QC	-3.33	2.12	0.12	10.46	1.84	109.33
	AT	-5.56	1.94	0.00	8.23	1.77	67.69
Ecozone	Pacific Maritime	-4.00	1.80	0.03	12.31	1.91	151.61
	Boreal Cordillera	-3.25	1.46	0.03	13.06	1.71	170.53
	Montane Cordillera	-4.13	2.65	0.12	12.18	2.78	148.43
	Taiga Plains	0.00	0.00	.	16.31	2.07	266.13
	Boreal Plains	-7.96	1.82	0.00	8.36	1.28	69.86
	Prairies	-8.85	1.80	0.00	7.46	1.56	55.72
	Boreal Shield	-6.47	2.18	0.00	9.84	1.23	96.91
	Taiga Shield	-7.03	5.40	0.19	9.29	5.12	86.23
	Hudson Plains	-8.63	2.85	0.00	7.69	1.44	59.08
	Mixedwood Plains	-6.81	2.29	0.00	9.50	1.31	90.23
	Atlantic Maritime	-6.51	2.49	0.01	9.80	1.53	96.09
Yr Round Road	No	1.47	2.30	0.52	11.26	2.15	126.86
	Yes	0.00	0.00	.	9.79	0.70	95.90
# FT work	0 FT	0.47	0.38	0.22	10.71	1.14	114.77
	1 FT	0.38	0.40	0.34	10.63	1.14	112.94
	2+FT	0.00	0.00	.	10.24	1.12	104.95
HH TF Activities	Yes	0.00	0.00	.	12.53	1.12	157.05
	No	-4.01	0.32	0.00	8.52	1.12	72.67

Effect	Parameter	ParamEffect	ParamEffectSE	peffect	Estimate	Standard Error	Average
Income	Wages	-0.37	0.52	0.48	9.97	1.07	99.34
	Social assistance	-0.15	0.59	0.80	10.18	1.07	103.68
	Pension	0.91	0.48	0.06	11.25	1.12	126.47
	Workers comp/EI	0.00	0.00	.	10.33	1.17	106.76
	Other	0.58	1.32	0.66	10.91	1.61	119.10
Age group	19-30	-3.25	0.87	0.00	8.93	1.04	79.72
	31-50	-2.19	0.75	0.00	9.99	1.04	99.83
	51-70	-1.17	0.64	0.07	11.01	1.17	121.28
	71+	0.00	0.00	.	12.18	1.40	148.35
Body Mass Index	Normal weight	0.00	0.00	.	10.04	1.17	100.82
	Overweight	0.50	0.38	0.18	10.54	1.10	111.13
	Obese	0.96	0.35	0.01	11.00	1.10	121.04
Yrs of Education	8 or less	0.36	0.40	0.37	10.43	1.15	108.85
	9 to 12	0.00	0.00	.	10.08	1.13	101.51
	13 or more	1.00	0.31	0.00	11.08	1.12	122.67
Gender	Female	-1.10	0.35	0.00	9.98	1.10	99.58
	Male	0.00	0.00	.	11.08	1.14	122.71
Health	Poor	-0.67	0.37	0.07	10.26	1.13	105.29
	Good	-0.54	0.38	0.16	10.39	1.09	108.02
	Very good to excellent	0.00	0.00	.	10.93	1.16	119.46
	HHSIZE	0.14	0.08	0.09	.	.	.
	Foodbasket cost	0.02	0.01	0.20			

Tables G.1 to G.37. Distribution of usual nutrient intake

Table G.1 Total energy intake (kcal/d): Usual intakes from food, by DRI age-sex group, household population[1]

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1385	2298 (53)	1473 (67)	1624 (61)	1900 (54)	2244 (57)	2632 (79)	3023 (113)	3277 (137)
	51-70	680	1948 (70)	1069 (72)	1222 (68)	1515 (68)	1904 (77)	2342 (92)	2782 (118)	3076 (142)
	71+	126	1761 (146)	1521 (190)	1568 (181)	1648 (173)	1739 (178)	1832 (198)	1919 (228)	1971 (253)
Female	19-50	2661	1864 (39)	1349 (75)	1448 (65)	1622 (50)	1834 (44)	2067 (59)	2298 (87)	2446 (109)
	51-70	1131	1669 (61)	1254 (123)	1340 (111)	1491 (91)	1672 (73)	1870 (70)	2066 (91)	2192 (113)
	71+	218	1664 (81)	1238 (67)	1319 (68)	1464 (70)	1638 (75)	1826 (83)	2006 (92)	2119 (98)

Notes:

In Tables G.1 to G.37 the following symbol, (-) indicates data have a coefficient of variation (CV) >33.3% and as such, are suppressed due to extreme sampling variability

[1] The SIDE SAS sub-routine nutrient analyses were performed on data from a total of 6201 participants (4010 women and 2191 men) to obtain the distribution (percentiles) of usual intake. Nutrient data for 286 individuals were excluded: 245 pregnant and/or lactating women due to different nutrient requirements for these groups; 27 participants with missing age and age group values; and 14 participants with zero kcal intake.

Table G.2 Protein (g/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1385	100 (3)	67 (6)	73 (6)	84 (4)	98 (4)	114 (5)	130 (8)	140 (10)
	51-70	680	91 (4)	56 (7)	62 (6)	73 (5)	88 (4)	106 (4)	125 (7)	139 (10)
	71+	126	97 (10)	64 (8)	69 (9)	79 (11)	93 (12)	110 (14)	128 (15)	139 (16)
Female	19-50	2661	76 (2)	51 (3)	56 (3)	65 (2)	75 (2)	87 (3)	99 (4)	107 (5)
	51-70	1131	75 (4)	51 (3)	56 (4)	64 (4)	75 (4)	86 (5)	98 (6)	106 (6)
	71+	218	76 (6)	50 (5)	55 (5)	63 (5)	73 (6)	85 (7)	98 (8)	107 (9)

Table G.3 Total carbohydrates (g/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	%<EAR
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)		(95% CI)
Male	19-50	1385	274 (7)	157 (8)	179 (7)	218 (7)	268 (8)	324 (11)	381 (15)	419 (19)	100	(-)
	51-70	680	226 (12)	125 (11)	143 (10)	175 (10)	218 (12)	272 (18)	330 (26)	369 (32)	100	(-)
	71+	126	188 (12)	110 (10)	123 (11)	149 (13)	181 (16)	213 (17)	241 (19)	260 (21)	100	(-)
Female	19-50	2661	225 (5)	139 (8)	155 (7)	183 (7)	218 (6)	257 (7)	297 (9)	323 (11)	100	(-)
	51-70	1131	197 (7)	140 (18)	152 (16)	172 (13)	197 (9)	224 (8)	252 (11)	270 (15)	100	(-)
	71+	218	194 (10)	133 (7)	144 (8)	164 (9)	190 (10)	218 (12)	245 (14)	263 (16)	100	(-)

Table G.4 Total fats (g/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1385	92 (2)	52 (4)	59 (4)	71 (3)	88 (3)	107 (3)	126 (5)	139 (7)
	51-70	680	77 (3)	38 (4)	45 (3)	57 (3)	73 (3)	93 (4)	115 (6)	129 (8)
	71+	126	71 (7)	60 (10)	62 (10)	66 (9)	70 (10)	74 (11)	78 (13)	80 (15)
Female	19-50	2661	76 (2)	57 (5)	61 (4)	68 (3)	76 (2)	84 (3)	93 (5)	98 (7)
	51-70	1131	66 (2)	48 (5)	51 (4)	58 (3)	66 (3)	75 (4)	84 (6)	90 (8)
	71+	218	66 (4)	50 (3)	53 (4)	59 (4)	65 (4)	73 (5)	80 (6)	84 (6)

Table G.5 Total saturated fats (g/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1385	30 (1)	18 (2)	20 (2)	24 (1)	29 (1)	34 (1)	40 (2)	43 (3)
	51-70	680	24 (1)	12 (1)	14 (1)	18 (1)	23 (1)	29 (1)	36 (2)	41 (3)
	71+	126	22 (2)	12 (3)	13 (3)	16 (3)	21 (3)	25 (3)	30 (4)	34 (4)
Female	19-50	2661	24 (1)	17 (1)	18 (1)	21 (1)	24 (1)	27 (1)	31 (1)	33 (2)
	51-70	1131	21 (1)	15 (2)	16 (1)	18 (1)	21 (1)	24 (1)	27 (2)	28 (3)
	71+	218	20 (1)	13 (2)	14 (2)	16 (1)	19 (1)	22 (1)	25 (2)	27 (2)

Table G.6 Total monounsaturated fats (g/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1385	36 (1)	18 (1)	21 (1)	27 (1)	34 (1)	42 (1)	51 (2)	57 (3)
	51-70	680	30 (1)	16 (2)	18 (2)	23 (2)	28 (1)	36 (2)	43 (3)	48 (4)
	71+	126	28 (3)	16 (3)	18 (3)	22 (3)	27 (3)	32 (4)	37 (4)	41 (5)
Female	19-50	2661	29 (1)	26 (2)	26 (2)	28 (1)	29 (1)	31 (1)	32 (2)	33 (2)
	51-70	1131	26 (1)	18 (2)	19 (2)	22 (2)	26 (1)	29 (2)	33 (3)	36 (4)
	71+	218	26 (2)	21 (2)	22 (2)	24 (2)	27 (2)	29 (2)	31 (3)	33 (3)

Table G.7 Total polyunsaturated fats (g/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1385	18 (1)	10 (1)	11 (1)	14 (1)	17 (1)	21 (1)	25 (1)	28 (2)
	51-70	680	15 (1)	7 (1)	8 (1)	10 (1)	14 (1)	18 (1)	23 (1)	27 (2)
	71+	126	14 (2)	9 (2)	10 (2)	11 (2)	14 (2)	16 (2)	19 (3)	20 (3)
Female	19-50	2661	16 (1)	12 (1)	13 (1)	14 (1)	15 (1)	17 (1)	19 (1)	20 (2)
	51-70	1131	13 (0.5)	9 (1)	10 (1)	11 (1)	13 (1)	15 (1)	17 (2)	19 (2)
	71+	218	14 (1)	11 (1)	11 (1)	13 (1)	14 (1)	16 (1)	17 (2)	18 (2)

Table G.8 Linoleic acid (g/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							AI	% > AI (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)		
Male	19-50	1385	14.4 (0.5)	7.7 (0.9)	8.8 (0.8)	10.9 (0.7)	13.7 (0.5)	17 (0.7)	20.5 (1.2)	22.9 (1.6)	17	25 (14.8-32.9)
	51-70	680	11.6 (0.6)	4.7 (0.7)	5.6 (0.7)	7.6 (0.6)	10.6 (0.6)	14.2 (0.8)	18.3 (1.3)	21.1 (1.7)	14	26.3 (15.5-33.4)
	71+	126	11.2 (1.5)	7.6 (1.8)	8.3 (1.8)	9.5 (1.8)	11.2 (1.8)	13.1 (2)	14.9 (2.3)	16.1 (2.6)	14	(-)
Female	19-50	2661	12.1 (0.4)	9.1 (0.3)	9.6 (0.3)	10.7 (0.4)	12 (0.4)	13.4 (0.5)	14.7 (0.5)	15.6 (0.5)	12	49.6 (34.1-64.1)
	51-70	1131	10.5 (0.4)	6.4 (0.8)	7.1 (0.7)	8.3 (0.6)	10.0 (0.5)	12.2 (0.7)	14.5 (1.2)	16.0 (1.5)	11	37.6 (21.2-53.4)
	71+	218	11.4 (1.2)	9.0 (1.0)	9.5 (1.0)	10.4 (1.1)	11.5 (1.2)	12.6 (1.3)	13.8 (1.5)	14.5 (1.6)	11	61.3 (7.6-93.2)

Table G.9 Linolenic acid (g/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							AI	% > AI (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)		
Male	19-50	1385	1.6 (0.1)	0.6 (0.1)	0.8 (0.1)	1.1 (0.1)	1.5 (0.1)	2.0 (0.1)	2.6 (0.1)	3 (0.2)	1.6	41.7 (33.7-49)
	51-70	680	1.6 (0.1)	0.6 (0.1)	0.7 (0.1)	1.0 (0.1)	1.4 (0.1)	2.0 (0.1)	2.7 (0.2)	3.2 (0.3)	1.6	39.8 (29.4-47.5)
	71+	126	1.5 (0.2)	0.9 (0.2)	1 (0.2)	1.2 (0.2)	1.4 (0.2)	1.7 (0.3)	2.1 (0.4)	2.3 (0.5)	1.6	(-)
Female	19-50	2661	1.4 (0.1)	0.9 (0.1)	1.0 (0.1)	1.1 (0.1)	1.4 (0.1)	1.6 (0.1)	1.9 (0.2)	2.0 (0.2)	1.1	78.4 (63.1-99.7)
	51-70	1131	1.4 (0.1)	0.8 (0.1)	0.9 (0.1)	1.1 (0.1)	1.4 (0.1)	1.6 (0.1)	1.9 (0.2)	2.1 (0.3)	1.1	76.6 (59.4-98.3)
	71+	218	1.4 (0.1)	0.9 (0.2)	1.0 (0.2)	1.2 (0.2)	1.4 (0.1)	1.6 (0.2)	1.9 (0.3)	2.0 (0.5)	1.1	81.6 (43.6-99.9)

Table G.10 Cholesterol (mg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1385	403 (22)	194 (36)	227 (35)	293 (31)	381 (27)	483 (30)	582 (39)	645 (48)
	51-70	680	348 (13)	180 (36)	207 (33)	260 (25)	330 (17)	410 (23)	489 (41)	539 (54)
	71+	126	422 (35)	311 (62)	339 (57)	389 (48)	446 (44)	505 (53)	558 (73)	591 (90)
Female	19-50	2661	300 (12)	193 (30)	214 (26)	251 (21)	299 (15)	352 (18)	406 (29)	441 (38)
	51-70	1131	282 (11)	133 (15)	158 (14)	207 (13)	273 (14)	352 (19)	434 (27)	486 (32)
	71+	218	297 (29)	173 (25)	194 (26)	233 (29)	283 (33)	341 (38)	400 (48)	439 (56)

Table G.11 Total sugars (g/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1385	94 (4)	46 (6)	55 (5)	71 (4)	91 (4)	115 (6)	139 (9)	155 (11)
	51-70	680	76 (8)	32 (7)	38 (7)	51 (7)	70 (7)	95 (11)	124 (18)	145 (24)
	71+	126	50 (4)	18 (6)	21 (5)	30 (5)	42 (5)	58 (6)	76 (9)	89 (13)
Female	19-50	2661	77 (3)	32 (3)	39 (3)	52 (3)	71 (3)	94 (4)	119 (6)	136 (7)
	51-70	1131	65 (3)	32 (8)	37 (8)	48 (6)	62 (5)	78 (4)	97 (6)	109 (9)
	71+	218	54 (5)	30 (8)	34 (8)	41 (7)	50 (6)	61 (7)	74 (11)	82 (15)

Table G.12 Total dietary fibre (g/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							AI	% > AI (95% CI)
			5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)			
Male	19-50	1385	14.6 (0.4)	9.8 (1)	10.7 (0.9)	12.4 (0.6)	14.3 (0.4)	16.6 (0.6)	18.8 (1.1)	20.3 (1.5)	38	0 (0-0)
	51-70	680	14.4 (0.9)	5.7 (0.5)	6.9 (0.6)	9.5 (0.7)	13.1 (0.9)	17.8 (1.2)	22.9 (1.6)	26.4 (1.8)	30	(-)
	71+	126	13.3 (1.5)	6.5 (1.7)	7.6 (1.7)	9.6 (1.7)	12.3 (1.7)	15.4 (1.9)	18.7 (2.5)	20.9 (3.1)	30	(-)
Female	19-50	2661	12.4 (0.3)	6.7 (0.6)	7.6 (0.5)	9.5 (0.4)	12 (0.3)	14.8 (0.4)	17.8 (0.7)	19.8 (0.9)	25	(-)
	51-70	1131	12.5 (0.5)	6.9 (0.8)	7.9 (0.8)	9.8 (0.7)	12.2 (0.7)	15 (0.7)	18 (0.9)	20 (1.1)	21	(-)
	71+	218	13.2 (0.7)	9 (1.6)	9.8 (1.5)	11.3 (1.1)	13.1 (0.9)	14.9 (1)	16.7 (1.5)	17.8 (1.9)	21	(-)

Table G.13 Vitamin A (RAE/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	%<EAR (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)		
Male	19-50	1385	491 (25)	299 (54)	332 (48)	395 (38)	477 (29)	572 (33)	670 (55)	734 (73)	625	84.4 (75-99.8)
	51-70	680	515 (31)	193 (47)	242 (47)	341 (44)	493 (45)	740 (75)	1024 (137)	1236 (194)	625	65.2 (55.9-85.5)
	71+	126	537 (61)	280 (74)	328 (70)	408 (66)	500 (66)	649 (80)	825 (117)	967 (156)	625	71.8 (45.6-100)
Female	19-50	2661	430 (16)	224 (32)	259 (29)	319 (23)	405 (19)	522 (25)	650 (46)	739 (64)	500	71.2 (64.1-85.8)
	51-70	1131	511 (38)	209 (43)	247 (41)	321 (37)	438 (35)	614 (45)	849 (90)	1038 (142)	500	60.8 (45-70.4)
	71+	218	579 (144)	245 (81)	281 (82)	355 (87)	474 (112)	669 (172)	967 (317)	(-)	500	54.5 (6.3-87.2)

Table G.14 Vitamin C (mg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	% < EAR (95% CI)	UL	% > UL (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)				
Male	19-50	1385	92 (6)	30 (10)	38 (10)	54 (8)	78 (7)	115 (9)	159 (18)	192 (26)	75	47 (21.6-56.7)	2000	0 (0-0)
	51-70	680	78 (13)	16 (5)	22 (6)	36 (8)	61 (12)	105 (19)	167 (29)	219 (40)	75	60 (38.9-76.3)	2000	0 (0-0)
	71+	126	41 (6)	(-)	(-)	20 (6)	30 (6)	45 (10)	(-)	(-)	75	93.7 (77.5-100)	2000	0 (0-0)
Female	19-50	2661	79 (4)	30 (5)	38 (5)	51 (5)	73 (5)	104 (6)	140 (10)	166 (14)	60	35.6 (24.5-46.9)	2000	0 (0-0)
	51-70	1131	69 (7)	(-)	28 (8)	41 (8)	63 (8)	93 (10)	130 (15)	158 (21)	60	47.1 (27.3-62.2)	2000	0 (0-0)
	71+	218	59 (12)	22 (5)	27 (6)	38 (8)	53 (12)	75 (17)	101 (23)	120 (28)	60	59 (27.8-92.7)	2000	0 (0-0)

Table G.15 Vitamin C (mg/d): Usual intakes from food (by smoking status)

Sex	Status	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	% < EAR (95% CI)	UL	% > UL (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)				
Males 19+	Non-smoker	1053	80 (7)	(-)	23 (6)	38 (7)	65 (8)	108 (9)	166 (15)	212 (20)	75	57.6 (41.8-67.1)	2000	0 (0-0)
	Smoker	1148	90 (8)	28 (7)	37 (7)	51 (7)	72 (7)	111 (12)	159 (22)	197 (31)	110	74.8 (65-87.8)	2000	0 (0-0)
Females 19+	Non-smoker	1827	82 (5)	40 (9)	46 (8)	59 (7)	79 (6)	105 (8)	134 (14)	155 (20)	60	25.9 (3.9-41.7)	2000	0 (0-0)
	Smoker	2198	70 (5)	20 (3)	27 (3)	41 (4)	61 (4)	94 (7)	134 (12)	164 (17)	95	75.7 (68.5-83.6)	2000	0 (0-0)

Table G.16 Vitamin D (μg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	% < EAR (95% CI)	UL	% > UL (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)				
Male	19-50	1385	4.3 (0.3)	2.1 (0.5)	2.4 (0.5)	3 (0.5)	4 (0.5)	5.3 (0.6)	6.8 (1)	7.9 (1.4)	10	98.7 (94.4-100)	100	0 (0-0)
	51-70	680	5.1 (0.5)	3.3 (0.9)	3.6 (0.9)	4.4 (0.8)	5.3 (0.7)	6.5 (0.7)	7.6 (1.2)	8.4 (1.8)	10	98.8 (88.9-100)	100	0 (0-0)
	71+	126	6.5 (0.9)	(-)	3.8 (1.2)	4.9 (1.1)	6.4 (1.2)	8.5 (1.8)	10.9 (2.7)	12.6 (3.7)	15	98.1 (87.8-100)	100	0 (0-0)
Female	19-50	2661	3.7 (0.3)	1.9 (0.4)	2.2 (0.4)	2.7 (0.3)	3.6 (0.3)	4.6 (0.4)	5.7 (0.6)	6.5 (0.9)	10	99.8 (98.5-100)	100	0 (0-0)
	51-70	1131	3.6 (0.3)	1.4 (0.4)	1.8 (0.5)	2.5 (0.5)	3.5 (0.5)	4.7 (0.5)	6.1 (0.7)	7.1 (1)	10	99.2 (96.5-100)	100	0 (0-0)
	71+	218	5.9 (0.9)	(-)	(-)	3.3 (1)	4.9 (1)	7.5 (1.2)	11.1 (2.1)	14.2 (3.1)	15	95.8 (91.1-100)	100	0 (0-0)

Table G.17 Folate (DFE/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	%<EAR (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)		
Male	19-50	1385	400 (13)	257 (30)	283 (27)	329 (20)	387 (15)	453 (19)	520 (31)	564 (42)	320	21.5 (1.3-32.3)
	51-70	680	372 (19)	215 (24)	244 (23)	296 (21)	363 (21)	443 (27)	526 (40)	583 (51)	320	33.9 (18.8-48.9)
	71+	126	348 (34)	185 (48)	211 (45)	263 (41)	326 (39)	395 (46)	470 (70)	526 (93)	320	47.5 (6.2-85.8)
Female	19-50	2661	336 (11)	216 (18)	239 (17)	281 (15)	332 (13)	391 (15)	450 (23)	489 (29)	320	44.0 (30.7-57)
	51-70	1131	324 (20)	196 (23)	218 (22)	261 (21)	318 (21)	388 (24)	463 (32)	514 (39)	320	50.8 (27.7-68.3)
	71+	218	335 (26)	188 (29)	210 (27)	254 (22)	312 (21)	381 (30)	456 (50)	506 (66)	320	(-)

Table G.18 Vitamin B6 (mg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	% < EAR (95% CI)	UL	% > UL (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)				
Male	19-50	1385	1.8 (0.1)	1.2 (0.2)	1.3 (0.2)	1.5 (0.1)	1.8 (0.1)	2.1 (0.1)	2.4 (0.2)	2.6 (0.2)	1.1	(-)	100	0 (0-0)
	51-70	680	1.5 (0.1)	0.7 (0.1)	0.9 (0.1)	1.1 (0.1)	1.4 (0.1)	1.8 (0.1)	2.2 (0.1)	2.5 (0.1)	1.4	49.7 (31.7-62)	100	0 (0-0)
	71+	126	1.6 (0.2)	1.0 (0.2)	1.1 (0.2)	1.3 (0.2)	1.6 (0.3)	1.9 (0.3)	2.2 (0.4)	2.4 (0.4)	1.4	(-)	100	0 (0-0)
Female	19-50	2661	1.4 (0)	0.9 (0.1)	1 (0.1)	1.1 (0)	1.4 (0)	1.6 (0)	1.9 (0.1)	2.1 (0.1)	1.1	21.2 (12.1-28.2)	100	0 (0-0)
	51-70	1131	1.3 (0.1)	0.8 (0.1)	0.9 (0.1)	1.1 (0.1)	1.3 (0.1)	1.5 (0.1)	1.7 (0.1)	1.9 (0.1)	1.3	52.4 (27.3-70.7)	100	0 (0-0)
	71+	218	1.4 (0.1)	0.8 (0.2)	0.9 (0.2)	1.1 (0.1)	1.3 (0.1)	1.6 (0.1)	1.9 (0.2)	2.1 (0.2)	1.3	47 (12-67.3)	100	0 (0-0)

Table G.19 Vitamin B12 (μg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	%<EAR (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)		
Male	19-50	1385	8.1 (0.8)	4.5 (0.9)	4.9 (0.9)	5.7 (0.8)	7.0 (0.7)	8.8 (0.9)	10.9 (1.7)	12.3 (2.5)	2.0	0 (0-0.4)
	51-70	680	7.0 (1.4)	1.8 (0.5)	2.2 (0.6)	3.2 (0.9)	5.4 (1.2)	8.8 (1.8)	13.7 (2.9)	18.1 (4.1)	2.0	(-)
	71+	126	7.3 (1.4)	5.9 (1.3)	6.2 (1.3)	6.8 (1.3)	7.6 (1.4)	8.4 (2)	(-)	(-)	2.0	0 (0-1.3)
Female	19-50	2661	4.5 (0.2)	3.0 (0.5)	3.3 (0.4)	3.8 (0.3)	4.5 (0.3)	5.2 (0.3)	6.1 (0.6)	6.6 (0.8)	2.0	0 (0-1.9)
	51-70	1131	5.7 (1.4)	3.2 (0.7)	3.6 (0.8)	4.4 (0.9)	5.5 (1.1)	6.9 (1.3)	8.4 (1.6)	9.6 (1.7)	2.0	(-)
	71+	218	4.7 (0.6)	(-)	1.9 (0.8)	2.6 (0.8)	3.8 (0.9)	6.1 (1.4)	9.3 (2.5)	11.8 (3.8)	2.0	(-)

Table G.20 Thiamin (mg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	%<EAR (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)		
Male	19-50	1385	1.9 (0.1)	1.2 (0.1)	1.4 (0.1)	1.6 (0.1)	1.9 (0.1)	2.2 (0.1)	2.5 (0.2)	2.8 (0.2)	1.0	(-)
	51-70	680	1.8 (0.1)	0.9 (0.1)	1.0 (0.1)	1.3 (0.1)	1.7 (0.1)	2.2 (0.1)	2.8 (0.1)	3.1 (0.2)	1.0	8.8 (3.9-13.1)
	71+	126	1.6 (0.1)	1.3 (0.2)	1.3 (0.2)	1.5 (0.2)	1.6 (0.2)	1.8 (0.2)	1.9 (0.3)	2.0 (0.4)	1.0	(-)
Female	19-50	2661	1.5 (0.04)	1.0 (0.1)	1.1 (0.1)	1.3 (0.1)	1.5 (0.1)	1.7 (0.1)	2.0 (0.1)	2.1 (0.1)	0.9	(-)
	51-70	1131	1.5 (0.1)	0.8 (0.1)	0.9 (0.1)	1.1 (0.1)	1.4 (0.1)	1.8 (0.1)	2.2 (0.1)	2.5 (0.1)	0.9	(-)
	71+	218	1.6 (0.1)	1.1 (0.1)	1.2 (0.1)	1.4 (0.1)	1.6 (0.1)	1.9 (0.1)	2.2 (0.2)	2.4 (0.2)	0.9	(-)

Table G.21 Riboflavin (mg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	%<EAR
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)		(95% CI)
Male	19-50	1385	2.3 (0.1)	1.6 (0.1)	1.8 (0.1)	2 (0.1)	2.3 (0.1)	2.7 (0.1)	3 (0.2)	3.2 (0.2)	1.1	0 (0-0.5)
	51-70	680	2.1 (0.1)	1.1 (0.1)	1.3 (0.1)	1.6 (0.1)	2 (0.1)	2.5 (0.1)	3 (0.1)	3.3 (0.2)	1.1	(-)
	71+	126	2.0 (0.1)	1.2 (0.2)	1.4 (0.2)	1.6 (0.2)	2.0 (0.2)	2.4 (0.2)	2.8 (0.3)	3.1 (0.4)	1.1	(-)
Female	19-50	2661	1.8 (0.04)	1.1 (0.1)	1.2 (0.1)	1.4 (0.05)	1.7 (0.05)	2.1 (0.1)	2.4 (0.1)	2.7 (0.1)	0.9	(-)
	51-70	1131	1.8 (0.1)	1.1 (0.1)	1.2 (0.1)	1.5 (0.1)	1.8 (0.1)	2.1 (0.1)	2.5 (0.1)	2.7 (0.1)	0.9	(-)
	71+	218	1.8 (0.1)	1.1 (0.1)	1.2 (0.1)	1.4 (0.1)	1.7 (0.1)	2 (0.1)	2.4 (0.2)	2.6 (0.3)	0.9	(-)

Table G.22 Niacin (NE/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	%<EAR
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)		(95% CI)
Male	19-50	1385	45.9 (1.2)	29.9 (2.9)	32.8 (2.6)	38.2 (2)	45 (1.5)	52.7 (1.9)	60.5 (3.1)	65.5 (4.1)	12	0 (0-0)
	51-70	680	39.3 (1.7)	23.3 (2.3)	26 (2.2)	30.9 (2)	37.7 (2)	46.2 (2.2)	55.5 (3.1)	61.8 (4)	12	0 (0-0.3)
	71+	126	43.6 (5.6)	27.7 (3.7)	30.2 (4.2)	35 (5.1)	41.4 (6.3)	49.2 (7.5)	57.5 (8.6)	63 (9.1)	12	0 (0-0)
Female	19-50	2661	35 (0.7)	24.8 (1.4)	26.8 (1.3)	30.4 (1)	34.7 (0.8)	39.6 (1)	44.5 (1.6)	47.7 (2.1)	11	0 (0-0)
	51-70	1131	34.1 (1.8)	22.7 (2.7)	24.9 (2.5)	28.9 (2.1)	33.7 (1.8)	39.2 (2)	44.9 (2.5)	48.7 (3.1)	11	0 (0-0)
	71+	218	35.1 (2.4)	23.8 (1.9)	25.8 (2)	29.5 (2.1)	34.1 (2.3)	39.5 (2.6)	45 (3.3)	48.8 (3.9)	11	0 (0-0)

Table G.23 Calcium (mg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	% < EAR	UL	% > UL (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)		(95% CI)		
Male	19-50	1385	707 (26)	492 (69)	533 (60)	608 (45)	703 (31)	809 (41)	915 (70)	982 (91)	800	73.2 (59-97.1)	2500	0 (0-0)
	51-70	680	618 (31)	250 (25)	303 (27)	416 (30)	581 (33)	784 (40)	1004 (54)	1157 (69)	800	76.5 (69.9-84.1)	2000	0.1 (0-0.5)
	71+	126	643 (61)	353 (70)	404 (67)	489 (66)	615 (71)	757 (82)	895 (98)	983 (116)	800	80.8 (61.9-99.7)	2000	0 (0-0.1)
Female	19-50	2661	576 (16)	370 (32)	407 (29)	476 (24)	563 (20)	663 (24)	765 (36)	832 (46)	800	93 (87.7-99)	2500	0 (0-0)
	51-70	1131	540 (15)	316 (28)	353 (26)	424 (21)	517 (18)	628 (25)	747 (45)	827 (62)	1000	99 (96.9-100)	2000	0 (0-0)
	71+	218	536 (45)	283 (72)	320 (68)	393 (58)	495 (48)	626 (52)	773 (80)	878 (109)	1000	97.8 (94.9-100)	2000	0 (0-0.1)

Table G.24 Iron (mg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	% < EAR (95% CI)	UL	% > UL (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)				
Male	19-50	1385	17.3 (0.6)	12.1 (1.3)	13 (1.1)	14.7 (0.9)	16.9 (0.6)	19.5 (0.9)	22.1 (1.5)	23.8 (2.1)	6.0	0 (0-0.1)	45	0 (0-0.1)
	51-70	680	15.7 (0.6)	9.1 (1.4)	10.3 (1.2)	12.4 (1)	15.3 (0.7)	18.6 (0.9)	22.1 (1.5)	24.3 (1.9)	6.0	(-)	45	0 (0-0)
	71+	126	15.5 (1.0)	9.5 (1.4)	10.5 (1.3)	12.4 (1.1)	14.9 (1.1)	17.8 (1.5)	20.7 (2.2)	22.7 (2.9)	6.0	(-)	45	0 (0-0.2)
Female	19-50	2661	13.2 (0.4)	8.6 (0.5)	9.4 (0.5)	10.8 (0.4)	12.8 (0.4)	15.1 (0.6)	17.5 (0.8)	19.1 (1.1)	8.1	(-)	45	0 (0-0)
	51-70	1131	12.7 (0.5)	8.0 (0.8)	8.9 (0.8)	10.4 (0.7)	12.5 (0.6)	14.9 (0.6)	17.5 (0.8)	19.2 (1.1)	5.0	0 (0-0.4)	45	0 (0-0)
	71+	218	13.2 (0.9)	8.8 (0.6)	9.4 (0.6)	10.6 (0.7)	12.2 (0.8)	14.2 (1.1)	16.5 (1.5)	18.2 (1.8)	5.0	0 (0-0)	45	0 (0-0)

Table G.25 Potassium (mg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							AI	% > AI (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)		
Male	19-50	1385	2790 (74)	1837 (127)	2017 (116)	2347 (96)	2757 (86)	3207 (111)	3658 (167)	3955 (216)	3400	17.3 (8.4-25.6)
	51-70	680	2550 (76)	1479 (132)	1669 (125)	2021 (112)	2477 (100)	3001 (104)	3528 (134)	3871 (167)	3400	12.7 (4-16.3)
	71+	126	2415 (160)	1648 (162)	1793 (173)	2061 (190)	2389 (203)	2733 (204)	3045 (201)	3234 (204)	3400	(-)
Female	19-50	2661	2236 (47)	1505 (98)	1643 (87)	1893 (68)	2204 (52)	2552 (63)	2904 (103)	3135 (136)	2600	22.3 (13.9-28.8)
	51-70	1131	2196 (107)	1539 (97)	1668 (104)	1903 (115)	2191 (124)	2507 (130)	2816 (135)	3012 (138)	2600	19.4 (8.6-36.2)
	71+	218	2156 (119)	1295 (249)	1431 (230)	1692 (190)	2043 (131)	2467 (200)	2925 (405)	3242 (588)	2600	19.4 (0.1-29.2)

Table G.26 Sodium (mg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							AI	% > AI (95% CI)	Chronic Disease Reduction Rate (CDRR)	% > CDRR (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)				
Male	19-50	1385	3719 (114)	2332 (226)	2582 (198)	3028 (150)	3599 (119)	4266 (167)	4949 (278)	5399 (366)	1500	99.9 (98.9-100)	2300	95.5 (88.4-99.8)
	51-70	681	3023 (108)	1586 (171)	1845 (153)	2316 (126)	2908 (115)	3606 (155)	4359 (252)	4879 (341)	1500	96.2 (91-99.1)	2300	75.6 (65.6-85.2)
	71+	126	2925 (175)	1435 (327)	1685 (295)	2159 (230)	2757 (202)	3427 (301)	4114 (507)	4575 (688)	1500	93.9 (85.4-100)	2300	69.4 (53.3-96.8)
Female	19-50	2661	2997 (75)	2030 (161)	2212 (140)	2544 (107)	2954 (84)	3412 (112)	3869 (179)	4164 (232)	1500	99.8 (98.9-100)	2300	86.7 (79.8-98.4)
	51-70	1131	2620 (92)	1604 (151)	1790 (136)	2128 (116)	2558 (106)	3063 (124)	3585 (176)	3929 (223)	1500	96.8 (92.4-99.9)	2300	65.2 (52.6-81)
	71+	218	2475 (129)	1487 (288)	1663 (256)	1983 (203)	2379 (164)	2818 (196)	3251 (292)	3528 (370)	1500	94.7 (82.6-100)	2300	55.1 (35.9-91.1)

Table G.27 Magnesium* (mg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	% < EAR (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)		
Male	19-30	415	272 (12)	193 (24)	207 (21)	235 (16)	268 (14)	304 (20)	339 (31)	361 (39)	330	87 (67.9-100)
	31-50	970	271 (7)	178 (14)	195 (12)	226 (9)	265 (8)	310 (10)	357 (18)	389 (25)	350	88.3 (81-96.6)
	51-70	680	256 (8)	134 (10)	156 (10)	196 (10)	248 (9)	307 (11)	366 (13)	404 (15)	350	86.9 (82.8-92.8)
	71+	218	236 (12)	178 (23)	188 (21)	207 (16)	229 (11)	254 (11)	280 (20)	297 (28)	350	99.6 (94.3-100)
Female	19-30	762	231 (8)	157 (21)	171 (19)	196 (14)	228 (10)	264 (13)	299 (21)	321 (28)	255	69.7 (55-96.9)
	31-50	1899	224 (5)	149 (8)	163 (8)	188 (6)	219 (6)	255 (7)	293 (10)	317 (12)	265	80 (73.2-86.4)
	51-70	1131	228 (10)	149 (15)	163 (14)	190 (13)	224 (12)	263 (12)	303 (15)	330 (17)	265	76.1 (64.4-89.4)
	71+	218	236 (12)	178 (23)	188 (21)	207 (16)	229 (11)	254 (11)	280 (20)	297 (28)	265	82.4 (70.3-99.8)

*Age-groups categorized differently from other SIDE tables due to different EAR values.

Table G.28 Phosphorus (mg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	% < EAR (95% CI)	UL	% > UL (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)				
Male	19-50	1385	1345 (37)	1050 (97)	1111 (81)	1216 (56)	1341 (41)	1474 (65)	1602 (107)	1683 (138)	580	0 (0-0.1)	4000	0 (0-0)
	51-70	680	1226 (46)	665 (59)	761 (56)	943 (49)	1190 (45)	1487 (59)	1801 (93)	2017 (125)	580	(-)	4000	0 (0-0)
	71+	126	1323 (129)	883 (100)	951 (112)	1081 (133)	1256 (158)	1473 (181)	1694 (197)	1835 (205)	580	0 (0-0.3)	4000	0 (0-0)
Female	19-50	2661	1080 (21)	821 (56)	874 (47)	966 (34)	1077 (26)	1197 (38)	1314 (60)	1389 (76)	580	0 (0-0.4)	4000	0 (0-0)
	51-70	1131	1049 (61)	751 (72)	809 (67)	911 (61)	1034 (60)	1171 (71)	1308 (94)	1397 (113)	580	(-)	4000	0 (0-0)
	71+	218	1084 (83)	600 (132)	674 (122)	816 (102)	1005 (79)	1242 (78)	1511 (128)	1706 (177)	580	(-)	4000	0 (0-0)

Table G.29 Zinc (mg/d): Usual intakes from food, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							EAR	% < EAR (95% CI)	UL	% > UL (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)				
Male	19-50	1385	14.2 (0.6)	9.2 (1)	10.1 (0.9)	11.8 (0.8)	13.9 (0.7)	16.4 (0.9)	19.0 (1.4)	20.7 (1.8)	9.4	(-)	40	0 (0-0.1)
	51-70	680	12.5 (0.5)	6.2 (0.9)	7.2 (0.8)	9.0 (0.7)	11.5 (0.6)	14.8 (0.7)	18.6 (1.2)	21.4 (1.7)	9.4	28.5 (9.1-39)	40	0 (0-0.2)
	71+	126	12.0 (1.4)	10.5 (1.4)	10.8 (1.3)	11.3 (1.3)	12.0 (1.5)	12.6 (1.9)	13.2 (2.6)	13.6 (3.2)	9.4	(-)	40	0 (0-0.1)
Female	19-50	2661	10.5 (0.3)	7.0 (0.7)	7.6 (0.6)	8.8 (0.5)	10.3 (0.4)	12.1 (0.4)	13.9 (0.7)	15.1 (0.9)	6.8	(-)	40	0 (0-0)
	51-70	1131	10.3 (0.6)	6.2 (0.9)	7.0 (0.9)	8.3 (0.7)	10.0 (0.6)	12.1 (0.7)	14.4 (1.1)	16.0 (1.4)	6.8	(-)	40	0 (0-0)
	71+	218	9.8 (0.7)	6.6 (0.5)	7.1 (0.5)	8.1 (0.5)	9.3 (0.6)	10.7 (0.7)	12.2 (1)	13.1 (1.2)	6.8	(-)	40	0 (0-0.2)

Table G.30 Percentage of total energy intake from protein, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							AMDR	% below AMDR (95% CI)	% within AMDR (95% CI)	% above AMDR (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)				
Male	19-50	1385	18.3 (0.7)	13 (1.1)	13.9 (1)	15.5 (0.8)	17.5 (0.6)	20.1 (0.7)	23 (1.2)	25.1 (1.8)	10-35	0.1 (0-0.7)	99.7 (98.2-100)	0.2 (0-1.3)
	51-70	680	20.6 (1.3)	15.5 (1.5)	16.2 (1.3)	17.5 (1.1)	19.5 (1)	22.2 (1.3)	25.2 (2.3)	27.5 (3.4)	10-35	0 (0-0.2)	99.4 (95.2-100)	0.6 (0-4.8)
	71+	126	22.4 (1.5)	17.5 (1.4)	18.4 (1.4)	20.1 (1.6)	22.1 (1.7)	24.4 (1.8)	26.5 (2)	27.8 (2.2)	10-35	0 (0-0)	not estimable[2]	0 (0-0.7)
Female	19-50	2661	16.6 (0.2)	12.3 (0.6)	13.2 (0.5)	14.7 (0.4)	16.6 (0.3)	18.7 (0.3)	20.9 (0.6)	22.4 (0.8)	10-35	0.3 (0-0.9)	not estimable[2]	0 (0-0)
	51-70	1131	18.4 (0.4)	14 (1.1)	14.8 (1)	16.4 (0.7)	18.2 (0.5)	20.3 (0.6)	22.4 (1)	23.8 (1.4)	10-35	0 (0-0.6)	100 (99.3-100)	0 (0-0.1)
	71+	218	18.1 (0.8)	14.9 (1.6)	15.5 (1.5)	16.6 (1.2)	17.9 (1)	19.3 (1.2)	20.6 (1.8)	21.5 (2.4)	10-35	0 (0-1.9)	100 (98.1-100)	0 (0-0.5)

[2] Percent within the AMDR and 95% CI values for this sex and age group were not estimable using the SIDE SAS sub-routine.

Table G.31 Percentage of total energy intake from carbohydrates, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							AMDR	% below AMDR (95% CI)	% within AMDR (95% CI)	% above AMDR (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)				
Male	19-50	1385	48.5 (0.8)	39 (1.8)	41.2 (1.4)	44.5 (0.9)	48.2 (0.8)	52.6 (1.2)	56.8 (1.8)	59.8 (2.4)	45-65	28.5 (11.2-35.3)	70.1 (63.4-88.8)	1.4 (0-3.4)
	51-70	680	47.9 (1.4)	35.6 (2.1)	38.1 (1.9)	42 (1.5)	46.2 (0.9)	51.7 (1.8)	58.3 (4)	63.5 (6.1)	45-65	43 (27.9-50.6)	52.8 (44.9-71.1)	4.1 (0-9.2)
	70+	126	43.3 (1.8)	35.9 (2.2)	37.3 (2.2)	39.7 (2.2)	42.4 (2.3)	45.2 (2.2)	47.7 (2.2)	49.1 (2.2)	45-65	73.6 (31.5-96.6)	not estimable[2]	0 (0-0)
Female	19-50	2661	48.9 (0.5)	39.5 (1.1)	41.5 (0.9)	44.9 (0.6)	48.6 (0.5)	52.4 (0.7)	55.8 (1)	57.8 (1.2)	45-65	25.7 (19-33)	not estimable[2]	0.2 (0-1.2)
	51-70	1131	48 (0.6)	39.9 (1.5)	41.7 (1.2)	44.7 (0.8)	48 (0.7)	51.4 (1)	54.6 (1.5)	56.5 (1.8)	45-65	27 (14.1-36.3)	72.9 (63.3-85.9)	0 (0-0.8)
	71+	218	47.5 (1.4)	42 (2.6)	43.2 (2.2)	45.2 (1.7)	47.6 (1.6)	50 (2)	52.3 (2.8)	53.7 (3.3)	45-65	22.8 (0-50.2)	77.2 (49.8-100)	0 (0-1.5)

[2] Percent within the AMDR and 95% CI values for this sex and age group were not estimable using the SIDE SAS sub-routine.

Table G.32 Percentage of total energy intake from fats, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake							AMDR	% below AMDR (95% CI)	% within AMDR (95% CI)	% above AMDR (95% CI)
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)				
Male	19-50	1385	36.0 (1.0)	29.6 (1.7)	30.6 (1.4)	32.4 (0.9)	34.8 (0.5)	37.4 (1.0)	40 (1.9)	41.7 (2.6)	20-35	0 (0-0.1)	52.1 (29-64.3)	47.9 (35.7-71)
	51-70	680	38.3 (3.2)	34.1 (1)	34.5 (1)	35.1 (1.2)	35.8 (1.3)	36.6 (1.5)	37.3 (1.7)	37.7 (1.9)	20-35	0 (0-0)	not estimable[2]	78.1 (6.9-99.6)
	71+	126	35.3 (1.5)	34.5 (1.8)	34.7 (1.8)	35 (1.8)	35.4 (1.8)	35.8 (1.8)	36.2 (1.8)	36.4 (1.8)	20-35	0 (0-0)	not estimable[2]	76.9 (0-100)
Female	19-50	2661	35.7 (0.3)	29 (0.8)	30.5 (0.7)	33 (0.5)	35.8 (0.4)	38.6 (0.5)	41.1 (0.7)	42.7 (0.8)	20-35	0 (0-0.1)	not estimable[2]	57.9 (50.9-65.2)
	51-70	1131	34.6 (0.4)	28.7 (0.5)	29.9 (0.5)	32 (0.5)	34.3 (0.5)	36.7 (0.5)	38.8 (0.6)	40.1 (0.6)	20-35	0 (0-0)	not estimable[2]	42.1 (31.9-53.7)
	71+	218	35.2 (1.1)	30.2 (1.2)	31.4 (1.2)	33.3 (1.2)	35.3 (1.2)	37.4 (1.3)	39.3 (1.4)	40.5 (1.5)	20-35	0 (0-0)	not estimable[2]	54.2 (20.2-79.9)

[2] Percent within the AMDR and 95% CI values for this sex and age group were not estimable using the SIDE SAS sub-routine.

Table G.33 Percentage of total energy intake from saturated fats, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1385	11.3 (0.2)	8.3 (0.5)	9 (0.4)	10 (0.3)	11.3 (0.2)	12.5 (0.3)	13.7 (0.4)	14.4 (0.5)
	51-70	680	11.1 (0.3)	9.2 (0.8)	9.6 (0.7)	10.3 (0.4)	11.1 (0.3)	11.9 (0.4)	12.7 (0.8)	13.2 (1)
	71+	126	11.2 (0.7)	7.2 (0.9)	7.9 (0.8)	9.2 (0.8)	10.8 (0.8)	12.8 (1)	14.8 (1.4)	16 (1.6)
Female	19-50	2661	11.4 (0.1)	8.7 (0.3)	9.3 (0.3)	10.3 (0.2)	11.4 (0.1)	12.6 (0.2)	13.7 (0.3)	14.4 (0.4)
	51-70	1131	10.9 (0.2)	8.5 (0.2)	9 (0.2)	9.8 (0.2)	10.8 (0.2)	11.8 (0.2)	12.8 (0.3)	13.5 (0.3)
	71+	218	10.6 (0.3)	8.6 (0.9)	9 (0.7)	9.7 (0.5)	10.5 (0.4)	11.4 (0.4)	12.2 (0.7)	12.7 (0.9)

Table G.34 Percentage of total energy intake from monounsaturated fats, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1385	13.6 (0.2)	10.7 (0.7)	11.3 (0.5)	12.3 (0.3)	13.5 (0.2)	14.6 (0.4)	15.7 (0.6)	16.4 (0.8)
	51-70	680	13.4 (0.3)	10.9 (0.3)	11.4 (0.3)	12.3 (0.3)	13.2 (0.3)	14.3 (0.3)	15.2 (0.3)	15.8 (0.3)
	71+	126	13.8 (0.7)	11.6 (0.8)	12 (0.8)	12.8 (0.8)	13.6 (0.9)	14.4 (0.9)	15.2 (0.9)	15.7 (1)
Female	19-50	2661	13.6 (0.2)	11.1 (0.6)	11.6 (0.5)	12.5 (0.3)	13.6 (0.2)	14.7 (0.3)	15.7 (0.5)	16.3 (0.6)
	51-70	1131	13.3 (0.2)	10.7 (0.3)	11.2 (0.3)	12.1 (0.3)	13.1 (0.3)	14.2 (0.3)	15.2 (0.3)	15.8 (0.3)
	71+	218	13.8 (0.6)	11.5 (0.6)	12 (0.6)	12.8 (0.6)	13.8 (0.7)	14.9 (0.7)	15.9 (0.8)	16.5 (0.9)

Table G.35 Percentage of total energy intake from polyunsaturated fats, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1385	6.9 (0.2)	5.8 (0.2)	6.0 (0.2)	6.4 (0.2)	6.8 (0.2)	7.3 (0.2)	7.7 (0.2)	8.0 (0.2)
	51-70	680	6.7 (0.2)	4.6 (0.5)	5.0 (0.5)	5.7 (0.3)	6.6 (0.2)	7.6 (0.3)	8.5 (0.5)	9.1 (0.7)
	71+	126	6.8 (0.5)	4.3 (0.6)	4.8 (0.5)	5.7 (0.5)	6.8 (0.6)	8.1 (0.6)	9.3 (0.8)	10.1 (0.9)
Female	19-50	2661	7.2 (0.1)	6.2 (0.1)	6.4 (0.1)	6.8 (0.1)	7.2 (0.1)	7.6 (0.1)	8 (0.1)	8.2 (0.1)
	51-70	1131	7.0 (0.1)	5.0 (0.4)	5.4 (0.3)	6.1 (0.2)	6.8 (0.1)	7.7 (0.3)	8.5 (0.5)	9.0 (0.7)
	71+	218	7.3 (0.4)	6.6 (0.4)	6.7 (0.4)	7.0 (0.4)	7.4 (0.4)	7.7 (0.4)	8.0 (0.4)	8.2 (0.5)

Table G.36 Percentage of energy from linoleic acid, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1385	5.5 (0.1)	5.0 (0.4)	5.1 (0.3)	5.3 (0.2)	5.5 (0.1)	5.7 (0.2)	5.9 (0.4)	6.0 (0.5)
	51-70	680	5.2 (0.2)	3.4 (0.5)	3.7 (0.4)	4.3 (0.3)	5.0 (0.2)	5.8 (0.3)	6.6 (0.5)	7.0 (0.6)
	71+	126	5.4 (0.4)	3.7 (0.6)	4.1 (0.5)	4.8 (0.5)	5.6 (0.5)	6.4 (0.6)	7.2 (0.9)	7.7 (1.2)
Female	19-50	2661	5.6 (0.1)	5.0 (0.1)	5.1 (0.1)	5.4 (0.1)	5.6 (0.1)	5.9 (0.1)	6.1 (0.1)	6.3 (0.1)
	51-70	1131	5.4 (0.1)	3.5 (0.2)	3.8 (0.2)	4.5 (0.2)	5.3 (0.1)	6.2 (0.2)	7.2 (0.4)	7.7 (0.5)
	71+	218	5.9 (0.3)	5.5 (0.4)	5.6 (0.4)	5.8 (0.4)	6.0 (0.4)	6.3 (0.4)	6.5 (0.4)	6.6 (0.4)

Table G.37 Percentage of energy from linolenic acid, by DRI age-sex group, household population

Sex	Age	n	Mean (SE)	Percentiles (SE) of usual intake						
				5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	1385	0.62 (0.02)	0.35 (0.04)	0.39 (0.03)	0.47 (0.03)	0.58 (0.03)	0.72 (0.03)	0.86 (0.05)	0.96 (0.07)
	51-70	680	0.71 (0.04)	0.37 (0.07)	0.42 (0.07)	0.52 (0.05)	0.66 (0.04)	0.82 (0.05)	1.0 (0.09)	1.12 (0.13)
	71+	126	0.72 (0.07)	0.36 (0.06)	0.42 (0.06)	0.54 (0.07)	0.7 (0.08)	0.88 (0.11)	1.13 (0.15)	1.31 (0.18)
Female	19-50	2661	0.65 (0.03)	0.46 (0.05)	0.5 (0.04)	0.56 (0.03)	0.64 (0.03)	0.73 (0.04)	0.82 (0.06)	0.87 (0.08)
	51-70	1131	0.73 (0.02)	0.43 (0.05)	0.48 (0.05)	0.57 (0.04)	0.69 (0.03)	0.84 (0.05)	0.99 (0.08)	1.09 (0.11)
	71+	218	0.77 (0.05)	0.51 (0.1)	0.55 (0.09)	0.64 (0.07)	0.74 (0.06)	0.86 (0.09)	0.99 (0.13)	1.07 (0.18)

Appendix H. Top 10 contributors to macro and micronutrients

A) Energy		B) Protein		C) Fat		D) Carbohydrates	
Food	% of total	Food	% of total	Food	% of total	Food	% of total
Bread/buns, white	8.1	Game meat	15.6	Cold cuts/sausages	8.5	Bread/buns, white	12.4
Pasta/noodles	5.0	Chicken	9.4	Beef	6.4	Carbonated drinks, regular	9.2
Chicken[a]	4.4	Beef	9.2	Chicken	6.2	Pasta/noodles	7.1
Carbonated drinks, regular	4.2	Bread/buns, white	6.1	Snack food	5.6	Condiments, sweet[g]	5.6
Beef[b]	4.1	Pork[f]	5.5	Eggs	5.3	Cereal	5.1
Cold cuts/sausages	4.1	Fish	4.9	Margarine	5.3	Fruit drinks	4.4
Snack food[c]	3.6	Eggs	4.7	Fried vegetables	3.9	Potatoes	4.1
Fried vegetables[d]	3.3	Cold cuts/sausages	4.5	Pizza	3.9	Fried vegetables	3.9
Pizza	3.3	Pasta/noodles	4.3	Pork	3.9	Grains	3.9
Game meat[e]	3.2	Mixed dishes	3.2	Vegetable oil	3.4	Pastries[h]	3.5

E) Saturated Fat		F) Monounsaturated Fat		G) Polyunsaturated Fat		H) Cholesterol	
Food	% of total	Food	% of total	Food	% of total	Food	% of total
Cold cuts/sausages	9.5	Cold cuts/sausages	10.0	Snack food	11.6	Eggs	37.6
Beef	8.1	Beef	7.7	Margarine	8.8	Game meat	9.9
Cheese	6.4	Chicken	6.5	Chicken	7.3	Chicken	8.5
Butter	5.9	Margarine	6.2	Bread/buns, white	5.6	Beef	7.1
Chicken	4.9	Eggs	5.8	Vegetable oil	4.8	Cold cuts/sausages	4.7
Eggs	4.8	Vegetable oil	5.6	Fried vegetables	4.7	Pork	4.5
Pizza	4.6	Snack food	4.9	Eggs	4.6	Fish	3.0
Pork	4.4	Pork	4.3	Salad dressing/dips	4.2	Sandwiches	2.6
Fried vegetables	3.7	Fried vegetables	4.0	Cold cuts/sausages	4.1	Mixed dishes	2.5
Mixed dishes	3.6	Pizza	3.9	Pastries	3.7	Cheese	2.3

I) Total Sugars		J) Fibre		K) Vitamin A		L) Vitamin C	
Food	% of total	Food	% of total	Food	% of total	Food	% of total
Carbonated drinks, regular	23.4	Bread/buns, white	15.9	Vegetables	22.0	Fruit drinks	33.8
Condiments, sweet	15.4	Cereal	9.5	Eggs	14.4	Fruit juice	19.7
Fruits	6.2	Vegetables	9.4	Margarine	9.0	Vegetables	11.0
Fruit juice	5.2	Fruits	6.7	Milk	8.6	Fruits	10.6
Fruit drinks	5.1	Pasta/noodles	6.1	Game meat	5.5	Potatoes	5.1
Milk	4.8	Fried vegetables	5.9	Soup	5.0	Fried vegetables	2.9
Pastries	4.1	Potatoes	5.7	Butter	4.0	Snack food	2.9
Iced tea	3.9	Snack food	5.3	Cheese	3.8	Soup	2.1
Bread/buns, white	3.8	Mixed dishes	4.1	Cream	2.6	Game meat	1.7
Cereal	2.8	Pizza	3.7	Pizza	2.5	Mixed dishes	1.7

M) Vitamin D		N) Folate		O) Calcium		P) Iron	
Food	% of total	Food	% of total	Food	% of total	Food	% of total
Fish	33.4	Bread/buns, white	20.3	Milk	13.8	Game meat	14.6
Milk	15.3	Pasta/noodles	16.6	Bread/buns, white	12.9	Bread/buns, white	12.4
Margarine	14.9	Vegetables	5.4	Cheese	8.8	Cereal	10.0
Eggs	11.7	Eggs	5.0	Pizza	6.0	Beef	5.4
Cold cuts/sausages	3.8	Pizza	4.8	Bannock	4.7	Pasta/noodles	5.1
Pasta/noodles	3.3	Bannock	4.2	Pasta/noodles	4.0	Soup	3.7
Pork	3.0	Cereal	3.3	Fruit drinks	3.6	Mixed dishes	3.6
Chicken	1.8	Soup	2.9	Vegetables	3.0	Pizza	3.1
Beef	1.6	Tea	2.8	Eggs	2.9	Eggs	3.0
Game meat	1.3	Fruit juice	2.6	Mixed dishes	2.7	Chicken	2.8

q) Sodium		r) Zinc	
Food	% of total	Food	% of total
Soup	12.0	Game meat	20.6
Bread/buns, white	11.0	Beef	14.9
Cold cuts/sausages	8.9	Bread/buns, white	4.6
Condiments[i]	7.1	Chicken	4.3
Mixed dishes	4.6	Cold cuts/sausages	4.1
Pizza	4.5	Pork	4.1
Pasta/noodles	4.0	Cereal	3.8
Snack food	3.3	Mixed dishes	3.6
Chicken	3.1	Pasta/noodles	3.6
Sandwiches	3.1	Eggs	3.2

[a]chicken = roasted, baked, fried and stewed.
[b]beef = ground, steak, ribs and brisket.
[c]snack food = potato chips, pretzels, popcorn.
[d]fried vegetables = French fries, hash browns, onion rings, battered and deep-fried zucchini.
[e]game meat = moose, caribou, deer, elk, rabbit, bear, beaver, groundhog, muskrat, porcupine, goose, duck, ptarmigan, grouse and pheasant.
[f]pork = loin, chops and ribs.
[g]condiments, sweet = sugar, jam, syrup, honey.
[h]pastries = cakes, pies, muffins, doughnuts.
[i]condiments = sauces, ketchup, mustard, salt, vinegar.

Predictors of Diabetes

Variable	By Var	Diabetes (%)	SE of Diabetes (%)	Estimate	Adjusted Odds Ratio	peffect
Region	BC	10.2	44.5	5.8	7.52	0.000
	AB	17.2	51.1	5.2	3.97	0.004
	SK	19.1	69.4	4.9	3.2	0.017
	MB	24.2	67.7	4.4	1.93	0.012
	ON	27.8	56.3	3.8	.	.
	QC	24.1	63.1	4.0	1.22	0.428
	AT	20.7	25.7	4.0	1.22	0.547
Ecozone	Pacific Maritime	11.7	46.2	4.1	0.57	0.312
	Montane Cordillera	8.1	83.9	4.3	0.69	0.653
	Taiga Plains	6.9	80.2	5.1	1.6	0.658
	Boreal Plains	21.7	64.4	3.9	0.46	0.065
	Prairies	20.5	83.2	3.9	0.49	0.091
	Taiga Shield	16.4	37.4	5.2	1.82	0.108
	Boreal Shield	25.1	35.1	4.6	.	.
	Hudson Plains	23.9	80.3	4.9	1.26	0.518
	Mixedwood Plains	23.1	73.4	5.1	1.57	0.085
	Atlantic Maritime	20.7	27.4	4.7	1.07	0.774
Yr Round Road	No	22.5	61.8	4.4	0.75	0.592
	Yes	20.9	27.8	4.7	.	.
# FT Work	0 FT	24.1	30.2	4.6	.	.
	1 FT	20.3	35.7	4.5	0.93	0.683
	2+FT	17.8	39.6	4.6	0.97	0.888

Variable	By Var	Diabetes (%)	SE of Diabetes (%)	Estimate	Adjusted Odds Ratio	peffect
HH TF activities	Yes	20.9	26.1	4.5	0.86	0.159
	No	21.3	35.8	4.7	.	.
Income	Wages	17.1	29.6	5.0	2.1	0.003
	Social assistance	18.1	29.4	4.8	1.59	0.014
	Pension	44.9	66.3	4.3	.	.
	Workers comp / Employment insurance	26.9	153.0	4.5	1.23	0.679
	Other	24.9	193.6	4.3	1.01	0.992
Age group	19-30	4.3	26.2	6.1	8.01	0.000
	31-50	16.1	29.1	4.7	1.96	0.042
	51-70	39.4	48.5	3.5	0.63	0.105
	71+	39.2	92.1	4.0	.	.
Body Mass Index	Normal weight	9.6	37.8	5.1	2.9	0.000
	Overweight	16.8	46.4	4.7	1.95	0.000
	Obese	29.4	35.7	4.0	.	.
Years of Education	8 or less	33.7	39.7	4.4	.	.
	9 to 12	18.0	23.2	4.7	1.26	0.158
	13 or more	18.2	41.1	4.7	1.27	0.268
Gender	Female	21.4	50.6	4.6	.	.
	Male	20.9	26.0	4.6	1.02	0.889
Smoking	No	24.7	41.9	4.8	0.78	0.058
	Yes	17.8	28.4	5.1	.	.
Health	Poor	31.8	29.1	0.8	.	.
	Good	17.4	39.0	1.5	2.06	0.000
	Very good to excellent	12.5	29.6	1.9	3.17	0.000
HHSIZE		.	.	0.0	0.97	0.287
TotalTF		.	.	0.0	1	0.141
Foodbasket cost		.	.	0.0	1	0.525

Self-reported Health

Variable	By Var	% Good Health*	SE of %Good	Effect	AOR	peffect
Region	BC	42.8	123.6	-0.27	0.77	0.50
	AB	46.0	107.2	-0.65	0.52	0.07
	SK	42.5	62.7	-0.70	0.50	0.02
	MB	34.1	59.5	-0.70	0.49	0.02
	ON	43.8	56.8	-0.65	0.52	0.02
	QC	48.1	95.6	0.00	1.00	0.98
	AT	48.7	61.8	0.00	.	.
Ecozone	Pacific Maritime	41.3	71.1	-0.51	0.60	0.24
	Montane Cordillera	43.6	329.3	-0.83	0.44	0.50
	Taiga Plains	46.0	185.6	-0.43	0.65	0.40
	Boreal Plains	39.3	91.5	-0.23	0.80	0.35
	Prairies	47.1	51.7	0.16	1.18	0.54
	Taiga Shield	44.7	142.5	-1.05	0.35	0.04
	Boreal Shield	38.1	39.8	-0.43	0.65	0.01
	Hudson Plains	39.3	116.7	-0.61	0.54	0.23
	Mixedwood Plains	57.5	98.4	0.00	.	.
	Atlantic Maritime	49.1	60.5	-0.48	0.62	0.07
Yr Round Road	No	44.8	100.4	0.77	2.16	0.12
	Yes	42.9	37.8	0.00	.	.
# FT Work	0 FT	37.8	54.1	-0.19	0.83	0.37
	1 FT	43.6	57.3	-0.10	0.91	0.46
	2+ FT	49.8	62.4	0.00	.	.
HH TF activities	Yes	47.1	38.1	0.00	.	.
	No	34.3	64.4	-0.48	0.62	0.01

Variable	By Var	% Good Health*	SE of %Good	Effect	AOR	peffect
Income	Wages	49.5	46.7	0.00	.	.
	Social assistance	37.6	94.1	-0.28	0.75	0.21
	Pension	36.6	60.7	-0.26	0.77	0.07
	Workers comp / Employment Insurance	27.0	91.1	-0.72	0.49	0.01
	Other	46.8	151.6	0.16	1.17	0.64
Age group	19-30	45.6	73.5	-0.70	0.50	0.09
	31-50	44.9	46.1	-0.78	0.46	0.13
	51-70	38.3	73.0	-0.57	0.56	0.16
	71+	45.7	156.3	0.00	.	.
Body Mass Index	Normal weight	51.9	73.8	0.00	.	.
	Obese	36.0	46.8	-0.71	0.49	0.00
	Overweight	53.8	70.4	-0.01	0.99	0.95
Years of Education	8 or less	29.5	69.0	-1.09	0.33	0.00
	9 to 12	43.4	46.1	-0.45	0.64	0.11
	13 or more	56.9	93.6	0.00	.	.
Gender	Female	48.4	41.1	0.00	.	.
	Male	40.5	43.0	-0.23	0.79	0.05
Smoking	No	45.5	55.2	0.23	1.26	0.11
	Yes	40.7	35.8	0.00	.	.
Diabetes	Yes	23.9	50.2	-1.10	0.33	0.00
	No	49.6	37.9	0.00	.	.
HHSIZE		.	.	-0.01	0.99	0.89
TotalTF		.	.	0.00	1.00	0.24
Foodbasket cost		.	.	0.00	1.00	0.29

"Good" = v. good or excellent vs "Poor" = Poor or Fair ("good" not included).

Predictors of Food Insecurity

Variable	By Var	Household Food Insecurity (%)	SE of % HFI	Adjusted Odds Ratio	peffect
Region	BC	51.2	3.7	5.34	0.01
	AB	61.6	7.9	5.58	0.01
	SK	50.5	4.1	3.43	0.05
	MB	52.2	5.8	2.29	0.01
	ON	40.8	5.1	1.22	0.64
	QC	49.2	8.4	1.43	0.07
	AT	39.6	2.0	.	.
Ecozone	Pacific Maritime	48.9	5.9	3.1	0.0
	Boreal Cordillera	23.7	6.5	.	.
	Montane Cordillera	56.7	6.5	3.6	0.0
	Taiga Plains	57.1	5.9	3.1	0.0
	Boreal Plains	47.2	4.2	2.6	0.0
	Prairies	57.4	10.4	4.3	0.0
	Boreal Shield	55.3	4.9	10.4	0.0
	Hudson Plains	63.1	3.4	12.4	0.0
	Taiga Shield	57.8	1.3	7.8	0.0
	Mixedwood Plains	27.4	3.8	5.8	0.0
	Atlantic Maritime	40.3	2.0	9.4	0.0
Yr Round Road	No	61.6	4.1	2.18	0.43
	Yes	49.0	2.4	.	.
# FT Work	0 FT	59.5	3.0	2.86	0.00
	1 FT	48.5	2.9	1.68	0.00
	2+ FT	39.1	2.2	.	.
HH TF activities	Yes	51.3	2.1	1.36	0.00
	No	47.6	3.2	.	.

Variable	By Var	Household Food Insecurity (%)	SE of % HFI	Adjusted Odds Ratio	peffect
Income	Wages	41.0	2.0	.	.
	social assistance	68.1	4.1	2.11	0.00
	Pension	41.2	3.3	0.97	0.86
	Workers comp/EI	61.4	5.6	1.69	0.04
	Other	52.0	7.7	1.05	0.86
Age group	19-30	53.5	4.3	1.96	0.06
	31-50	53.0	2.3	2.15	0.00
	51-70	43.6	2.5	1.44	0.19
	71+	41.3	5.7	.	.
Body Mass Index	Normal weight	53.1	2.7	.	.
	Overweight	49.2	2.6	0.90	0.35
	Obese	49.9	2.5	0.99	0.95
Years of Education	8 or less	55.3	4.0	1.33	0.10
	9 to 12	51.8	2.5	1.17	0.17
	13 or more	38.5	3.0	.	.
Gender	Female	52.7	2.6	1.45	0.01
	Male	44.6	2.5	.	.
Smoking	No	45.1	2.6	0.83	0.02
	Yes	54.8	2.4	.	.
Health	Poor	57.9	2.5	1.39	0.00
	Good	48.6	2.6	.	.
	Very good to excellent	42.2	3.6	0.83	0.27
HHSIZE				1.12	0.00
TotalTF				1.00	0.54
Foodbasket cost				1.00	0.61

Appendix J. Maximum concentration of pharmaceuticals in surface water in First Nations communities by ecozone (ng/L)

#	Pharmaceutical	Pacific Maritime					Boreal Cordillera					Montane Cordillera				
		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites	
			Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected
1	Acetaminophen	17.5	9	1	26	2	<10	2	0	6	0	13.8	6	1	18	1
2	Atenolol	6.7	9	1	26	2	<5	2	0	6	0	5	6	1	18	1
3	Atorvastatin	<5	9	0	26	0	<5	2	0	6	0	<5	6	0	18	0
4	Bezafibrate	<1	9	0	26	0	<1	2	0	6	0	<1	6	0	18	0
5	Caffeine	19.4	9	3	26	4	51.9	2	2	6	3	91.5	6	3	18	5
6	Carbamazepine	<0.5	9	0	26	0	<0.5	2	0	6	0	<0.5	6	0	18	0
7	Chlortetracycline	<10	9	0	26	0	<10	2	0	6	0	<10	6	0	18	0
8	Cimetidine	<2	9	0	26	0	<2	2	0	6	0	<2	6	0	18	0
9	Ciprofloxacin	37.7	9	1	26	1	<20	2	0	6	0	<20	6	0	18	0
10	Clarithromycin	<2	9	0	26	0	<2	2	0	6	0	<2	6	0	18	0
11	Clofibric Acid	4.1	9	2	26	5	8.6	2	1	6	2	2.3	6	1	18	1
12	Codeine	<5	9	0	26	0	<5	2	0	6	0	<5	6	0	18	0
13	Cotinine	<5	9	0	26	0	<5	2	0	6	0	16	6	2	18	2
14	Dehydronifedipine	9.5	9	2	26	2	<2	2	0	6	0	3.3	6	1	18	1
15	Diclofenac	<15	9	0	26	0	<15	2	0	6	0	<15	6	0	18	0
16	Diltiazem	<5	9	0	26	0	<5	2	0	6	0	<5	6	0	18	0
17	Diphenhydramine	<10	9	0	26	0	<10	2	0	6	0	<10	6	0	18	0
18	Erythromycin	<10	9	0	26	0	<10	2	0	6	0	<10	6	0	18	0
19	Fluoxetine	41.7	9	1	26	1	50.7	2	1	6	2	18.3	6	1	18	1
20	Furosemide	<5	9	0	26	0	<5	2	0	6	0	<5	6	0	18	0

#	Pharmaceutical	Pacific Maritime					Boreal Cordillera					Montane Cordillera				
		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites	
			Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected
21	Gemfibrozil	<10	9	0	26	0	<10	2	0	6	0	<10	6	0	18	0
22	Hydrochlorothiazide	<5	9	0	26	0	<5	2	0	6	0	<5	6	0	18	0
23	Ibuprofen	<20	9	0	26	0	<20	2	0	6	0	<20	6	0	18	0
24	Indomethacin	<15	9	0	26	0	<15	2	0	6		<15	6	0	18	0
25	Isochlortetracycline	<10	9	0	26	0	<10	2	0	6	0	<10	6	0	18	0
26	Ketoprofen	307	9	1	26	3	<2	2	0	6	0	45.2	6	2	18	6
27	Lincomycin	<10	9	0	26	0	<10	2	0	6	0	<10	6	0	18	0
28	Metformin	<10	9	0	26	0	<10	2	0	6	0	<10	6	0	18	0
29	Metoprolol	<5	9	0	26	0	<5	2	0	6	0	<5	6	0	18	0
30	Monensin	<10	9	0	26	0	<10	2	0	6	0	<10	6	0	18	0
31	Naproxen	<5	9	0	26	0	<5	2	0	6	0	<5	6	0	18	0
32	Oxytetracycline	<10	9	0	26	0	<10	2	0	6	0	<10	6	0	18	0
33	Pentoxifylline	4.5	9	1	26	3	<2	2	0	6	0	<2	6	0	18	0
34	Ranitidine	.<10	9	0	26	0	<10	2	0	6	0	<10	6	0	18	0
35	Roxithromycin	<5	9	0	26	0	<5	2	0	6	0	<5	6	0	18	0
36	Sulfamethazine	<5	9	0	26	0	<5	2	0	6	0	<5	6	0	18	0
37	Sulfamethoxazole	<2	9	0	26	0	<2	2	0	6	0	<2	6	0	18	0
38	Tetracycline	<10	9	0	26	0	<10	2	0	6	0	<10	6	0	18	0
39	Trimethoprim	2.4	9	1	26	1	<2	2	1	6	2	<2	6	0	18	0
40	Warfarin	6.85	9	1	26	3	<0.5	2	0	6	0	3.87	6	1	18	1
41	17-alpha-Ethinylestradiol	<0.20	9	0	26	0	<0.20	2	0	6	0	<0.20	6	0	18	0
42	alpha-Trenbolone	<2	9	0	26	0	<2	2	0	6	0	<2	6	0	18	0
43	beta-Trenbolone	<2	9	0	26	0	<2	2	0	6	0	<2	6	0	18	0

#	Pharmaceutical	Taiga Plains					Boreal Plains					Prairies				
		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites	
			Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected
1	Acetaminophen	<10	3	0	9	0	17	18	1	54	3	64	8	1	18	2
2	Atenolol	<5	3	0	9	0	28.7	18	4	54	10	17.9	8	2	18	3
3	Atorvastatin	<5	3	0	9	0	<5	18	0	54	0	<5	8	0	18	0
4	Bezafibrate	<1	3	0	9	0	2.9	18	1	54	1	<1	8	0	18	0
5	Caffeine	8.4	3	1	9	1	160	18	10	54	16	30.5	8	4	18	6
6	Carbamazepine	<0.5	3	0	9	0	17.3	18	3	54	5	0.75	8	1	18	1
7	Chlortetracycline	<10	3	0	9	0	12	18	2	54	3	<10	8	0	18	0
8	Cimetidine	3.3	3	1	9	3	5.6	18	4	54	11	40.9	8	4	18	8
9	Ciprofloxacin	<20	3	0	9	0	<20	18	0	54	0	<20	8	0	18	0
10	Clarithromycin	9.4	3	1	9	1	4.1	18	1	54	1	<2	8	0	18	0
11	Clofibric Acid	<1	3	0	9	0	<1	18	0	54	0	4.4	8	1	18	1
12	Codeine	<5	3	0	9	0	14.7	18	1	54	1	<5	8	0	18	0
13	Cotinine	<5	3	0	9	0	8.5	18	7	54	12	16.7	8	7	18	10
14	Dehydronifedipine	<2	3	0	9	0	3.1	18	1	54	1	<2	8	0	18	0
15	Diclofenac	<15	3	0	9	0	<15	18	0	54	0	35	8	1	18	1
16	Diltiazem	<5	3	0	9	0	<5	18	0	54	0	<5	8	0	18	0
17	Diphenhydramine	<10	3	0	9	0	<10	18	0	54	0	<10	8	0	18	0
18	Erythromycin	<10	3	0	9	0	<10	18	0	54	0	<10	8	0	18	0
19	Fluoxetine	<5	3	0	9	0	32.4	18	1	54	1	<5	8	0	18	0
20	Furosemide	<5	3	0	9	0	<5	18	0	54	0	<5	8	0	18	0
21	Gemfibrozil	<10	3	0	9	0	1.5	18	1	54	1	<10	8	0	18	0
22	Hydrochlorothiazide	<5	3	0	9	0	<5	18	0	54	0	<5	8	0	18	0

#	Pharmaceutical	Taiga Plains					Boreal Plains					Prairies				
		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites	
			Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected
23	Ibuprofen	<20	3	0	9	0	<20	18	0	54	0	<20	8	0	18	0
24	Indomethacin	<15	3	0	9	0	<15	18	0	54	0	<15	8	0	18	0
25	Isochlortetracycline	13	3	1	9	1	<10	18	0	54	0	<10	8	0	18	0
26	Ketoprofen	<2	3	0	9	0	4.6	18	1	54	1	7.3	8	1	18	1
27	Lincomycin	<10	3	0	9	0	<10	18	0	54	0	<10	8	0	18	0
28	Metformin	<10	3	0	9	0	93	18	4	54	6	41	8	1	18	1
29	Metoprolol	<5	3	0	9	0	7	18	1	54	1	<5	8	0	18	0
30	Monensin	<10	3	0	9	0	<10	18	0	54	0	<10	8	0	18	0
31	Naproxen	<5	3	0	9	0	<5	18	0	54	0	16.3	8	2	18	2
32	Oxytetracycline	<10	3	0	9	0	<10	18	0	54	0	<10	8	0	18	0
33	Pentoxifylline	<2	3	0	9	0	<2	18	0	54	0	<2	8	0	18	0
34	Ranitidine	<10	3	0	9	0	<10	18	0	54	0	<10	8	0	18	0
35	Roxithromycin	<5	3	0	9	0	<5	18	0	54	0	<5	8	0	18	0
36	Sulfamethazine	<5	3	0	9	0	<5	18	0	54	0	<5	8	0	18	0
37	Sulfamethoxazole	<2	3	0	9	0	19	18	3	54	5	<2	8	0	18	0
38	Tetracycline	<10	3	0	9	0	<10	18	0	54	0	<10	8	0	18	0
39	Trimethoprim	<2	3	0	9	0	4.3	18	1	54	1	<2	8	0	18	0
40	Warfarin	<0.5	3	0	9	0	<0.5	18	0	54	0	<0.5	8	0	18	0
41	17-alpha-Ethinylestradiol	<0.20	3	0	9	0	<0.20	18	0	54	0	<0.20	8	0	18	0
42	alpha-Trenbolone	<2	3	0	9	0	<2	18	0	54	0	<2	8	0	18	0
43	beta-Trenbolone	<2	3	0	9	0	<2	18	0	54	0	<2	8	0	18	0

#	Pharmaceutical	Boreal Shield					Taiga Shield					Hudson Plains				
		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites	
			Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected
1	Acetaminophen	307	21	2	58	4	24	5	1	15	1	25	5	1	14	2
2	Atenolol	245	21	7	58	16	<5	5	0	15	0	105	5	3	14	8
3	Atorvastatin	<5	21	0	58	0	<5	5	0	15	0	<5	5	0	14	0
4	Bezafibrate	11.2	21	2	58	2	<1	5	0	15	0	<1	5	0	14	0
5	Caffeine	355	21	13	58	20	40.1	5	3	15	4	4018	5	2	14	4
6	Carbamazepine	39.6	21	2	58	2	1.8	5	1	15	1	8.1	5	1	14	1
7	Chlortetracycline	<10	21	0	58	0	<10	5	0	15	0	<10	5	0	14	0
8	Cimetidine	2.9	21	3	58	6	5.1	5	1	15	3	<2	5	0	14	0
9	Ciprofloxacin	<20	21	0	58	0	<20	5	0	15	0	<20	5	0	14	0
10	Clarithromycin	69.6	21	2	58	2	<2	5	0	15	0	<2	5	0	14	0
11	Clofibric Acid	<1	21	0	58	0	<1	5	0	15	0	<1	5	0	14	0
12	Codeine	101	21	1	58	1	<5	5	0	15	0	62.5	5	1	14	1
13	Cotinine	46.2	21	2	58	2	56.6	5	2	15	3	43.8	5	1	14	1
14	Dehydronifedipine	2.4	21	1	58	1	<2	5	0	15	0	<2	5	0	14	0
15	Diclofenac	15	21	1	58	1	<15	5	0	15	0	<15	5	0	14	0
16	Diltiazem	73.1	21	1	58	1	<5	5	0	15	0	<5	5	0	14	0
17	Diphenhydramine	56	21	1	58	1	<10	5	0	15	0	12	5	1	14	1
18	Erythromycin	23	21	1	58	1	<10	5	0	15	0	<10	5	0	14	0
19	Fluoxetine	<5	21	0	58	0	<5	5	0	15	0	<5	5	0	14	0
20	Furosemide	<5	21	0	58	0	<5	5	0	15	0	<5	5	0	14	0
21	Gemfibrozil	16.8	21	1	58	1	<10	5	0	15	0	7.1	5	1	14	1
22	Hydrochlorothiazide	5.6	21	1	58	1	<5	5	0	15	0	37.9	5	1	14	1
23	Ibuprofen	53	21	2	58	2	<20	5	0	15	0	367	5	1	14	1

#	Pharmaceutical	Boreal Shield					Taiga Shield					Hudson Plains				
		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites	
			Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected
24	Indomethacin	<15	21	0	58	0	<15	5	0	15	0	<15	5	0	14	0
25	Isochlortetracycline	<10	21	0	58	0	<10	5	0	15	0	<10	5	0	14	0
26	Ketoprofen	9.3	21	3	58	3	<2	5	0	15	0	<2	5	0	14	0
27	Lincomycin	<10	21	0	58	0	<10	5	0	15	0	<10	5	0	14	0
28	Metformin	5640	21	7	58	9	60	5	1	15	1	6210	5	1	14	3
29	Metoprolol	77	21	1	58	1	<5	5	0	15	0	<5	5	0	14	0
30	Monensin	<10	21	0	58	0	<10	5	0	15	0	<10	5	0	14	0
31	Naproxen	75	21	2	58	2	<5	5	0	15	0	67.6	5	1	14	1
32	Oxytetracycline	<10	21	0	58	0	<10	5	0	15	0	<10	5	0	14	0
33	Pentoxifylline	12.7	21	1	58	1	<2	5	0	15	0	<2	5	0	14	0
34	Ranitidine	<10	21	0	58	0	<10	5	0	15	0	15	5	1	14	1
35	Roxithromycin	<5	21	0	58	0	<5	5	0	15	0	<5	5	0	14	0
36	Sulfamethazine	<5	21	0	58	0	<5	5	0	15	0	<5	5	0	14	0
37	Sulfamethoxazole	87	21	3	58	3	<2	5	0	15	0	9.3	5	1	14	3
38	Tetracycline	<10	21	0	58	0	<10	5	0	15	0	<10	5	0	14	0
39	Trimethoprim	32	21	2	58	2	<2	5	0	15	0	3.9	5	1	14	1
40	Warfarin	2.92	21	2	58	6	<0.5	5	0	15	0	<0.5	5	0	14	0
41	17-alpha-Ethinylestradiol	0.45	21	1	58	1	<0.2	5	0	15	0	0.55	5	1	14	2
42	alpha-Trenbolone	<2	21	0	58	0	<2	5	0	15	0	<2	5	0	14	0
43	beta-Trenbolone	<2	21	0	58	0	<2	5	0	15	0	<2	5	0	14	0

#	Pharmaceutical	Mixedwood Plains					Atlantic Maritime				
		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites	
			Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected
1	Acetaminophen	20	6	3	24	6	124	12	2	37	2
2	Atenolol	42	6	5	24	27	24.3	12	5	37	11
3	Atorvastatin	<5	6	0	24	0	8.8	12	1	37	1
4	Bezafibrate	7.8	6	4	24	15	1.1	12	1	37	1
5	Caffeine	502	6	6	24	28	851	12	10	37	14
6	Carbamazepine	45.7	6	5	24	24	37.6	12	5	37	6
7	Chlortetracycline	<10	6	0	24	0	<10	12	0	37	0
8	Cimetidine	4	6	2	24	6	<2	12	0	37	0
9	Ciprofloxacin	36	6	3	24	7	<20	12	0	37	0
10	Clarithromycin	35.3	6	4	24	17	21.3	12	2	37	2
11	Clofibric Acid	<1	6	0	24	0	<1	12	0	37	0
12	Codeine	101	6	2	24	12	9.6	12	1	37	1
13	Cotinine	31.3	6	5	24	17	90	12	2	37	3
14	Dehydronifedipine	<2	6	0	24	0	<2	12	0	37	0
15	Diclofenac	38	6	3	24	7	16	12	1	37	1
16	Diltiazem	5.2	6	1	24	1	<5	12	0	37	0
17	Diphenhydramine	14	6	1	24	3	30	12	1	37	1
18	Erythromycin	<10	6	0	24	0	<10	12	0	37	0
19	Fluoxetine	<5	6	0	24	0	<5	12	0	37	0
20	Furosemide	12.5	6	1	24	3	30.7	12	1	37	1
21	Gemfibrozil	5.6	6	4	24	12	<10	12	0	37	0
22	Hydrochlorothiazide	85.9	6	3	24	13	38.7	12	1	37	1
23	Ibuprofen	85	6	1	24	3	150	12	1	37	1

#	Pharmaceutical	Mixedwood Plains					Atlantic Maritime				
		Max conc. (ng/L)	# of communities		# of sites		Max conc. (ng/L)	# of communities		# of sites	
			Collected	Detected	Collected	Detected		Collected	Detected	Collected	Detected
24	Indomethacin	<15	6	0	24	0	<15	12	0	37	0
25	Isochlortetracycline	<10	6	0	24	0	<10	12	0	37	0
26	Ketoprofen	3.1	6	1	24	1	7.2	12	1	37	2
27	Lincomycin	<10	6	0	24	0	<10	12	0	37	0
28	Metformin	2020	6	5	24	26	5880	12	8	37	14
29	Metoprolol	25.6	6	3	24	15	25.3	12	1	37	1
30	Monensin	<10	6	0	24	0	<10	12	0	37	0
31	Naproxen	120	6	5	24	16	244	12	3	37	3
32	Oxytetracycline	<10	6	0	24	0	<10	12	0	37	0
33	Pentoxifylline	<2	6	0	24	0	26.9	12	1	37	1
34	Ranitidine	33	6	2	24	10	12	12	1	37	1
35	Roxithromycin	<5	6	0	24	0	<5	12	0	37	0
36	Sulfamethazine	19.1	6	3	24	7	24.2	12	1	37	1
37	Sulfamethoxazole	45.7	6	5	24	27	22	12	3	37	3
38	Tetracycline	<10	6	0	24	0	<10	12	0	37	0
39	Trimethoprim	10.2	6	3	24	13	<2	12	0	37	0
40	Warfarin	0.51	6	1	24	1	<0.5	12	0	37	0
41	17-alpha-Ethinylestradiol	0.74	6	1	24	2	<0.2	12	0	37	0
42	alpha-Trenbolone	<2	6	0	24	0	<2	12	0	37	0
43	beta-Trenbolone	<2	6	0	24	0	<2	12	0	37	0

Appendix K. Traditional foods collected with the highest level of metals of human health concern by ecozone

Cadmium

Sample	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Pacific Maritime (n=65 food species collected)						
Moose kidney	1	5.37	NA	5.37	5.37	5.37
Seaweed	5	3.99	2.10	4.81	0.61	5.76
Mussel	3	3.67	4.15	2.75	0.05	8.20
Oyster	1	3.56	NA	3.56	3.56	3.56
Moose liver	2	2.86	1.08	2.86	2.09	3.62
Boreal Cordillera (n=6 food species collected)						
Moose liver	1	8.46	NA	8.46	8.46	8.46
Caribou Weed	1	1.54	NA	1.54	1.54	1.54
Moose meat	2	0.02	0.01	0.02	0.02	0.03
Sockeye Salmon	2	0.01	0.00	0.01	0.01	0.01
Blueberries	1	0.00	NA	0.00	0.00	0.00
Montane Cordillera (n=46 food species collected)						
Moose kidney	2	7.31	4.09	7.31	4.41	10.20
Moose liver	2	1.54	0.39	1.54	1.26	1.81
Deer Liver	1	0.32	NA	0.32	0.32	0.32
Yew bark	1	0.31	NA	0.31	0.31	0.31
Devils Club bark	1	0.26	NA	0.26	0.26	0.26

Sample	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Taiga Plains (n=33 food species collected)						
Moose kidney	2	16.39	15.01	16.39	5.77	27.00
Rabbit liver	1	3.75	NA	3.75	3.75	3.75
Moose liver	2	1.67	1.31	1.67	0.74	2.60
Moose Heart	2	1.45	2.02	1.45	0.03	2.88
Hare or Rabbit meat	3	0.81	1.38	0.01	0.01	2.40
Boreal Plains (n=68 food species collected)						
Beaver kidney	1	21.60	NA	21.60	21.60	21.60
Rabbit kidney	1	11.30	NA	11.30	11.30	11.30
Moose kidney	16	10.19	9.87	6.92	0.41	31.10
Deer kidney	2	5.62	0.71	5.62	5.12	6.12
Beaver liver	1	3.44	NA	3.44	3.44	3.44
Prairies (n=37 food types collected)						
Moose kidney	2	7.77	7.40	7.77	2.53	13.00
Elk kidney	1	2.13	NA	2.13	2.13	2.13
Deer kidney	3	1.99	1.38	1.46	0.95	3.55
Rabbit kidney	1	1.38	NA	1.38	1.38	1.38
Moose liver	3	1.01	1.22	0.49	0.14	2.40

Cadmium concentrations in traditional food by ecozone						
Sample	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Boreal Shield (n=101 food types collected)						
Moose kidney	9	14.24	8.62	13.00	0.00	29.80
Deer kidney	2	4.44	6.21	4.44	0.05	8.83
Caribou kidney	1	3.91	NA	3.91	3.91	3.91
Moose liver	14	2.12	1.56	1.92	0.01	6.80
Sea Snail	1	1.47	NA	1.47	1.47	1.47
Taiga Shield (n=27 food types collected)						
Moose kidney	1	12.60	NA	12.60	12.60	12.60
Caribou kidney	3	3.89	3.40	5.23	0.02	6.42
Moose liver	1	0.72	NA	0.72	0.72	0.72
Caribou liver	2	0.71	0.31	0.71	0.49	0.93
Ptarmigan meat	1	0.36	NA	0.36	0.36	0.36
Hudson Plains (n=32 food types collected)						
Moose kidney	4	13.25	10.89	14.05	0.00	24.90
Moose liver	5	1.52	0.91	1.21	0.72	2.85
Beaver meat	4	0.62	1.21	0.01	0.01	2.43
Moose meat	7	0.05	0.10	0.00	0.00	0.28
Northern Pike or Jackfish eggs	1	0.04	NA	0.04	0.04	0.04

Cadmium concentrations in traditional food by ecozone						
Sample	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Mixedwood Plains (n=86 food types collected)						
Deer kidney	2	3.22	4.25	3.22	0.22	6.22
Tobacco	1	0.39	NA	0.39	0.39	0.39
Fiddlehead	2	0.39	0.53	0.39	0.01	0.76
Deer liver	3	0.15	0.04	0.14	0.12	0.20
Puffball mushroom	1	0.13	NA	0.13	0.13	0.13
Atlantic Maritime (n=89 food types collected)						
Moose kidney	3	7.90	5.26	5.67	4.12	13.90
Moose liver	9	2.50	2.04	1.99	0.01	5.80
Oyster	3	1.28	0.30	1.37	0.95	1.52
Rabbit liver	1	1.09	NA	1.09	1.09	1.09
Moose heart	4	1.04	2.04	0.03	0.01	4.10

Lead

Lead concentrations in traditional food by ecozone						
Sample	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Pacific Maritime (n=66 food species collected)						
Grouse	2	18.25	25.81	18.25	0.00	36.50
Deer meat	8	1.03	2.03	0.05	0.00	5.63
Cascara Bark	1	0.90	NA	0.90	0.90	0.90
Bear liver	1	0.73	NA	0.73	0.73	0.73
Rabbit/hare meat	1	0.60	NA	0.60	0.60	0.60
Boreal Cordillera (n=6 food species collected)						
Caribou Weed	1	0.30	NA	0.30	0.30	0.30
Blueberries	1	0.00	NA	0.00	0.00	0.00
Salmon	2	0.00	0.00	0.00	0.00	0.00
Trout	2	0.00	0.00	0.00	0.00	0.00
Moose meat	2	0.00	0.00	0.00	0.00	0.00
Montane Cordillera (n=46 food species collected)						
Deer	5	2.81	6.20	0.04	0.00	13.90
Devils Club bark	1	0.70	NA	0.70	0.70	0.70
Black Bear meat	2	0.57	0.81	0.57	0.00	1.14
Moose kidney	2	0.50	0.49	0.50	0.15	0.85
Rabbit meat	2	0.34	0.44	0.34	0.03	0.65
Taiga Plains (n=33 food species collected)						
Grouse meat	3	2.63	4.44	0.12	0.01	7.75
Canada Goose meat	2	1.33	1.87	1.33	0.00	2.65
Beaver fat	1	0.77	NA	0.77	0.77	0.77
Duck meat	4	0.09	0.18	0.01	0.00	0.36
Deer meat	1	0.04	NA	0.04	0.04	0.04

Lead concentrations in traditional food by ecozone						
Sample	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Boreal Plains (n=68 food species collected)						
Bison meat	3	43.75	75.56	0.24	0.01	131.00
Duck heart	1	9.34	NA	9.34	9.34	9.34
Grouse meat	20	4.16	13.53	0.10	0.00	60.60
Beaver heart	1	2.69	NA	2.69	2.69	2.69
Rabbit/hare meat	13	2.15	7.56	0.01	0.00	27.30
Prairies (n=37 food species collected)						
Rabbit/hare meat	7	23.74	61.41	0.21	0.02	163.00
Deer meat	8	3.52	9.57	0.09	0.00	27.20
Grouse Meat	8	3.29	8.35	0.07	0.00	23.90
Duck gizzard	2	1.89	2.57	1.89	0.07	3.70
Ling cod/ mariah/burbot liver	1	0.67	-	0.67	0.67	0.67
Boreal Shield (n=101 food species collected)						
Grouse meat	25	8.84	30.47	0.33	0.00	152.00
Duck meat	19	6.68	23.70	0.04	0.00	104.00
Beaver meat	12	4.50	14.22	0.01	0.00	49.49
Black Bear meat	5	2.75	6.07	0.01	0.00	13.60
Goose meat	13	1.51	4.37	0.18	0.00	16.00
Taiga Shield (n=27 food species collected)						
Caribou heart	3	1.83	3.16	0.01	0.00	5.48
Muskrat meat	1	1.79	-	1.79	1.79	1.79
Grouse meat	5	1.51	2.43	0.52	0.06	5.84
Ptarmigan meat	1	0.27	-	0.27	0.27	0.27
Moose tongue	1	0.16	-	0.16	0.16	0.16

Arsenic

Lead concentrations in traditional food by ecozone						
Sample	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Hudson Plains (n=32 food species collected)						
Grouse meat	4	0.36	0.47	0.21	0.00	1.01
Duck meat	10	0.24	0.42	0.08	0.00	1.31
Goose meat	7	0.21	0.30	0.06	0.00	0.76
Moose liver	5	0.09	0.16	0.01	0.00	0.37
Moose meat	7	0.07	0.16	0.01	0.00	0.42
Mixedwood Plains (n=86 food species collected)						
Deer meat	6	7.35	17.18	0.10	0.00	42.40
Deer liver	3	1.79	3.08	0.02	0.01	5.35
Mushrooms	1	1.19	-	1.19	1.19	1.19
Tobacco	1	1.10	-	1.10	1.10	1.10
Onions	1	1.07	-	1.07	1.07	1.07
Atlantic Maritime (n=89 food species collected)						
Squirrel meat	2	45.38	62.11	45.38	1.46	89.30
Rabbit or Hare meat	8	5.23	14.14	0.03	0.02	40.20
Dandelion roots	1	3.79	-	3.79	3.79	3.79
Grouse meat	12	2.10	6.62	0.06	0.01	23.10
Deer meat	11	1.17	3.66	0.01	0.00	12.20

Arsenic concentrations in traditional food by ecozone						
Sample	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Pacific Maritime (n=65 food species collected)						
Seaweed	5	25.27	13.37	31.00	3.45	35.10
Octopus	1	9.07	NA	9.07	9.07	9.07
Prawn	3	8.91	1.13	8.48	8.06	10.20
Crab	6	7.49	4.04	6.57	3.48	12.80
Sea Cucumber	1	5.13	NA	5.13	5.13	5.13
Boreal Cordillera (n=6 food species collected)						
Salmon	2	0.61	0.05	0.61	0.57	0.64
Caribou Weed	1	0.30	NA	0.30	0.30	0.30
Trout	2	0.07	NA	0.07	0.05	0.08
Moose Liver	1	0.06	NA	0.06	0.06	0.06
Blueberries	1	0.0	NA	0.0	0.0	0.0
Montane Cordillera (n=46 food species collected)						
Halibut	1	3.37	NA	3.37	3.37	3.37
Eulachon grease	1	2.04	NA	2.04	2.04	2.04
Salmon	9	0.71	0.17	0.64	0.53	1.01
Ling cod/mariah/ burbot	2	0.49	0.63	0.49	0.04	0.93
Salmon eggs	4	0.29	0.09	0.30	0.18	0.38
Taiga Plains (n=33 food species collected)						
Muskrat or wihkes root	2	0.75	0.78	0.75	0.20	1.30
Salmon	1	0.53	NA	0.53	0.53	0.53
Morel mushroom	1	0.20	NA	0.20	0.20	0.20
Labrador Tea	1	0.10	NA	0.10	0.10	0.10
Poplar Tree bark	1	0.08	NA	0.08	0.08	0.08

Arsenic concentrations in traditional food by ecozone						
Sample	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Boreal Plains (n=68 food species collected)						
Dandelion greens	1	1.80	NA	1.80	1.80	1.80
Currants	1	0.60	NA	0.60	0.60	0.60
Lambs Quarters leaves	1	0.46	NA	0.46	0.46	0.46
Cattail Tops and stems	1	0.31	NA	0.31	0.31	0.31
Duck meat	22	0.21	0.90	0.01	0.00	4.22
Prairies (n=37 food species collected)						
Blueberry leaves	1	0.42	NA	0.42	0.42	0.42
Muskrat or wihkes root	1	0.28	NA	0.28	0.28	0.28
Rabbit/hare meat	7	0.22	0.57	0.00	0.00	1.50
Ling cod/mariah/ burbot liver	1	0.14	NA	0.14	0.14	0.14
Duck gizzard	2	0.12	0.07	0.12	0.07	0.17
Boreal Shield (n=101 food species collected)						
Lobster	2	8.11	1.67	8.11	6.93	9.29
Sea Snail	1	3.31	NA	3.31	3.31	3.31
Cod	2	2.97	2.47	2.97	1.22	4.72
Mussel	1	2.95	NA	2.95	2.95	2.95
Cod eggs	1	2.50	NA	2.50	2.50	2.50
Taiga Shield (n=27 food species collected)						
Salmon	1	0.56	NA	0.56	0.56	0.56
Whitefish	4	0.20	0.17	0.18	0.01	0.41
Sucker	2	0.11	0.00	0.11	0.11	0.11
Ling cod/mariah/ burbot	1	0.09	NA	0.09	0.09	0.09
Trout	8	0.06	0.07	0.02	0.01	0.17

Arsenic concentrations in traditional food by ecozone						
Sample	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Hudson Plains (n=32 food species collected)						
Cisco	1	1.93	NA	1.93	1.93	1.93
Whitefish	4	1.85	0.65	1.66	1.30	2.77
Northern Pike or Jackfish Eggs	1	0.75	NA	0.75	0.75	0.75
Northern Pike or Jackfish	4	0.73	0.91	0.38	0.11	2.04
Trout	3	0.58	0.40	0.54	0.21	1.00
Mixedwood Plains (n=86 food species collected)						
Sturgeon	2	0.58	0.18	0.58	0.45	0.71
Puffball mushrooms	1	0.54	-	0.54	0.54	0.54
Smelt	1	0.37	-	0.37	0.37	0.37
Tobacco	1	0.20	-	0.20	0.20	0.20
Salmon	2	0.19	0.21	0.19	0.04	0.33
Atlantic Maritime (n=89 food species collected)						
Perch	1	11.90	-	11.90	11.90	11.90
Crabs	8	11.12	7.83	7.91	4.91	25.90
Shad	1	7.44	-	7.44	7.44	7.44
Sole	2	5.78	6.11	5.78	1.46	10.10
Lobster	10	5.28	3.60	4.10	1.61	13.80

Mercury

Sample	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Mercury concentrations in traditional food by ecozone						
Pacific Maritime (n=65 food species collected)						
Mushrooms	5	0.21	0.28	0.06	0.01	0.68
Halibut	5	0.19	0.12	0.17	0.02	0.33
Rockfish	6	0.17	0.13	0.16	0.01	0.38
Trout	6	0.09	0.11	0.04	0.00	0.28
Cockles	3	0.05	0.08	0.01	0.00	0.15
Boreal Cordillera (n=6 food species collected)						
Trout	1	0.31	NA	0.31	0.31	0.31
Salmon	2	0.03	0.01	0.03	0.03	0.04
Caribou Weed	1	0.02	NA	0.02	0.02	0.02
Moose liver	1	0.01	NA	0.01	0.01	0.01
Blueberries	1	0.00	NA	0.00	0.00	0.00
Montane Cordillera (n=46 food species collected)						
Arctic Char	1	0.92	NA	0.92	0.92	0.92
Carp	1	0.72	NA	0.72	0.72	0.72
Ling Cod or Mariah or Burbot	2	0.27	0.23	0.27	0.11	0.43
Halibut	1	0.22	NA	0.22	0.22	0.22
Groundhog meat	1	0.09	-	0.09	0.09	0.09
Taiga Plains (n=33 food species collected)						
Northern Pike or Jackfish	2	0.20	0.04	0.20	0.18	0.23
Walleye or Pickerel	1	0.16	NA	0.16	0.16	0.16
Trout	2	0.10	0.06	0.10	0.05	0.14
Salmon	1	0.04	-	0.04	0.04	0.04
Arctic Grayling	1	0.02	-	0.02	0.02	0.02

Sample	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Mercury concentrations in traditional food by ecozone						
Boreal Plains (n=72 food species collected)						
Walleye or Pickerel	12	0.46	0.26	0.38	0.07	1.02
Northern Pike or Jackfish	10	0.44	0.26	0.36	0.18	0.96
Mooneye or Goldeye	1	0.20	-	0.20	0.20	0.20
Ling Cod or Mariah or Burbot	2	0.18	0.05	0.18	0.14	0.22
Arctic Grayling	1	0.17	-	0.17	0.17	0.17
Prairies (n=37 food species collected)						
Walleye or Pickerel	3	0.19	0.04	0.21	0.14	0.22
Northern Pike or Jackfish	4	0.15	0.12	0.14	0.04	0.28
Whitefish	4	0.14	0.13	0.14	0.01	0.28
Perch	1	0.09	NA	0.09	0.09	0.09
Duck Gizzard	2	0.04	0.04	0.04	0.02	0.07
Boreal Shield (n=102 food species collected)						
Harp Seal	1	1.06	NA	1.06	1.06	1.06
Caribou Kidney	1	0.65	NA	0.65	0.65	0.65
Northern Pike or Jackfish	13	0.58	0.72	0.29	0.15	2.75
Carp	1	0.37	NA	0.37	0.37	0.37
Walleye or Pickerel	21	0.37	0.29	0.28	0.08	1.27

Mercury concentrations in traditional food by ecozone						
Sample	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Taiga Shield (n=27 food species collected)						
Caribou kidney	3	0.57	0.49	0.80	0.01	0.91
Walleye or Pickerel	2	0.43	0.09	0.43	0.36	0.49
Trout	8	0.36	0.17	0.40	0.10	0.58
Ling Cod or Mariah or Burbot	1	0.28	-	0.28	0.28	0.28
Northern Pike or Jackfish	4	0.25	0.13	0.21	0.14	0.44
Hudson Plains (n=32 food species collected)						
Northern Pike or Jackfish	4	0.54	0.15	0.51	0.42	0.74
Walleye or Pickerel	4	0.40	0.14	0.43	0.22	0.52
Sturgeon	4	0.39	0.19	0.35	0.20	0.63
Trout	3	0.12	0.01	0.12	0.11	0.14
Whitefish	4	0.10	0.03	0.10	0.07	0.12
Mixedwood Plains (n=86 food species collected)						
Puffball mushroom	1	1.72	NA	1.72	1.72	1.72
Sturgeon	2	0.40	0.23	0.40	0.24	0.56
Walleye or Pickerel	6	0.39	0.21	0.36	0.18	0.78
Bass	4	0.38	0.23	0.37	0.11	0.66
Trout	3	0.21	0.06	0.19	0.16	0.28
Atlantic Maritime (n=89 food species collected)						
Bass	4	0.47	0.43	0.33	0.14	1.07
Striped Bass	7	0.16	0.09	0.12	0.03	0.32
Sucker	1	0.14	NA	0.14	0.14	0.14
Halibut	3	0.14	0.12	0.11	0.03	0.26
Eel	9	0.11	0.03	0.12	0.06	0.14

Methylmercury

Methylmercury concentrations in traditional food by ecozone						
Sample*	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Pacific Maritime (n=36 food species analyzed)						
Halibut	5	0.27	0.08	0.28	0.18	0.38
Rockfish	6	0.24	0.13	0.19	0.11	0.41
Trout	6	0.14	0.12	0.10	0.03	0.36
Cod	2	0.07	0.01	0.07	0.06	0.08
Crabs	6	0.06	0.04	0.04	0.03	0.13
Boreal Cordillera (n=4 food species analyzed)						
Trout	2	0.11	0.02	0.11	0.10	0.12
Salmon	2	0.04	0.00	0.04	0.03	0.04
Moose meat	2	0.00	0.00	0.00	0.00	0.00
Moose liver	1	0.00	NA	0.00	0.00	0.00
Montane Cordillera (n=20 food species analyzed)						
Arctic Char	1	0.74	NA	0.74	0.74	0.74
Ling Cod or Mariah or Burbot	1	0.36	NA	0.36	0.36	0.36
Carp	1	0.18	NA	0.18	0.18	0.18
Halibut	1	0.17	NA	0.17	0.17	0.17
Trout	6	0.17	0.19	0.10	0.06	0.54
Taiga Plains (n=11 food species analyzed)						
Walleye or Pickerel	1	0.32	NA	0.32	0.32	0.32
Northern Pike or Jackfish	2	0.15	0.03	0.15	0.13	0.17
Trout	2	0.12	0.05	0.12	0.08	0.15
Salmon	1	0.05	NA	0.05	0.05	0.05
Duck Meat	1	0.01	NA	0.01	0.01	0.01

Methylmercury concentrations in traditional food by ecozone						
Sample*	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Boreal Plains (n=18 food species analyzed)						
Northern Pike or Jackfish	10	0.27	0.16	0.27	0.08	0.58
Walleye or Pickerel	12	0.27	0.19	0.28	0.03	0.67
Trout	9	0.18	0.24	0.04	0.01	0.69
Ling Cod or Mariah or Burbot	1	0.13	NA	0.13	0.13	0.13
Sucker	4	0.06	0.03	0.06	0.04	0.08
Prairies (n=14 food species analyzed)						
Walleye or Pickerel	3	0.17	0.06	0.15	0.12	0.24
Northern Pike or Jackfish	4	0.10	0.07	0.09	0.04	0.18
Whitefish	4	0.10	0.14	0.03	0.01	0.30
Yellow Perch	1	0.08	NA	0.08	0.08	0.08
Duck Gizzard	2	0.06	0.04	0.06	0.03	0.09
Boreal Shield (n=44 food species analyzed)						
Harp Seal meat	1	1.39	NA-	1.39	1.39	1.39
Walleye or Pickerel	14	0.38	0.48	0.16	0.06	1.49
Northern Pike or Jackfish	10	0.36	0.24	0.28	0.08	0.72
Lobster	2	0.32	0.23	0.32	0.16	0.49
Trout	15	0.28	0.23	0.29	0.03	0.90
Taiga Shield (n=17 food species analyzed)						
Trout	8	0.44	0.26	0.44	0.14	0.95
Walleye or Pickerel	2	0.42	0.07	0.42	0.37	0.47
Ling Cod or Mariah or Burbot	1	0.36	NA-	0.36	0.36	0.36
Duck meat	3	0.24	0.16	0.16	0.13	0.42
Northern Pike or Jackfish	4	0.22	0.19	0.15	0.09	0.49

Methylmercury concentrations in traditional food by ecozone						
Sample*	Number of communities/ pooled samples	Mean (µg/g)	SD (µg/g)	Median (µg/g)	Minimum (µg/g)	Maximum (µg/g)
Hudson Plains (n=12 food species analyzed)						
Northern Pike or Jackfish	4	0.33	0.22	0.29	0.15	0.61
Sturgeon	4	0.27	0.20	0.23	0.09	0.54
Walleye or Pickerel	3	0.25	0.24	0.14	0.09	0.53
Trout	3	0.09	0.04	0.07	0.06	0.14
Whitefish	4	0.06	0.01	0.06	0.04	0.07
Mixedwood Plains (n=14 food species analyzed)						
Walleye or Pickerel	6	0.21	0.20	0.10	0.04	0.49
Bass	3	0.19	0.12	0.26	0.05	0.27
Sturgeon	2	0.19	0.06	0.19	0.15	0.23
Trout	3	0.17	0.16	0.07	0.07	0.36
Catfish	3	0.10	0.05	0.08	0.06	0.16
Atlantic Maritime (n=26 food species analyzed)						
Bass	3	0.60	0.80	0.14	0.13	1.53
Sucker	1	0.14	-	0.14	0.14	0.14
Striped Bass	6	0.13	0.10	0.10	0.03	0.32
Eel	8	0.10	0.04	0.11	0.04	0.16
Crabs	2	0.10	0.10	0.10	0.02	0.17

*Note: Many non-seafood samples were not tested for methylmercury.

DDE

Sample*	Number of communities/ pooled samples	Mean (ng/g)	SD (ng/g)	Median (ng/g)	Minimum (ng/g)	Maximum (ng/g)
Pacific Maritime (n=41 food species analyzed)						
Eulachon grease	4	22.65	6.00	21.90	16.50	30.30
Salmon	37	3.25	3.73	2.41	0.00	21.20
Cod	2	2.56	2.28	2.56	0.94	4.17
Eulachon	4	2.54	1.40	2.46	1.12	4.10
Salmon Eggs	6	2.31	1.19	2.27	0.80	4.38
Boreal Cordillera (n=7 food species analyzed)						
Salmon	2	0.87	1.22	0.87	0.00	1.73
Blueberries	1	0.00	NA	0.00	0.00	0.00
Trout	2	0.00	0.00	0.00	0.00	0.00
Moose meat	2	0.00	0.00	0.00	0.00	0.00
Moose liver	1	0.00	NA	0.00	0.00	0.00
Montane Cordillera (n=25 food species analyzed)						
Eulachon grease	1	15.00	NA	15.00	15.00	15.00
Trout	6	5.33	9.90	0.40	0.00	24.90
Ling Cod or Mariah or Burbot	2	2.77	3.91	2.77	0.00	5.53
Salmon eggs	4	2.14	4.27	0.00	0.00	8.54
Salmon	9	1.59	0.77	1.76	0.00	2.36
Taiga Plains (n=15 food species analyzed)						
Salmon goose meat	1	4.96	NA	4.96	4.96	4.96
Salmon	1	3.71	NA	3.71	3.71	3.71
Duck meat	1	1.24	NA	1.24	1.24	1.24
Arctic Grayling	1	0.70	NA	0.70	0.70	0.70
Northern Pike or Jackfish	2	0.03	0.04	0.03	0.00	0.06

Sample*	Number of communities/ pooled samples	Mean (ng/g)	SD (ng/g)	Median (ng/g)	Minimum (ng/g)	Maximum (ng/g)
Boreal Plains (n=20 food species analyzed)						
Beaver kidney	1	16.10	NA	16.10	16.10	16.10
Beaver liver	1	13.80	NA	13.80	13.80	13.80
Elk liver	1	9.39	NA	9.39	9.39	9.39
Trout	9	6.15	10.53	1.66	0.00	32.50
Beaver meat	3	5.04	4.22	3.78	1.59	9.75
Prairies (n=15 food species analyzed)						
Deer liver	2	5.75	8.13	5.75	0.00	11.50
Whitefish	4	1.99	2.50	0.97	0.33	5.68
Duck meat	5	1.20	0.75	1.57	0.06	1.93
Walleye or Pickerel	3	0.19	0.32	0.00	0.00	0.56
Northern Pike or Jackfish	4	0.05	0.08	0.02	0.00	0.17
Boreal Shield (n=45 food species analyzed)						
Salmon eggs	1	64.30	-	64.30	64.30	64.30
Harp Seal meat	1	28.50	-	28.50	28.50	28.50
Salmon	5	24.13	23.76	12.40	5.89	61.10
Duck meat	8	13.53	27.44	5.22	0.00	81.00
Trout	18	12.15	17.46	4.82	0.33	64.95
Taiga Shield (n=16 food species analyzed)						
Duck meat	1	102.00	-	102.00	102.00	102.00
Trout	7	5.83	4.87	5.19	1.37	15.70
Whitefish	4	1.28	0.82	1.31	0.24	2.25
Trout eggs	2	0.83	0.37	0.83	0.57	1.09
Goose liver	1	0.31	-	0.31	0.31	0.31

PCBs

Sample*	Number of communities/ pooled samples	Mean (ng/g)	SD (ng/g)	Median (ng/g)	Minimum (ng/g)	Maximum (ng/g)
Hudson Plains (n=13 food species analyzed)						
Goose meat	6	14.13	15.41	9.37	1.66	42.90
Duck meat	1	5.04	NA	5.04	5.04	5.04
Black Bear fat	1	3.39	NA	3.39	3.39	3.39
Sturgeon	4	2.90	2.70	2.00	0.77	6.84
Whitefish eggs	1	2.13	NA	2.13	2.13	2.13
Mixedwood Plains (n=14 food species analyzed)						
Trout	3	70.93	59.97	102.00	1.80	109.00
Smelt	1	28.35	-	28.35	28.35	28.35
Salmon	2	25.65	23.13	25.65	9.29	42.00
Sturgeon	2	22.30	5.52	22.30	18.40	26.20
Catfish	3	10.90	7.21	13.70	2.71	16.30
Atlantic Maritime (n=24 food species analyzed)						
Bass	3	19.13	30.12	2.43	1.05	53.90
Eel	7	9.66	11.89	4.53	1.10	35.10
Trout	19	6.73	10.53	2.23	0.51	38.50
Atlantic salmon	12	5.59	3.50	4.98	1.59	11.70
Shad	1	4.54	-	4.54	4.54	4.54

Note: Some non fat samples were not tested for organochlorines.

Sample*	Number of communities/ pooled samples	Mean (ng/g)	SD (ng/g)	Median (ng/g)	Minimum (ng/g)	Maximum (ng/g)
Pacific Maritime (n=41 food species analyzed)						
Pacific Herring	1	8.24	NA	8.24	8.24	8.24
Prawns	3	1.39	2.40	0.00	0.00	4.16
Eulachon grease	4	1.11	2.23	0.00	0.00	4.45
Trout	6	1.04	1.19	0.87	0.00	2.70
Halibut	5	0.87	1.12	0.46	0.00	2.67
Boreal Cordillera (n=7 food species analyzed)						
Blueberries	1	0.00	NA	0.00	0.00	0.00
Trout	2	0.00	0.00	0.00	0.00	0.00
Moose meat	2	0.00	0.00	0.00	0.00	0.00
Moose liver	1	0.00	NA	0.00	0.00	0.00
Black Bear fat	1	0.00	NA	0.00	0.00	0.00
Montane Cordillera (n=25 food species analyzed)						
Arctic Char	1	1.63	NA	1.63	1.63	1.63
Salmon eggs	4	1.20	2.40	0.00	0.00	4.79
Ling Cod or Mariah or Burbot	2	0.23	0.32	0.23	0.00	0.45
Trout	6	0.14	0.22	0.00	0.00	0.47
Salmon	9	0.14	0.21	0.00	0.00	0.44
Taiga Plains (n=15 food species analyzed)						
Salmon	1	1.14	-	1.14	1.14	1.14
Trout	2	0.78	1.10	0.78	0.00	1.55
Northern Pike or Jackfish	2	0.00	0.00	0.00	0.00	0.00
Walleye or Pickerel	1	0.00	-	0.00	0.00	0.00
Beaver meat	2	0.00	0.00	0.00	0.00	0.00

Sample*	Number of communities/ pooled samples	Mean (ng/g)	SD (ng/g)	Median (ng/g)	Minimum (ng/g)	Maximum (ng/g)
Boreal Plains (n=20 food species analyzed)						
Mallard meat	7	24.34	64.21	0.00	0.00	169.95
Elk liver	1	10.72	NA	10.72	10.72	10.72
Beaver meat	3	4.95	4.15	5.43	0.58	8.83
Trout	9	2.65	4.28	0.41	0.00	12.32
Rabbit or hare meat	2	0.35	0.49	0.35	0.00	0.69
Prairies (n=15 food species analyzed)						
Whitefish	4	1.46	2.19	0.56	0.00	4.71
Deer liver	2	0.55	0.78	0.55	0.00	1.10
Walleye or Pickerel	3	0.30	0.51	0.00	0.00	0.89
Duck meat	5	0.28	0.38	0.00	0.00	0.75
Perch	1	0.00	NA	0.00	0.00	0.00
Boreal Shield (n=45 food species analyzed)						
Harp Seal meat	1	265.40	NA	265.40	265.40	265.40
Carp	1	126.52	NA	126.52	126.52	126.52
Salmon eggs	1	111.34	NA	111.34	111.34	111.34
Duck meat	8	84.12	201.65	11.12	0.00	582.01
Salmon	5	67.51	62.07	36.44	18.31	161.20
Taiga Shield (n=16 food species analyzed)						
Duck meat	1	127.71	Na	127.71	127.71	127.71
Black Bear fat	1	19.63	NA	19.63	19.63	19.63
Lake Trout	6	7.62	4.98	6.89	2.72	15.18
Whitefish	4	1.97	2.16	1.44	0.19	4.80
Trout eggs	2	0.67	0.94	0.67	0.00	1.33

Sample*	Number of communities/ pooled samples	Mean (ng/g)	SD (ng/g)	Median (ng/g)	Minimum (ng/g)	Maximum (ng/g)
Hudson Plains (n=13 food species analyzed)						
Black Bear fat	1	7.13	NA	7.13	7.13	7.13
Northern Pike or Jackfish eggs	1	4.76	NA	4.76	4.76	4.76
Whitefish eggs	1	4.29	NA	4.29	4.29	4.29
Sturgeon	4	3.44	2.56	3.72	0.56	5.78
Northern Pike or Jackfish	4	1.88	1.60	1.54	0.46	3.98
Mixedwood Plains (n=14 food species analyzed)						
Sturgeon	2	324.00	39.53	324.00	296.04	351.95
Trout	3	194.16	166.65	282.01	1.96	298.51
Catfish	3	110.63	111.34	89.06	11.65	231.17
Salmon	2	73.83	43.35	73.83	43.18	104.48
Smelt	1	64.47	-	64.47	64.47	64.47
Atlantic Maritime (n=24 food species analyzed)						
Bass	2	21.30	26.27	21.30	2.73	39.88
Eel	7	9.01	10.42	5.73	1.83	31.61
Trout	19	8.13	12.57	3.05	0.21	45.57
Mackerel	7	7.82	3.62	7.21	3.28	13.39
Atlantic Salmon	11	6.75	4.36	4.42	2.81	15.36

Note: Some non fat samples were not tested for organochlorines.

Appendix L. Ecozone level Principal traditional food contributors to contaminant intake among adults

Cadmium

Cadmium – Ecozone Level Contaminant Intake (all adults)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Pacific Maritime (n=65 food species collected)			
Oyster	2.45	0.00	6.25
Seaweed	1.23	0.04	2.43
Moose Liver	0.82	0.19	1.46
Mussel	0.74	0.53	0.94
Herring Egg	0.27	0.04	0.50
Boreal Cordillera (n=6 food species collected)			
Moose liver	20.50	2.48	38.51
Moose meat	0.98	0.54	1.43
Salmon	0.04	0.03	0.04
Blueberries	0.00	0.00	0.00
Trout	0.00	0.00	0.00
Montane Cordillera (n=46 food species collected)			
Moose Kidney	5.41	0.00	11.42
Moose Liver	1.55	0.00	3.37
Deer Liver	0.68	0.00	1.47
Moose Meat	0.20	0.13	0.27
Deer Meat	0.08	0.01	0.15
Taiga Plains (n=33 food species collected)			
Moose Kidney	13.55	4.12	22.98
Moose Liver	2.66	0.66	4.67
Grouse Meat	0.52	0.25	0.79
Moose Meat	0.52	0.36	0.67
Walleye or Pickerel	0.03	0.00	0.06

Cadmium – Ecozone Level Contaminant Intake (all adults)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Boreal Plains (n=68 food species collected)			
Moose kidney	9.19	1.93	16.44
Moose liver	2.01	0.50	3.52
Deer kidney	0.81	0.00	1.71
Moose meat	0.11	0.04	0.17
Deer liver	0.04	0.00	0.08
Prairies (n=37 food species collected)			
Moose kidney	0.76	0.00	1.53
Deer kidney	0.49	0.00	1.19
Elk kidney	0.22	0.01	0.44
Moose liver	0.12	0.00	0.26
Deer liver	0.11	0.03	0.19
Boreal Shield (n=101 food species collected)			
Moose kidney	6.62	1.39	11.85
Moose liver	1.53	0.38	2.68
Mussel	0.92	0.00	2.68
Caribou kidney	0.59	0.00	1.30
Rabbit or hare heart	0.16	0.08	0.25
Taiga Shield (n=27 food species collected)			
Caribou kidney	3.28	1.82	4.74
Ptarmigan meat	1.82	0.00	4.56
Moose kidney	0.44	0.08	0.79
Caribou liver	0.29	0.00	0.57
Caribou meat	0.18	0.06	0.30

Lead

Cadmium – Ecozone Level Contaminant Intake (all adults)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Hudson Plains (n=32 food species collected)			
Moose kidney	4.72	2.91	6.53
Beaver meat	0.57	0.22	0.92
Moose meat	0.53	0.32	0.75
Moose liver	0.47	0.26	0.69
Ptarmigan	0.03	0.01	0.04
Mixedwood Plains (n=86 food species collected)			
Fiddlehead	0.03	0.00	0.07
Deer meat	0.03	0.01	0.05
Strawberry	0.02	0.01	0.03
Deer kidney	0.01	0.00	0.03
Moose Meat	0.01	0.01	0.01
Atlantic Maritime (n=89 food species collected)			
Lobster	0.52	0.43	0.60
Oyster	0.26	0.15	0.37
Mussel	0.10	0.07	0.14
Scallop	0.10	0.06	0.13
Moose kidney	0.09	0.02	0.16

Lead – Ecozone Level Contaminant Intake (all adults)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Pacific Maritime (n=65 food species collected)			
Deer meat	3.56	0.00	7.13
Grouse	1.58	0.29	2.88
Halibut	1.00	0.43	1.57
Elk meat	0.12	0.00	0.28
Seaweed	0.10	0.00	0.19
Boreal Cordillera (n=6 food species collected)			
Blueberries	0.00	0.00	0.00
Trout	0.00	0.00	0.00
Moose Meat	0.00	0.00	0.00
Moose Liver	0.00	0.00	0.00
Salmon	0.00	0.00	0.00
Montane Cordillera (n=46 food species collected)			
Deer Meat	51.15	3.40	98.91
Moose Kidney	0.37	0.00	0.78
Moose Meat	0.20	0.13	0.26
Black Bear Meat	0.12	0.01	0.22
Grouse	0.08	0.00	0.17
Taiga Plains (n=33 food species collected)			
Grouse Meat	11.30	5.48	17.11
Goose Meat	3.45	2.09	4.80
Duck Meat	0.20	0.02	0.38
Moose Meat	0.10	0.07	0.13
Deer Meat	0.04	0.01	0.06

Lead – Ecozone Level Contaminant Intake (all adults)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Boreal Plains (n=68 food species collected)			
Bison Meat	8.55	0.41	16.68
Moose Meat	8.39	3.19	13.60
Deer Meat	2.14	0.74	3.54
Grouse Meat	1.89	0.66	3.13
Elk Meat	0.97	0.44	1.49
Prairies (n=37 food species collected)			
Deer Meat	12.63	8.54	16.73
Grouse Meat	0.59	0.00	1.38
Goose Meat	0.14	0.00	0.38
Moose Meat	0.09	0.06	0.13
Duck Meat	0.04	0.00	0.11
Boreal Shield (n=101 food species collected)			
Moose Meat	6.21	4.47	7.95
Grouse Meat	4.49	2.24	6.75
Beaver Meat	3.31	0.97	5.65
Goose Meat	2.17	0.29	4.06
Duck Meat	1.59	0.00	3.52
Taiga Shield (n=27 food species collected)			
Grouse Meat	2.68	2.06	3.31
Caribou Heart	2.45	1.69	3.22
Ptarmigan Meat	1.34	0.00	3.35
Caribou Meat	0.99	0.33	1.65
Caribou Kidney	0.11	0.06	0.16

Lead – Ecozone Level Contaminant Intake (all adults)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Hudson Plains (n=32 food species collected)			
Goose Meat	1.70	1.03	2.37
Moose Meat	0.72	0.43	1.02
Grouse Meat	0.15	0.02	0.29
Northern Pike/ Jackfish	0.05	0.01	0.09
Duck Meat	0.05	0.03	0.07
Mixedwood Plains (n=86 food species collected)			
Deer Meat	26.51	6.25	46.77
Moose Meat	0.29	0.20	0.38
Strawberries	0.15	0.10	0.20
Deer Liver	0.08	0.00	0.22
Wild Ginger	0.03	0.02	0.04
Atlantic Maritime (n=89 food species collected)			
Deer Meat	1.25	0.86	1.65
Moose Meat	0.27	0.13	0.42
Squirrel Meat	0.08	0.01	0.15
Mussel	0.08	0.05	0.10
Shrimp	0.05	0.04	0.07

Arsenic

Arsenic – Ecozone Level Contaminant Intake (all adults)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Pacific Maritime (n=65 food species collected)			
Prawns	18.26	0.00	37.45
Halibut	12.39	5.31	19.46
Seaweed	7.80	0.22	15.38
Clams	7.57	2.51	12.63
Eulachon grease	5.92	0.35	11.48
Boreal Cordillera (n=6 food species collected)			
Salmon	1.98	1.75	2.21
Moose Liver	0.15	0.02	0.27
Trout	0.03	0.00	0.05
Blueberries	0.00	0.00	0.00
Moose meat	0.00	0.00	0.00
Montane Cordillera (n=46 food species collected)			
Salmon	1.69	1.07	2.30
Halibut	0.95	0.00	1.96
Deer meat	0.51	0.03	0.99
Salmon eggs	0.42	0.02	0.81
Ling Cod or Mariah or Burbot	0.22	0.00	0.59
Taiga Plains (n=33 food species collected)			
Moose meat	0.40	0.28	0.53
Northern Pike or Jackfish	0.25	0.07	0.43
Salmon	0.17	0.08	0.27
Beaver meat	0.13	0.06	0.19
Walleye or Pickerel	0.11	0.00	0.26

Arsenic – Ecozone Level Contaminant Intake (all adults)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Boreal Plains (n=68 food species collected)			
Moose meat	0.12	0.05	0.20
Walleye or Pickerel	0.09	0.05	0.14
Northern Pike or Jackfish	0.05	0.03	0.08
Dandelion Greens	0.03	0.00	0.07
Whitefish	0.03	0.01	0.04
Prairies (n=37 food species collected)			
Walleye or Pickerel	0.08	0.00	0.16
Northern Pike or Jackfish	0.02	0.01	0.04
Deer meat	0.02	0.02	0.03
Whitefish	0.01	0.01	0.02
Moose meat	0.01	0.01	0.02
Boreal Shield (n=101 food species collected)			
Mussel	3.96	0.00	11.58
Lobster	1.14	0.89	1.38
Cod	0.81	0.62	1.00
Walleye or Pickerel	0.62	0.38	0.87
Whitefish	0.25	0.08	0.42
Taiga Shield (n=27 food species collected)			
Whitefish	0.51	0.02	1.00
Caribou Meat	0.34	0.11	0.56
Trout	0.06	0.05	0.07
Atlantic Salmon	0.04	0.00	0.11
Northern Pike or Jackfish	0.04	0.01	0.06

Mercury

Arsenic – Ecozone Level Contaminant Intake (all adults)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Hudson Plains (n=32 food species collected)			
Whitefish	1.90	0.51	3.29
Northern Pike or Jackfish	1.61	0.38	2.84
Cisco	1.11	0.66	1.55
Walleye or Pickerel	1.09	0.87	1.31
Sturgeon	0.24	0.16	0.31
Mixedwood Plains (n=86 food species collected)			
Salmon	0.09	0.00	0.20
Walleye or Pickerel	0.07	0.05	0.09
Sturgeon	0.07	0.00	0.14
Perch	0.05	0.02	0.08
Maple Syrup	0.02	0.01	0.03
Atlantic Maritime (n=89 food species collected)			
Lobster	8.58	7.18	9.97
Crabs	2.83	1.94	3.73
Shrimp	2.35	1.60	3.09
Haddock	2.33	1.36	3.30
Scallops	1.28	0.75	1.80

Mercury – Ecozone Level Contaminant Intake (all adults)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Pacific Maritime (n=65 food species collected)			
Halibut	1.02	0.43	1.60
Rockfish	0.24	0.14	0.34
Salmon	0.12	0.08	0.17
Salmon eggs	0.06	0.03	0.10
Cockles	0.04	0.02	0.06
Boreal Cordillera (n=6 food species collected)			
Salmon	0.11	0.10	0.13
Trout	0.07	0.01	0.12
Moose liver	0.01	0.00	0.02
Blueberries	0.00	0.00	0.00
Moose meat	0.00	0.00	0.00
Montane Cordillera (n=46 food species collected)			
Ling Cod or Mariah or Burbot	0.12	0.00	0.33
Salmon eggs	0.07	0.00	0.13
Salmon	0.07	0.04	0.09
Halibut	0.06	0.00	0.13
Trout	0.02	0.01	0.04
Taiga Plains (n=33 food species collected)			
Northern Pike or Jackfish	1.42	0.40	2.43
Walleye or Pickerel	0.46	0.00	1.04
Duck meat	0.02	0.00	0.03
Salmon	0.01	0.01	0.02
Moose kidney	0.01	0.00	0.01

Mercury – Ecozone Level Contaminant Intake (all adults)			
Boreal Plains (n=68 food species collected)			
Walleye or Pickerel	0.83	0.42	1.24
Northern Pike or Jackfish	0.63	0.34	0.92
Whitefish	0.06	0.03	0.09
Moose meat	0.02	0.01	0.03
Moose kidney	0.01	0.00	0.02
Prairies (n=37 food species collected)			
Walleye or Pickerel	0.19	0.01	0.37
Northern Pike or Jackfish	0.07	0.03	0.12
Whitefish	0.03	0.01	0.05
Perch	0.02	0.00	0.05
Deer kidney	0.00	0.00	0.01
Boreal Shield (n=101 food species collected)			
Walleye or Pickerel	2.83	1.73	3.94
Northern Pike or Jackfish	1.01	0.24	1.77
Whitefish	0.14	0.04	0.24
Trout	0.12	0.04	0.21
Caribou kidney	0.10	0.00	0.21
Taiga Shield (n=27 food species collected)			
Caribou kidney	0.48	0.27	0.70
Trout	0.33	0.29	0.36
Walleye or Pickerel	0.26	0.10	0.43
Whitefish	0.24	0.01	0.47
Caribou meat	0.21	0.07	0.36

Mercury – Ecozone Level Contaminant Intake (all adults)			
Hudson Plains (n=32 food species collected)			
Northern Pike or Jackfish	1.20	0.28	2.12
Walleye or Pickerel	1.03	0.82	1.24
Sturgeon	0.21	0.14	0.28
Whitefish	0.10	0.03	0.17
Moose meat	0.04	0.02	0.05
Mixedwood Plains (n=86 food species collected)			
Walleye or Pickerel	0.53	0.35	0.70
Perch	0.24	0.09	0.39
Sturgeon	0.05	0.00	0.09
Salmon	0.02	0.00	0.05
Trout	0.02	0.00	0.04
Atlantic Maritime (n=89 food species collected)			
Lobster	0.17	0.14	0.19
Atlantic Salmon	0.07	0.05	0.08
Haddock	0.04	0.02	0.06
Halibut	0.04	0.02	0.05
Crabs	0.03	0.02	0.04

Methylmercury

Methylmercury – Ecozone Level Contaminant Intake (all adults)			
Sample*	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Pacific Maritime (n=36 food species analyzed)			
Halibut	1.46	0.63	2.30
Rockfish	0.35	0.21	0.49
Salmon	0.16	0.10	0.23
Cod	0.07	0.00	0.13
Prawns	0.05	0.00	0.10
Boreal Cordillera (n=4 food species analyzed)			
Salmon	0.12	0.10	0.13
Trout	0.05	0.00	0.09
Moose Meat	0.00	0.00	0.00
Moose Liver	0.00	0.00	0.00
Montane Cordillera (n=20 food species analyzed)			
Ling Cod or Mariah or Burbot	0.16	0.00	0.44
Salmon	0.11	0.07	0.15
Trout	0.07	0.02	0.12
Halibut	0.05	0.00	0.10
Whitefish	0.01	0.01	0.01
Taiga Plains (n=11 food species analyzed)			
Northern Pike or Jackfish	1.05	0.30	1.80
Walleye or Pickerel	0.93	0.00	2.09
Duck Meat	0.03	0.00	0.06
Salmon	0.01	0.01	0.02
Trout	0.01	0.00	0.01

Methylmercury – Ecozone Level Contaminant Intake (all adults)			
Sample*	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Boreal Plains (n=18 food species analyzed)			
Walleye or Pickerel	0.49	0.25	0.73
Northern Pike or Jackfish	0.39	0.21	0.57
Whitefish	0.03	0.01	0.04
Deer meat	0.01	0.00	0.02
Trout	0.01	0.00	0.02
Prairies (n=14 food species analyzed)			
Walleye or Pickerel	0.17	0.01	0.34
Northern Pike or Jackfish	0.05	0.02	0.08
Whitefish	0.02	0.01	0.03
Perch	0.02	0.00	0.04
Duck meat	0.00	0.00	0.00
Boreal Shield (n=44 food species analyzed)			
Walleye or Pickerel	2.93	1.78	4.07
Northern Pike or Jackfish	0.62	0.15	1.09
Trout	0.11	0.03	0.18
Whitefish	0.10	0.03	0.17
Sturgeon	0.05	0.02	0.07
Taiga Shield (n=17 food species analyzed)			
Trout	0.40	0.35	0.45
Walleye or Pickerel	0.26	0.10	0.42
Whitefish	0.23	0.01	0.45
Caribou meat	0.18	0.06	0.30
Northern Pike or Jackfish	0.18	0.05	0.32

Methylmercury – Ecozone Level Contaminant Intake (all adults)			
Sample*	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Hudson Plains (n=12 food species analyzed)			
Northern Pike or Jackfish	0.74	0.17	1.30
Walleye or Pickerel	0.65	0.52	0.78
Sturgeon	0.15	0.10	0.20
Whitefish	0.06	0.02	0.11
Cisco	0.02	0.01	0.03
Mixedwood Plains (n=14 food species analyzed)			
Walleye or Pickerel	0.28	0.19	0.38
Perch	0.11	0.04	0.17
Sturgeon	0.02	0.00	0.05
Trout	0.01	0.00	0.03
Salmon	0.01	0.00	0.03
Atlantic Maritime (n=26 food species analyzed)			
Lobster	0.12	0.10	0.14
Atlantic Salmon	0.05	0.04	0.07
Crabs	0.02	0.02	0.03
Shrimp	0.02	0.01	0.03
Halibut	0.02	0.01	0.03

*Note: Many non-seafood samples were not tested for methylmercury.

DDE

Sample*	Mean (ng/day)	Lower 95% CI (ng/day)	Upper 95% CI (ng/day)
Pacific Maritime (n=41 food species analyzed)			
Eulachon grease	34.35	2.04	66.65
Salmon	14.01	8.69	19.33
Halibut	9.81	4.20	15.42
Salmon eggs	4.88	2.14	7.62
Eulachon	3.14	0.71	5.57
Boreal Cordillera (n=7 food species analyzed)			
Salmon	2.83	2.51	3.16
Blueberries	0.00	0.00	0.00
Trout	0.00	0.00	0.00
Moose meat	0.00	0.00	0.00
Moose liver	0.00	0.00	0.00
Montane Cordillera (n=25 food species analyzed)			
Salmon	3.79	2.40	5.17
Salmon eggs	3.11	0.17	6.05
Trout	2.24	0.61	3.87
Eulachon grease	1.48	0.00	3.97
Ling Cod or Mariah or Burbot	1.24	0.00	3.37
Taiga Plains (n=15 food species analyzed)			
Goose meat	12.90	7.82	17.98
Duck meat	2.64	0.26	5.02
Salmon	1.20	0.54	1.86
Northern Pike or Jackfish	0.21	0.06	0.37
Arctic Grayling	0.06	0.00	0.12

Sample*	Mean (ng/day)	Lower 95% CI (ng/day)	Upper 95% CI (ng/day)
Boreal Plains (n=20 food species analyzed)			
Moose meat	7.71	2.93	12.48
Moose liver	2.71	0.68	4.74
Northern Pike or Jackfish	0.84	0.45	1.23
Duck meat	0.43	0.16	0.70
Whitefish	0.41	0.20	0.62
Prairies (n=15 food species analyzed)			
Deer liver	2.58	0.64	4.52
Whitefish	0.43	0.16	0.70
Walleye or Pickerel	0.19	0.01	0.37
Duck meat	0.11	0.00	0.27
Northern Pike or Jackfish	0.03	0.01	0.04
Boreal Shield (n=45 food species analyzed)			
Walleye or Pickerel	10.20	6.21	14.19
Whitefish	8.32	2.59	14.05
Trout	4.64	1.39	7.88
Ptarmigan meat	3.64	0.00	10.68
Goose meat	3.52	0.47	6.58
Taiga Shield (n=16 food species analyzed)			
Trout	5.24	4.61	5.86
Whitefish	3.30	0.16	6.45
Duck meat	2.50	1.29	3.72
Goose meat	0.44	0.00	1.33
Northern Pike or Jackfish	0.16	0.04	0.29

Sample*	Mean (ng/day)	Lower 95% CI (ng/day)	Upper 95% CI (ng/day)
Hudson Plains (n=13 food species analyzed)			
Goose meat	113.71	68.93	158.50
Northern Pike or Jackfish	2.04	0.48	3.60
Sturgeon	1.59	1.08	2.10
Whitefish	1.44	0.39	2.49
Duck meat	0.99	0.56	1.43
Mixedwood Plains (n=14 food species analyzed)			
Salmon	11.92	0.00	27.65
Trout	6.40	0.00	13.01
Walleye or Pickerel	4.77	3.21	6.33
Sturgeon	2.72	0.09	5.34
Perch	1.31	0.51	2.10
Atlantic Maritime (n=24 food species analyzed)			
Atlantic Salmon	5.35	4.10	6.61
Eel	1.63	0.99	2.28
Lobster	1.54	1.29	1.79
Trout	1.28	0.92	1.63
Smelt	0.95	0.58	1.33

*Note: Some non fat samples were not tested for organochlorines.

PCBs

Sample*	Mean (ng/day)	Lower 95% CI (ng/day)	Upper 95% CI (ng/day)
Pacific Maritime (n=41 food species analyzed)			
Halibut	4.76	2.04	7.48
Pacific Herring	4.06	0.00	8.62
Salmon	3.66	2.27	5.05
Prawns	2.84	0.00	5.83
Eulachon grease	1.69	0.10	3.27
Boreal Cordillera (n=7 food species analyzed)			
Blueberries	0.00	0.00	0.00
Trout	0.00	0.00	0.00
Moose meat	0.00	0.00	0.00
Moose liver	0.00	0.00	0.00
Black Bear fat	0.00	0.00	0.00
Montane Cordillera (n=25 food species analyzed)			
Salmon eggs	1.74	0.10	3.39
Salmon	0.33	0.21	0.45
Ling Cod or Mariah or Burbot	0.10	0.00	0.27
Trout	0.06	0.02	0.10
Raspberries	0.00	0.00	0.00
Taiga Plains (n=15 food species analyzed)			
Salmon	0.37	0.17	0.57
Trout	0.05	0.03	0.07
Northern Pike or Jackfish	0.00	0.00	0.00
Walleye or Pickerel	0.00	0.00	0.00
Beaver Meat	0.00	0.00	0.00

Sample*	Mean (ng/day)	Lower 95% CI (ng/day)	Upper 95% CI (ng/day)
Boreal Plains (n=20 food species analyzed)			
Duck meat	2.68	1.02	4.33
Walleye or Pickerel	0.45	0.23	0.67
Beaver meat	0.39	0.00	0.83
Elk liver	0.24	0.00	0.49
Northern Pike or Jackfish	0.22	0.12	0.32
Prairies (n=15 food species analyzed)			
Whitefish	0.31	0.12	0.51
Walleye or Pickerel	0.30	0.02	0.59
Deer liver	0.25	0.06	0.43
Duck meat	0.03	0.00	0.06
Perch	0.00	0.00	0.00
Boreal Shield (n=45 food species analyzed)			
Walleye or Pickerel	42.48	25.85	59.10
Ptarmigan meat	24.37	0.00	71.60
Duck meat	19.97	0.00	44.29
Whitefish	19.91	6.19	33.62
Trout	11.36	3.42	19.30
Taiga Shield (n=16 food species analyzed)			
Black Bear fat	15.69	0.00	55.61
Trout	5.86	5.16	6.56
Whitefish	5.10	0.25	9.95
Duck meat	3.13	1.61	4.66
Northern Pike or Jackfish	0.21	0.05	0.37

Sample*	Mean (ng/day)	Lower 95% CI (ng/day)	Upper 95% CI (ng/day)
Hudson Plains (n=13 food species analyzed)			
Northern Pike or Jackfish	4.16	0.98	7.35
Goose Meat	2.72	1.65	3.79
Sturgeon	1.89	1.29	2.49
Whitefish	1.79	0.48	3.10
Walleye or Pickerel	1.76	1.40	2.11
Mixedwood Plains (n=14 food species analyzed)			
Sturgeon	39.47	1.31	77.62
Salmon	34.31	0.00	79.61
Walleye or Pickerel	33.09	22.27	43.90
Trout	17.53	0.00	35.61
Catfish	11.03	0.00	28.86
Atlantic Maritime (n=24 food species analyzed)			
Atlantic Salmon	6.46	4.95	7.97
Mackerel	1.64	0.74	2.54
Trout	1.54	1.11	1.97
Eel	1.52	0.92	2.13
Lobster	1.20	1.00	1.39

*Note: Some non fat samples were not tested for organochlorines.

Cadmium

Cadmium – Ecozone Level Contaminant Intake (consumers only)			
Sample	**Mean (µg/day)**	**Lower 95% CI (µg/day)**	**Upper 95% CI (µg/day)**
Pacific Maritime			
Oyster	2.45	0.00	6.26
Seaweed	1.23	0.04	2.43
Moose Liver	0.82	0.19	1.46
Mussel	0.74	0.53	0.94
Herring Egg	0.28	0.05	0.51
Boreal Cordillera			
Moose liver	20.50	2.48	38.51
Moose meat	0.98	0.54	1.43
Salmon	0.12	0.10	0.15
Blueberries	0.00	0.00	0.00
Trout	0.00	0.00	0.00
Montane Cordillera			
Moose kidney	5.41	0.00	11.42
Moose liver	1.55	0.00	3.37
Deer liver	0.68	0.00	1.47
Moose meat	0.20	0.13	0.27
Deer Meat	0.08	0.01	0.15
Deer Meat			
Moose kidney	13.62	4.14	23.09
Moose liver	2.68	0.67	4.69
Grouse meat	0.53	0.26	0.80
Moose meat	0.52	0.36	0.68
Walleye or Pickerel	0.03	0.00	0.06

Cadmium – Ecozone Level Contaminant Intake (consumers only)			
Sample	**Mean (µg/day)**	**Lower 95% CI (µg/day)**	**Upper 95% CI (µg/day)**
Boreal Plains			
Moose kidney	9.46	2.01	16.92
Moose liver	2.07	0.52	3.62
Deer kidney	0.84	0.00	1.76
Moose meat	0.11	0.04	0.18
Deer liver	0.04	0.00	0.08
Prairies			
Moose kidney	0.84	0.00	1.69
Deer kidney	0.54	0.00	1.32
Elk kidney	0.24	0.01	0.48
Moose liver	0.13	0.00	0.29
Deer liver	0.12	0.03	0.21
Boreal Shield			
Moose kidney	7.04	1.55	12.53
Moose liver	1.63	0.42	2.83
Mussel	0.92	0.00	2.69
Caribou kidney	0.62	0.00	1.38
Rabbit or Hare heart	0.17	0.09	0.26
Taiga Shield			
Caribou kidney	3.41	2.04	4.78
Ptarmigan meat	1.90	0.00	4.57
Moose kidney	0.45	0.11	0.80
Caribou liver	0.30	0.03	0.57
Caribou meat	0.19	0.08	0.30

Lead

Cadmium – Ecozone Level Contaminant Intake (consumers only)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Hudson Plains			
Moose kidney	4.75	2.93	6.57
Beaver meat	0.57	0.22	0.93
Moose meat	0.53	0.32	0.75
Moose liver	0.47	0.26	0.69
Ptarmigan meat	0.03	0.01	0.04
Mixedwood Plains			
Fiddlehead	0.04	0.00	0.07
Deer meat	0.03	0.01	0.05
Strawberries	0.02	0.02	0.03
Deer kidney	0.01	0.00	0.03
Moose meat	0.01	0.01	0.01
Atlantic Maritime			
Lobster	0.52	0.43	0.60
Oyster	0.26	0.15	0.37
Mussel	0.10	0.07	0.14
Scallop	0.10	0.06	0.13
Moose kidney	0.09	0.02	0.16

Lead – Ecozone Level Contaminant Intake (consumers only)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Pacific Maritime			
Deer Meat	3.56	0.00	7.14
Grouse	1.58	0.29	2.88
Halibut	1.00	0.43	1.58
Elk Meat	0.12	0.00	0.28
Seaweed	0.10	0.00	0.19
Boreal Cordillera			
Blueberries	0.00	0.00	0.00
Trout	0.00	0.00	0.00
Moose meat	0.00	0.00	0.00
Moose liver	0.00	0.00	0.00
Salmon	0.00	0.00	0.00
Montane Cordillera			
Deer meat	51.15	3.40	98.91
Moose kidney	0.37	0.00	0.78
Moose meat	0.20	0.13	0.26
Black Bear meat	0.12	0.01	0.22
Grouse meat	0.08	0.00	0.17
Taiga Plains			
Grouse meat	11.33	5.50	17.17
Goose meat	3.46	2.09	4.82
Duck meat	0.20	0.02	0.38
Moose meat	0.10	0.07	0.13
Deer meat	0.04	0.01	0.06

Lead – Ecozone Level Contaminant Intake (consumers only)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Boreal Plains			
Bison meat	8.81	0.37	17.25
Moose meat	8.65	3.34	13.96
Deer Meat	2.21	0.75	3.67
Grouse	1.93	0.68	3.19
Elk meat	0.99	0.45	1.54
Prairies			
Deer meat	13.93	9.43	18.43
Grouse meat	0.66	0.00	1.54
Goose meat	0.15	0.00	0.42
Moose meat	0.10	0.06	0.14
Duck meat	0.05	0.00	0.12
Boreal Shield			
Moose meat	6.61	4.73	8.48
Grouse meat	4.82	2.51	7.12
Beaver meat	3.52	1.09	5.95
Goose meat	2.28	0.36	4.21
Duck meat	1.64	0.00	3.61
Taiga Shield			
Grouse meat	2.78	2.27	3.28
Caribou heart	2.50	1.72	3.28
Ptarmigan meat	1.40	0.00	3.36
Caribou meat	1.03	0.41	1.64
Caribou kidney	0.11	0.07	0.16

Lead – Ecozone Level Contaminant Intake (consumers only)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Hudson Plains			
Goose meat	1.71	1.04	2.38
Moose meat	0.73	0.43	1.02
Grouse meat	0.15	0.02	0.29
Northern Pike or Jackfish	0.05	0.01	0.09
Duck meat	0.05	0.03	0.07
Mixedwood Plains			
Deer meat	28.99	6.51	51.46
Moose meat	0.32	0.22	0.42
Strawberries	0.17	0.11	0.22
Deer liver	0.09	0.00	0.24
Wild Ginger	0.03	0.00	0.09
Atlantic Maritime			
Deer meat	1.45	1.00	1.91
Moose meat	0.31	0.14	0.47
Squirrel meat	0.09	0.01	0.17
Mussel	0.09	0.06	0.12
Shrimp	0.06	0.04	0.08

Arsenic

Arsenic – Ecozone Level Contaminant Intake (consumers only)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Pacific Maritime			
Prawns	18.28	0.00	37.49
Halibut	12.40	5.32	19.49
Seaweed	7.81	0.23	15.40
Clams	7.58	2.51	12.65
Eulachon grease	5.93	0.36	11.50
Boreal Cordillera			
Salmon	1.98	1.75	2.21
Moose liver	0.15	0.02	0.27
Trout	0.03	0.00	0.05
Blueberries	0.00	0.00	0.00
Moose meat	0.00	0.00	0.00
Montane Cordillera			
Salmon	1.69	1.07	2.30
Halibut	0.95	0.00	1.96
Deer meat	0.51	0.03	0.99
Salmon eggs	0.42	0.02	0.81
Ling Cod or Mariah or Burbot	0.22	0.00	0.59
Taiga Plains			
Moose meat	0.41	0.28	0.53
Northern Pike or Jackfish	0.25	0.07	0.44
Salmon	0.17	0.08	0.27
Beaver meat	0.13	0.06	0.19
Walleye or Pickerel	0.11	0.00	0.26

Arsenic – Ecozone Level Contaminant Intake (consumers only)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Boreal Plains			
Moose meat	0.13	0.05	0.21
Walleye or Pickerel	0.09	0.05	0.14
Northern Pike or Jackfish	0.05	0.03	0.08
Dandelion greens	0.03	0.00	0.07
Whitefish	0.03	0.01	0.04
Prairies			
Walleye or Pickerel	0.09	0.00	0.18
Northern Pike or Jackfish	0.03	0.01	0.04
Deer meat	0.02	0.02	0.03
Whitefish	0.02	0.01	0.03
Moose meat	0.01	0.01	0.02
Boreal Shield			
Mussels	3.98	0.00	11.60
Lobster	1.15	0.90	1.39
Cod	0.75	0.58	0.92
Walleye or Pickerel	0.66	0.42	0.91
Whitefish	0.26	0.09	0.44
Taiga Shield			
Whitefish	0.53	0.06	1.00
Caribou meat	0.35	0.14	0.56
Trout	0.06	0.06	0.07
Atlantic Salmon	0.04	0.00	0.11
Northern Pike or Jackfish	0.04	0.01	0.06

Arsenic – Ecozone Level Contaminant Intake (consumers only)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Hudson Plains			
Whitefish	1.91	0.52	3.31
Northern Pike or Jackfish	1.62	0.39	2.86
Cisco	1.12	0.67	1.56
Walleye or Pickerel	1.10	0.88	1.32
Sturgeon	0.24	0.16	0.31
Mixedwood Plains			
Salmon	0.10	0.00	0.22
Walleye or Pickerel	0.08	0.05	0.10
Sturgeon	0.08	0.00	0.15
Perch	0.05	0.02	0.09
Maple Syrup	0.03	0.01	0.04
Atlantic Maritime			
Lobster	9.95	8.35	11.54
Crab	3.28	2.23	4.33
Shrimp	2.72	1.85	3.59
Haddock	2.70	1.57	3.82
Scallop	1.48	0.86	2.10

Mercury

Mercury – Ecozone Level Contaminant Intake (consumers only)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Pacific Maritime			
Halibut	1.02	0.44	1.60
Rockfish	0.24	0.14	0.34
Salmon	0.12	0.08	0.17
Salmon eggs	0.07	0.03	0.10
Cockles	0.04	0.02	0.06
Boreal Cordillera			
Salmon	0.11	0.10	0.13
Trout	0.07	0.01	0.12
Moose liver	0.01	0.00	0.02
Blueberries	0.00	0.00	0.00
Moose meat	0.00	0.00	0.00
Montane Cordillera			
Ling Cod or Mariah or Burbot	0.12	0.00	0.33
Salmon eggs	0.07	0.00	0.13
Salmon	0.07	0.04	0.09
Halibut	0.06	0.00	0.13
Trout	0.02	0.01	0.04
Taiga Plains			
Northern Pike or Jackfish	1.42	0.41	2.44
Walleye or Pickerel	0.47	0.00	1.05
Duck meat	0.02	0.00	0.03
Salmon	0.01	0.01	0.02
Moose kidney	0.01	0.00	0.02

Mercury – Ecozone Level Contaminant Intake (consumers only)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Boreal Plains			
Walleye or Pickerel	0.85	0.43	1.27
Northern Pike or Jackfish	0.65	0.35	0.94
Whitefish	0.06	0.03	0.09
Moose meat	0.02	0.01	0.03
Moose kidney	0.01	0.00	0.03
Prairies			
Walleye or Pickerel	0.21	0.01	0.42
Northern Pike or Jackfish	0.08	0.03	0.13
Whitefish	0.03	0.01	0.05
Perch	0.02	0.00	0.05
Deer kidney	0.00	0.00	0.01
Boreal Shield			
Walleye or Pickerel	3.02	1.90	4.14
Northern Pike or Jackfish	1.07	0.28	1.86
Whitefish	0.15	0.05	0.25
Trout	0.13	0.04	0.22
Caribou kidney	0.10	0.00	0.23
Taiga Shield			
Caribou kidney	0.50	0.30	0.70
Trout	0.34	0.31	0.36
Walleye or Pickerel	0.27	0.12	0.43
Whitefish	0.25	0.03	0.47
Caribou meat	0.22	0.09	0.35

Mercury – Ecozone Level Contaminant Intake (consumers only)			
Sample	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Hudson Plains			
Northern Pike or Jackfish	1.21	0.29	2.14
Walleye or Pickerel	1.04	0.83	1.25
Sturgeon	0.21	0.15	0.28
Whitefish	0.10	0.03	0.17
Moose Meat	0.04	0.02	0.05
Mixedwood Plains			
Walleye or Pickerel	0.57	0.38	0.77
Perch	0.26	0.10	0.42
Sturgeon	0.05	0.00	0.10
Salmon	0.02	0.00	0.05
Trout	0.02	0.00	0.04
Atlantic Maritime			
Lobster	0.19	0.16	0.22
Atlantic Salmon	0.08	0.06	0.09
Haddock	0.05	0.03	0.07
Halibut	0.04	0.02	0.06
Crabs	0.03	0.02	0.04

Methylmercury

Methylmercury – Ecozone Level Contaminant Intake (consumers only)			
Sample*	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Pacific Maritime			
Halibut	1.46	0.63	2.30
Rockfish	0.35	0.21	0.49
Salmon	0.16	0.10	0.23
Cod	0.07	0.00	0.13
Prawns	0.05	0.00	0.10
Boreal Cordillera			
Salmon	0.12	0.10	0.13
Trout	0.05	0.00	0.09
Moose Meat	0.00	0.00	0.00
Moose Liver	0.00	0.00	0.00
Montane Cordillera			
Ling Cod or Mariah or Burbot	0.16	0.00	0.44
Salmon	0.11	0.07	0.15
Trout	0.07	0.02	0.12
Halibut	0.05	0.00	0.10
Whitefish	0.01	0.01	0.01
Taiga Plains			
Northern Pike or Jackfish	1.06	0.30	1.81
Walleye or Pickerel	0.93	0.00	2.10
Duck Meat	0.03	0.00	0.06
Salmon	0.01	0.01	0.02
Trout	0.01	0.00	0.01

Methylmercury – Ecozone Level Contaminant Intake (consumers only)			
Sample*	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Boreal Plains			
Walleye or Pickerel	0.50	0.25	0.75
Northern Pike or Jackfish	0.40	0.22	0.59
Whitefish	0.03	0.01	0.04
Deer Meat	0.01	0.00	0.02
Trout	0.01	0.00	0.02
Prairies			
Walleye or Pickerel	0.19	0.01	0.37
Northern Pike or Jackfish	0.05	0.02	0.09
Whitefish	0.02	0.01	0.04
Perch	0.02	0.00	0.05
Duck meat	0.00	0.00	0.01
Boreal Shield			
Walleye or Pickerel	3.12	1.96	4.27
Northern Pike or Jackfish	0.66	0.17	1.15
Trout	0.12	0.04	0.19
Whitefish	0.11	0.04	0.18
Sturgeon	0.05	0.02	0.07
Taiga Shield			
Trout	0.41	0.38	0.45
Walleye or Pickerel	0.27	0.12	0.42
Whitefish	0.24	0.03	0.45
Caribou meat	0.19	0.08	0.30
Northern Pike or Jackfish	0.19	0.06	0.32

Methylmercury – Ecozone Level Contaminant Intake (consumers only)			
Sample*	Mean (µg/day)	Lower 95% CI (µg/day)	Upper 95% CI (µg/day)
Hudson Plains			
Northern Pike or Jackfish	0.75	0.18	1.31
Walleye or Pickerel	0.65	0.52	0.78
Sturgeon	0.15	0.10	0.20
Whitefish	0.06	0.02	0.11
Cisco	0.02	0.01	0.03
Mixedwood Plains			
Walleye or Pickerel	0.31	0.21	0.41
Perch	0.12	0.05	0.19
Sturgeon	0.03	0.00	0.05
Trout	0.02	0.00	0.03
Salmon	0.01	0.00	0.03
Atlantic Maritime			
Lobster	0.14	0.12	0.17
Atlantic Salmon	0.06	0.05	0.08
Crabs	0.03	0.02	0.04
Shrimp	0.02	0.02	0.03
Halibut	0.02	0.01	0.03

*Note: Many non-seafood samples were not tested for methylmercury.

DDE Consumers only

Sample*	Mean (ng/day)	Lower 95% CI (ng/day)	Upper 95% CI (ng/day)
Pacific Maritime			
Eulachon grease	34.39	2.06	66.72
Salmon	14.03	8.70	19.36
Halibut	9.83	4.21	15.44
Salmon eggs	4.89	2.15	7.63
Eulachon	3.14	0.71	5.57
Boreal Cordillera			
Salmon	2.83	2.51	3.16
Blueberries	0.00	0.00	0.00
Trout	0.00	0.00	0.00
Moose meat	0.00	0.00	0.00
Moose liver	0.00	0.00	0.00
Montane Cordillera			
Salmon	3.79	2.40	5.17
Salmon eggs	3.11	0.17	6.05
Trout	2.24	0.61	3.87
Eulachon grease	1.48	0.00	3.97
Ling Cod or Mariah or Burbot	1.24	0.00	3.37
Taiga Plains			
Goose meat	12.93	7.84	18.03
Duck meat	2.65	0.26	5.03
Salmon	1.22	0.55	1.88
Northern Pike or Jackfish	0.21	0.06	0.37
Arctic Grayling	0.06	0.00	0.12

Sample*	Mean (ng/day)	Lower 95% CI (ng/day)	Upper 95% CI (ng/day)
Boreal Plains			
Moose meat	7.94	3.07	12.81
Moose liver	2.79	0.71	4.87
Northern Pike or Jackfish	0.87	0.47	1.26
Duck meat	0.45	0.17	0.73
Whitefish	0.42	0.20	0.64
Prairies			
Deer Liver	2.85	0.67	5.03
Whitefish	0.47	0.18	0.75
Walleye or Pickerel	0.21	0.01	0.41
Duck meat	0.12	0.00	0.30
Northern Pike or Jackfish	0.03	0.01	0.05
Boreal Shield			
Walleye or Pickerel	10.86	6.83	14.89
Whitefish	8.92	3.09	14.75
Trout	4.94	1.55	8.32
Goose meat	3.70	0.58	6.83
Ptarmigan meat	3.66	0.00	10.70
Taiga Shield			
Trout	5.43	5.00	5.86
Whitefish	3.41	0.37	6.45
Duck meat	2.61	1.53	3.69
Goose meat	0.45	0.00	1.34
Northern Pike or Jackfish	0.17	0.05	0.29

Sample*	Mean (ng/day)	Lower 95% CI (ng/day)	Upper 95% CI (ng/day)
Hudson Plains			
Goose meat	114.44	69.54	159.34
Northern Pike or Jackfish	2.06	0.49	3.63
Sturgeon	1.60	1.09	2.11
Whitefish	1.45	0.39	2.51
Duck meat	1.00	0.57	1.43
Mixedwood Plains			
Salmon	13.03	0.00	30.39
Trout	7.03	0.00	14.37
Walleye or Pickerel	5.22	3.48	6.96
Sturgeon	2.97	0.10	5.84
Perch	1.43	0.56	2.30
Atlantic Maritime			
Atlantic Salmon	6.21	4.79	7.63
Eel	1.89	1.15	2.64
Lobster	1.79	1.50	2.07
Trout	1.47	1.06	1.88
Smelt	1.10	0.68	1.53

*Note: Some non fat samples were not tested for organochlorines.

PCBs consumers only

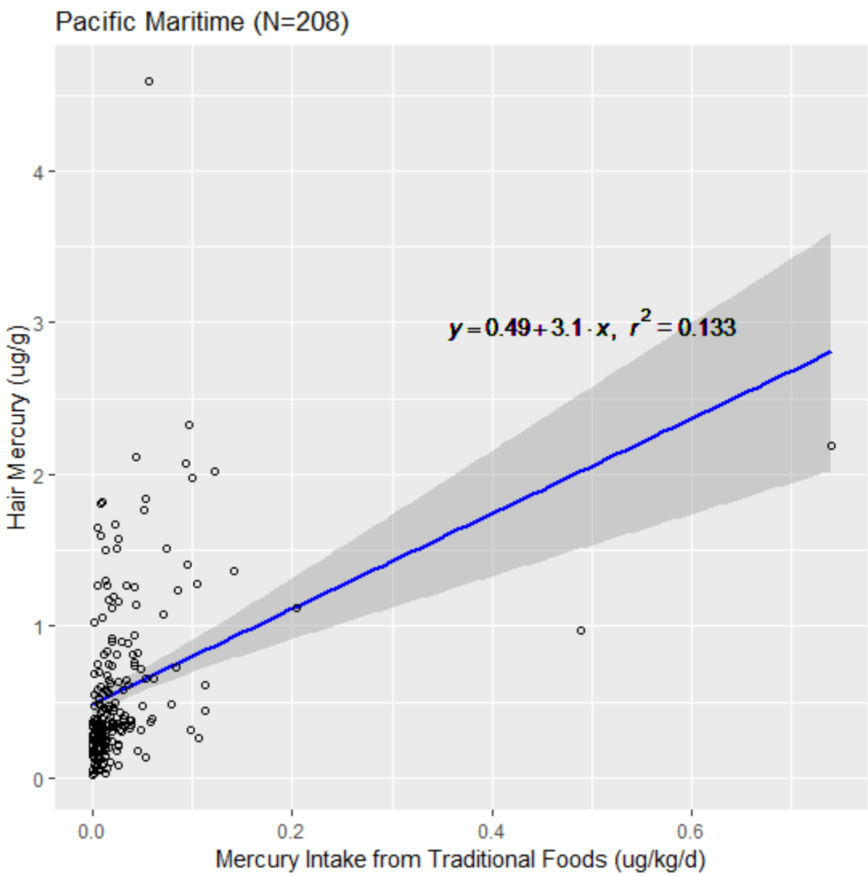
Sample*	Mean (ng/day)	Lower 95% CI (ng/day)	Upper 95% CI (ng/day)
Pacific Maritime			
Halibut	4.77	2.04	7.49
Pacific Herring	4.06	0.00	8.63
Salmon	3.67	2.27	5.06
Prawns	2.84	0.00	5.83
Eulachon grease	1.69	0.10	3.28
Boreal Cordillera			
Blueberries	0.00	0.00	0.00
Trout	0.00	0.00	0.00
Moose meat	0.00	0.00	0.00
Moose liver	0.00	0.00	0.00
Black Bear fat	0.00	0.00	0.00
Montane Cordillera			
Salmon eggs	1.74	0.10	3.39
Salmon	0.33	0.21	0.45
Ling Cod or Mariah or Burbot	0.10	0.00	0.27
Trout	0.06	0.02	0.10
Raspberries	0.00	0.00	0.00
Taiga Plains			
Salmon	0.37	0.17	0.58
Trout	0.05	0.03	0.07
Northern Pike or Jackfish	0.00	0.00	0.00
Walleye or Pickerel	0.00	0.00	0.00
Beaver meat	0.00	0.00	0.00

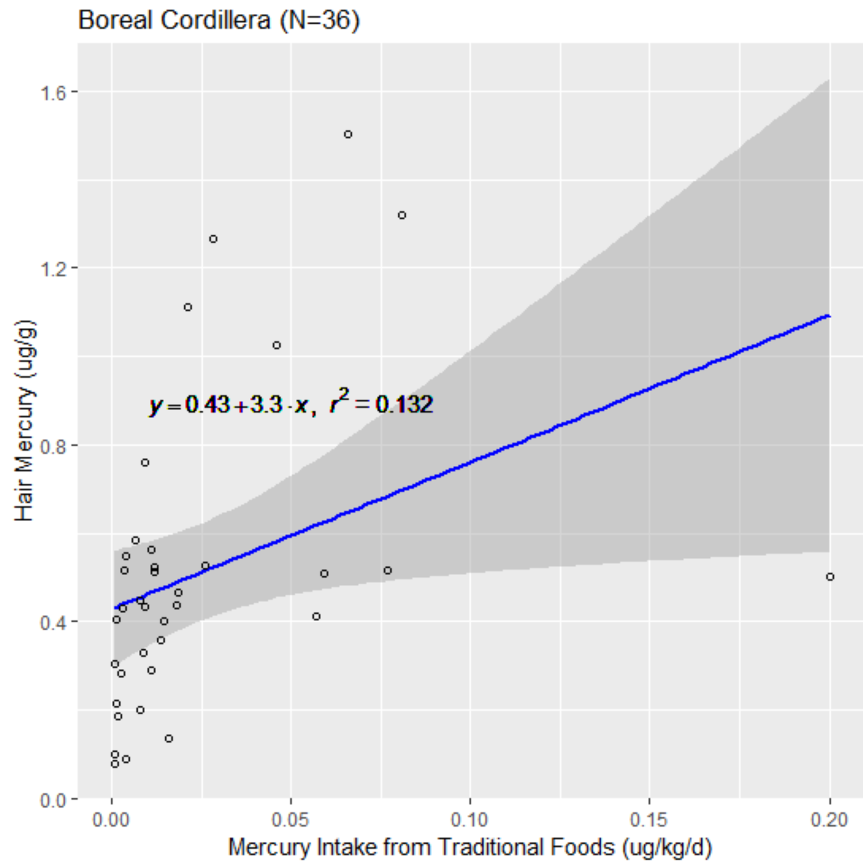
Sample*	Mean (ng/day)	Lower 95% CI (ng/day)	Upper 95% CI (ng/day)
Boreal Plains			
Duck meat	2.77	1.05	4.49
Walleye or Pickerel	0.47	0.24	0.69
Beaver meat	0.40	0.00	0.86
Elk liver	0.25	0.00	0.51
Northern Pike or Jackfish	0.23	0.12	0.33
Prairies			
Whitefish	0.34	0.13	0.55
Walleye or Pickerel	0.33	0.01	0.65
Deer liver	0.27	0.06	0.48
Duck meat	0.03	0.00	0.07
Perch	0.00	0.00	0.00
Boreal Shield			
Walleye or Pickerel	45.21	28.43	61.99
Ptarmigan meat	24.51	0.00	71.72
Whitefish	21.33	7.39	35.27
Duck meat	20.72	0.00	45.47
Trout	12.09	3.81	20.37
Taiga Shield			
Black Bear fat	16.29	0.00	56.04
Trout	6.08	5.60	6.56
Whitefish	5.26	0.57	9.96
Duck meat	3.27	1.92	4.62
Northern Pike or Jackfish	0.22	0.07	0.37

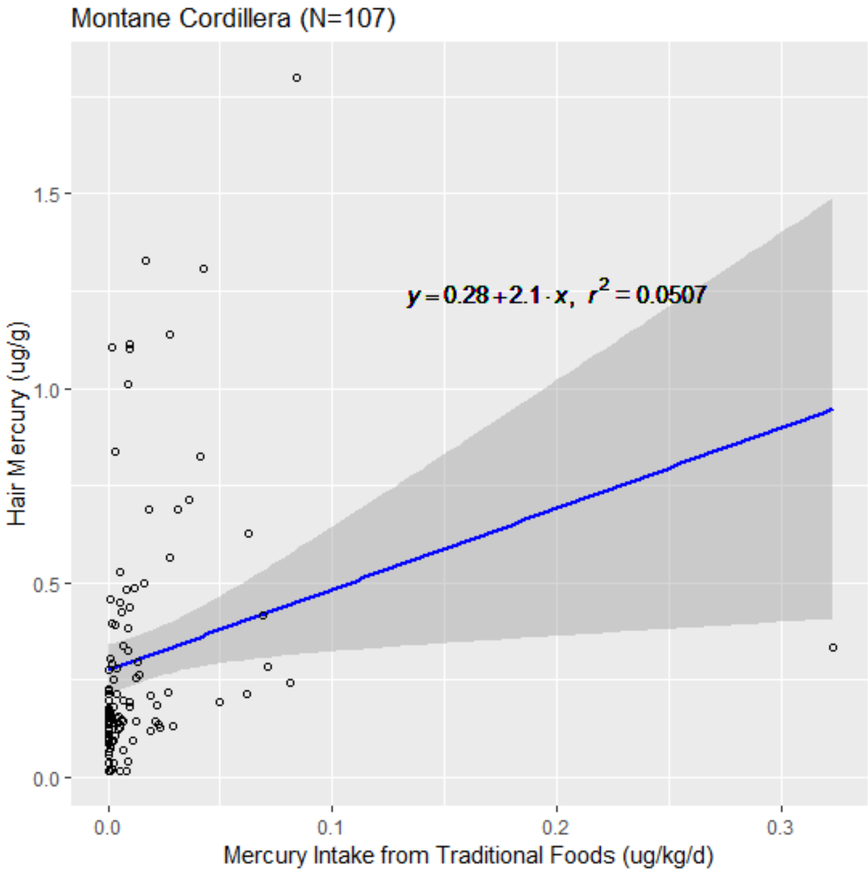
Sample*	Mean (ng/day)	Lower 95% CI (ng/day)	Upper 95% CI (ng/day)
Hudson Plains			
Northern Pike or Jackfish	4.19	1.00	7.39
Goose meat	2.74	1.66	3.81
Sturgeon	1.90	1.30	2.51
Whitefish	1.80	0.49	3.12
Walleye or Pickerel	1.77	1.41	2.13
Mixedwood Plains			
Sturgeon	43.16	1.40	84.92
Salmon	37.53	0.00	87.49
Walleye or Pickerel	36.18	24.09	48.27
Trout	19.25	0.00	39.34
Catfish	12.06	0.00	31.76
Atlantic Maritime			
Atlantic Salmon	7.49	5.78	9.21
Mackerel	1.90	0.84	2.96
Trout	1.78	1.28	2.27
Eel	1.77	1.07	2.46
Lobster	1.39	1.17	1.61

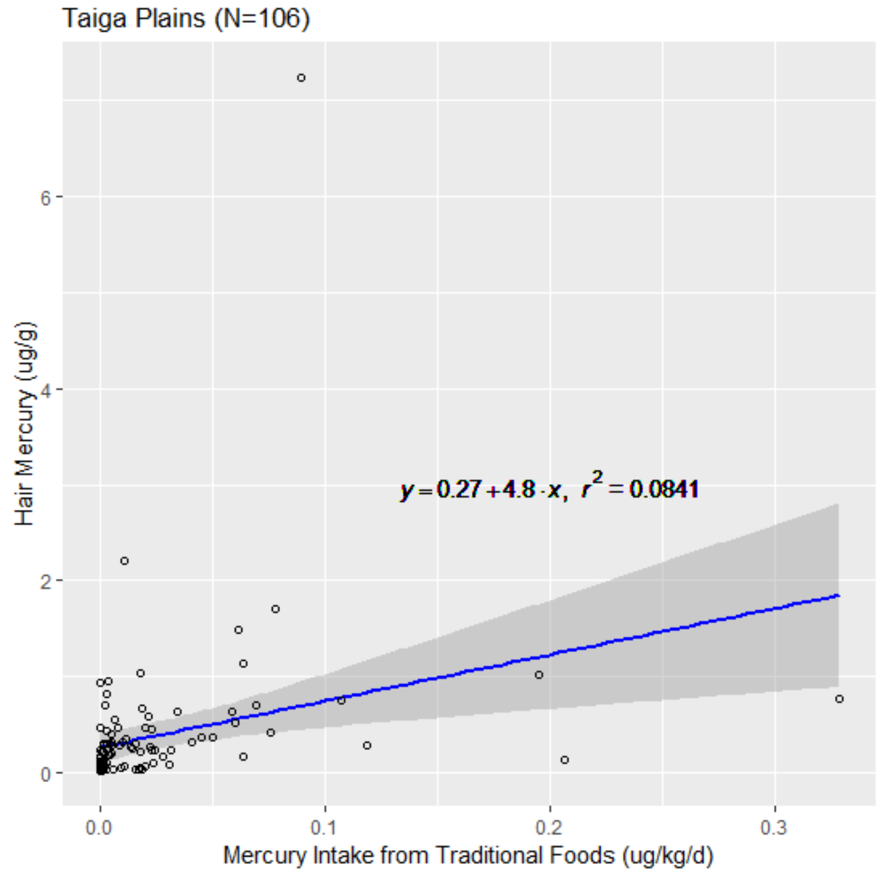
*Note: Some non fat samples were not tested for organochlorines.

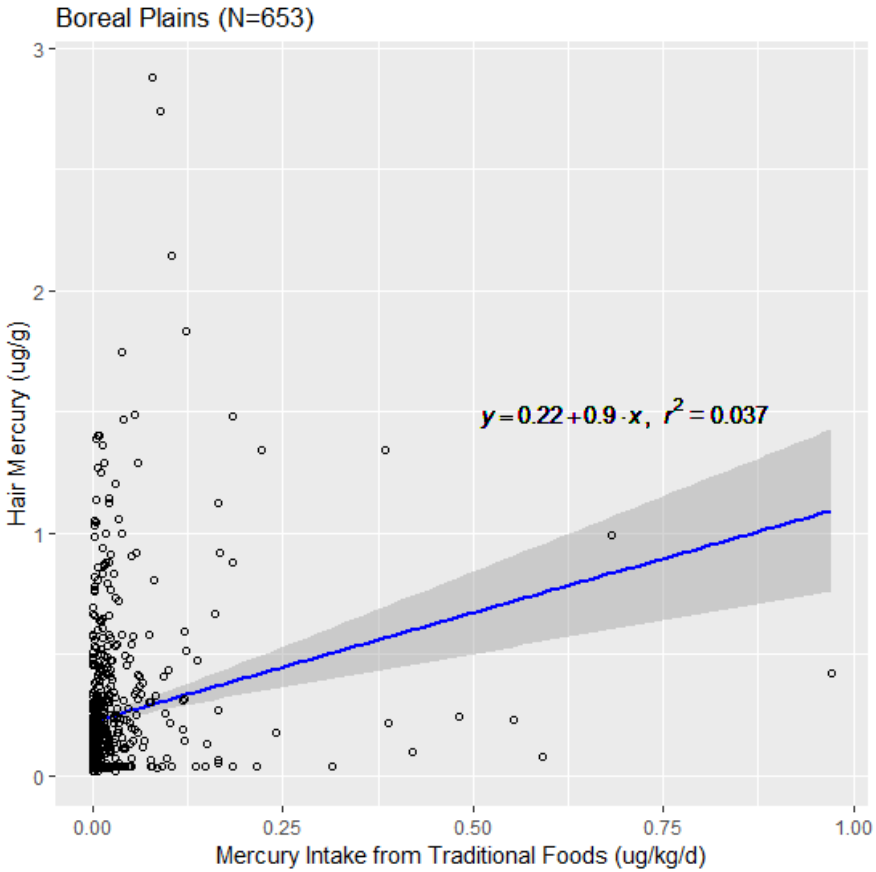
Appendix N. Ecozone level correlation of hair mercury and mercury intake from traditional foods

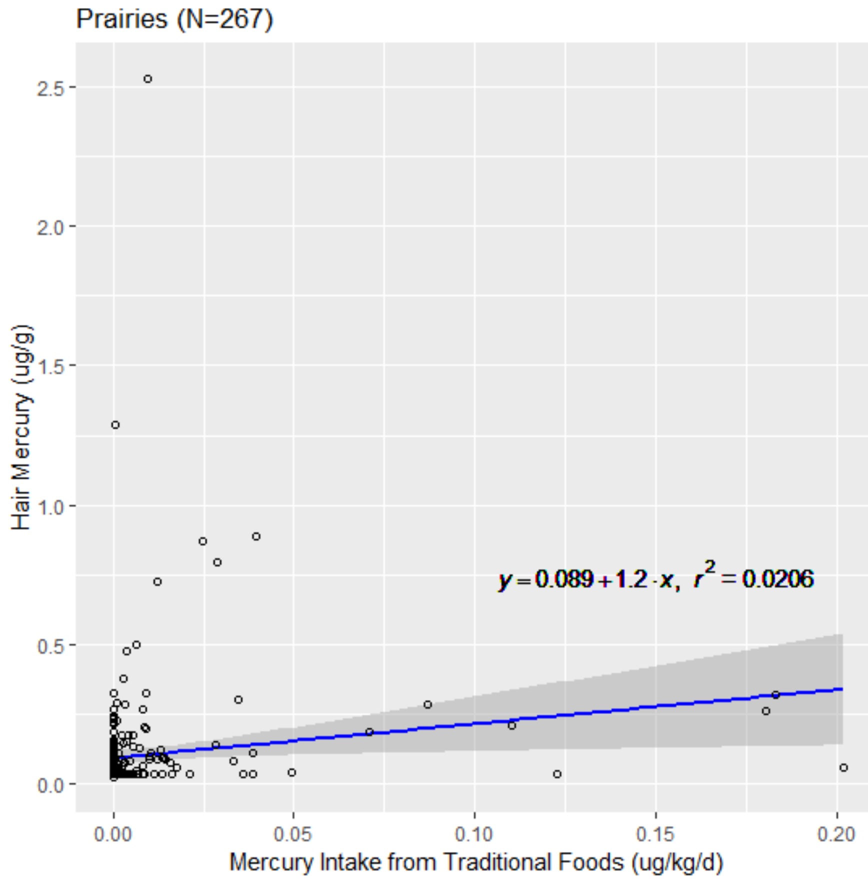


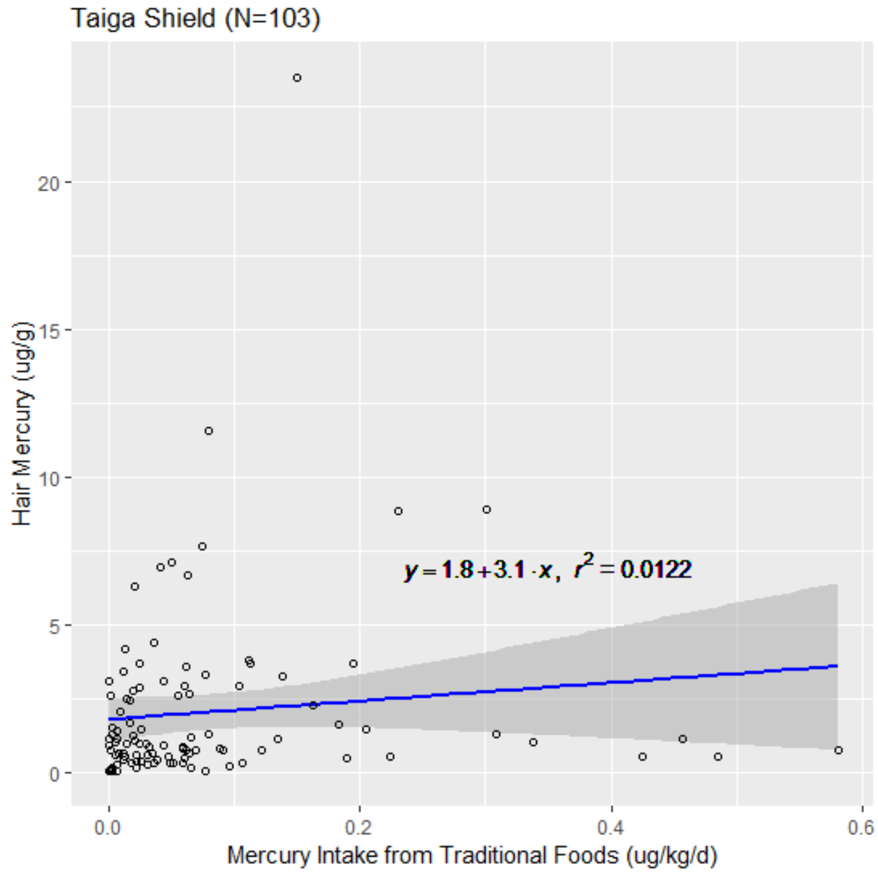



Montane Cordillera (N=107)
$y = 0.28 + 2.1 \cdot x,\ r^2 = 0.0507$
Hair Mercury (ug/g)
0.0
0.5
1.0
1.5
0.0
0.1
0.2
0.3
Mercury Intake from Traditional Foods (ug/kg/d)

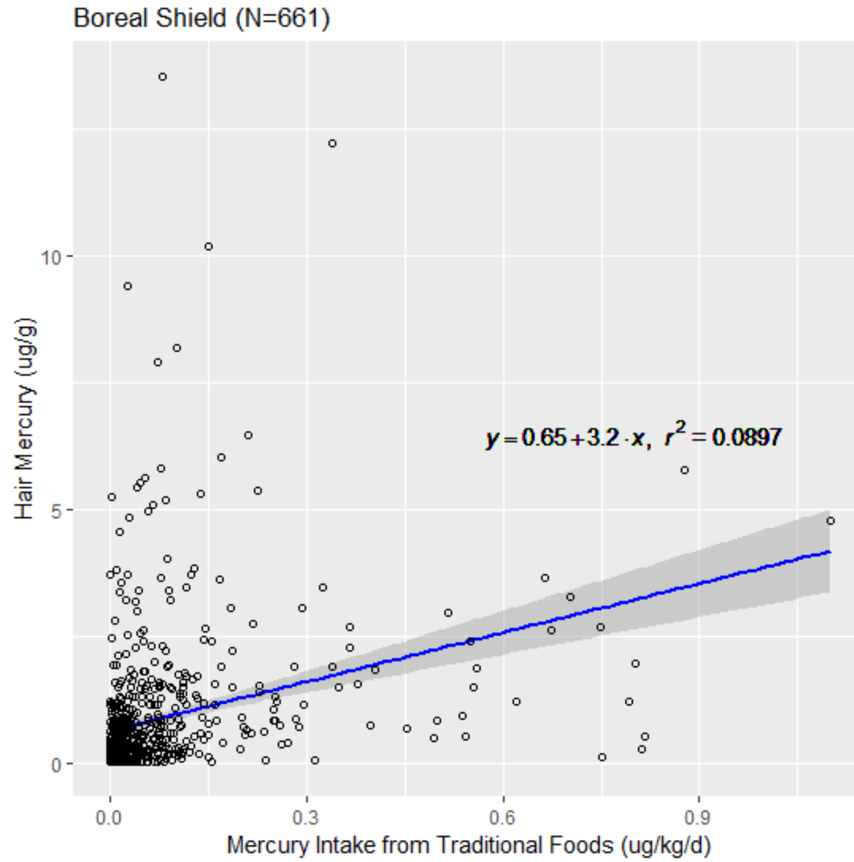

Taiga Plains (N=106)
$y = 0.27 + 4.8 \cdot x,\ r^2 = 0.0841$
Hair Mercury (ug/g)
0
2
4
6
0.0
0.1
0.2
0.3
Mercury Intake from Traditional Foods (ug/kg/d)


Boreal Plains (N=653)
y = 0.22 + 0.9 · x, r² = 0.037
Hair Mercury (ug/g)
Mercury Intake from Traditional Foods (ug/kg/d)
0
1
2
3
0.00
0.25
0.50
0.75
1.00

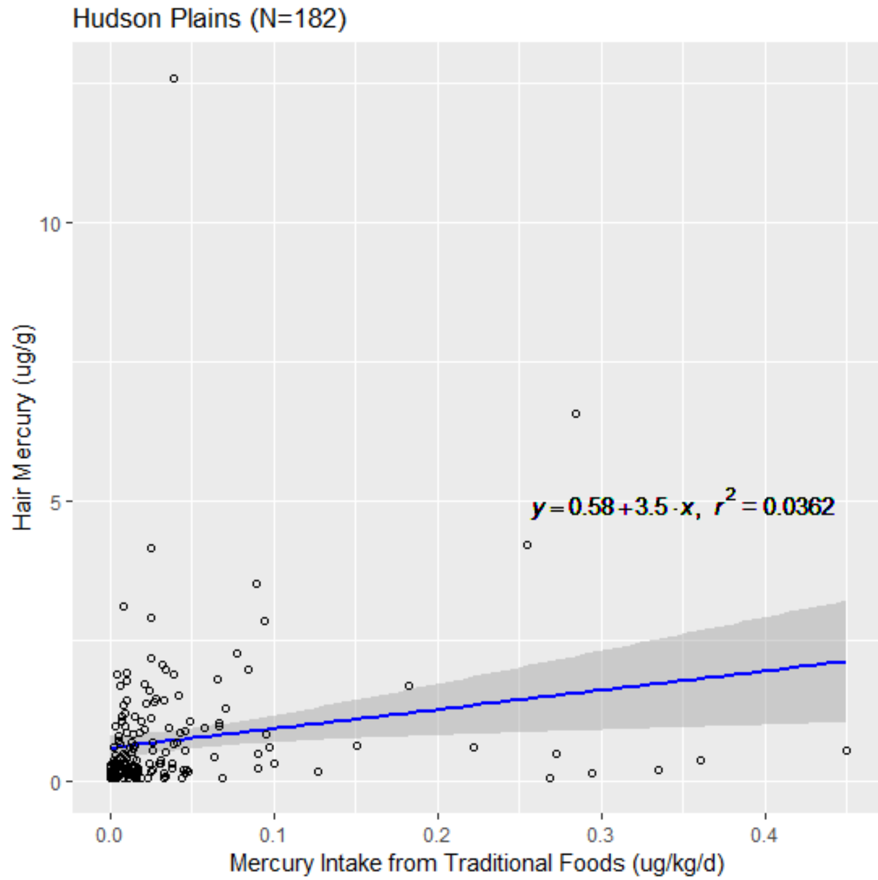

Prairies (N=267)
y = 0.089 + 1.2 · x, r² = 0.0206
Hair Mercury (ug/g)
Mercury Intake from Traditional Foods (ug/kg/d)
0.0
0.5
1.0
1.5
2.0
2.5
0.00
0.05
0.10
0.15
0.20



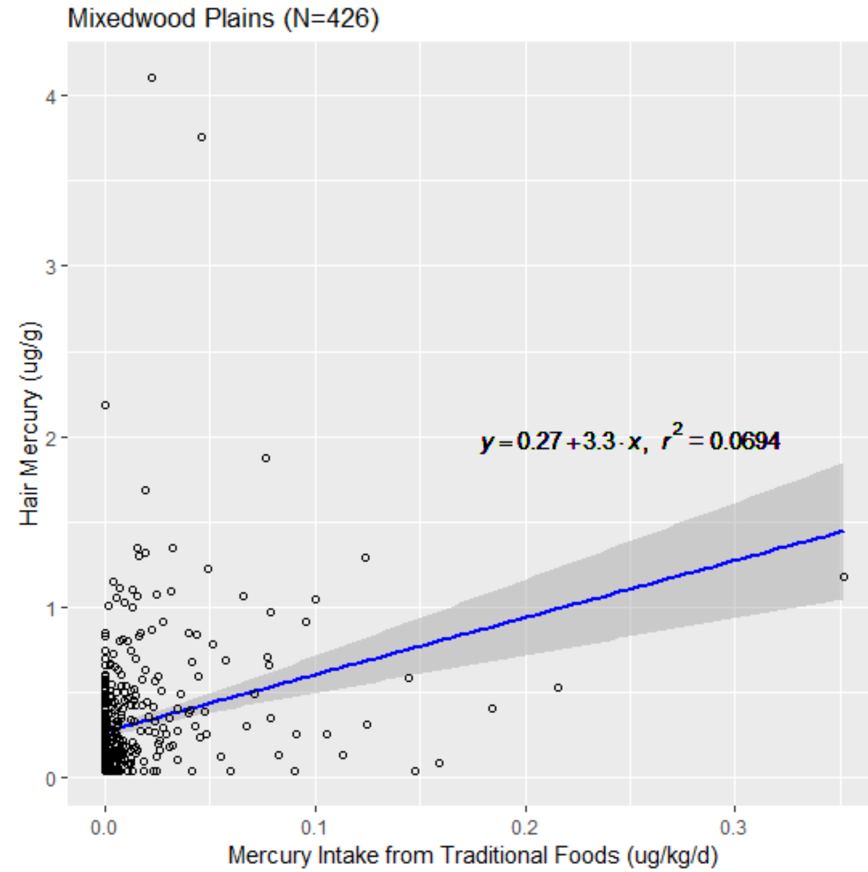
Taiga Shield (N=103)
y = 1.8 + 3.1 · x, r² = 0.0122
Hair Mercury (ug/g)
Mercury Intake from Traditional Foods (ug/kg/d)
0
5
10
15
20
0.0
0.2
0.4
0.6



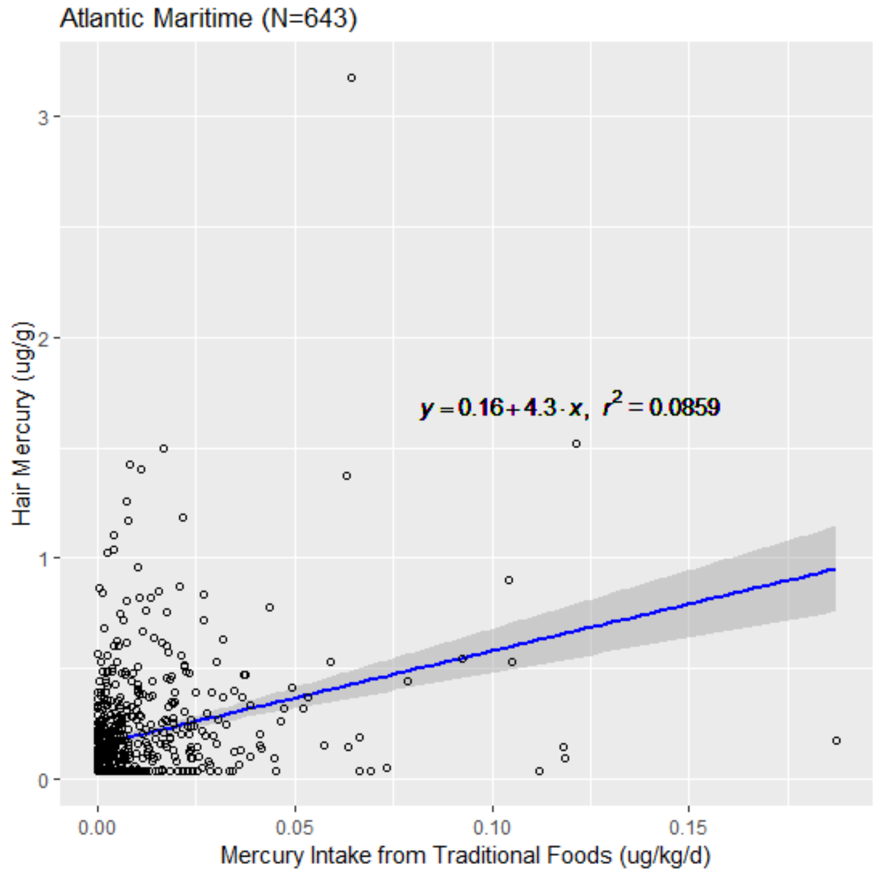
Boreal Shield (N=661)
y = 0.65 + 3.2 · x, r² = 0.0897
Hair Mercury (ug/g)
Mercury Intake from Traditional Foods (ug/kg/d)
0
5
10
0.0
0.3
0.6
0.9



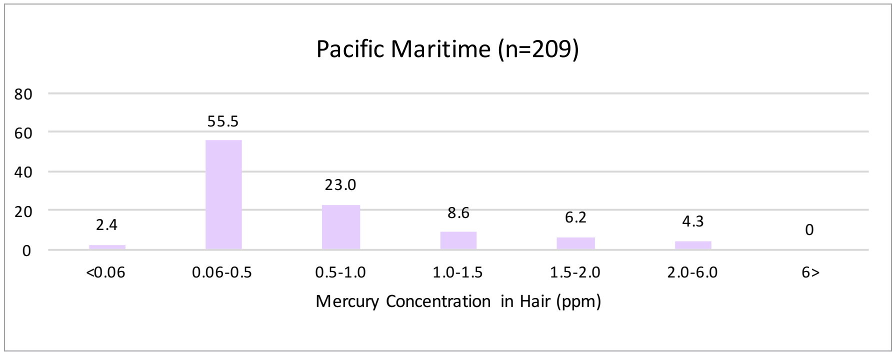
Hudson Plains (N=182)
Hair Mercury (ug/g)
Mercury Intake from Traditional Foods (ug/kg/d)
$y = 0.58 + 3.5 \cdot x, \ r^2 = 0.0362$

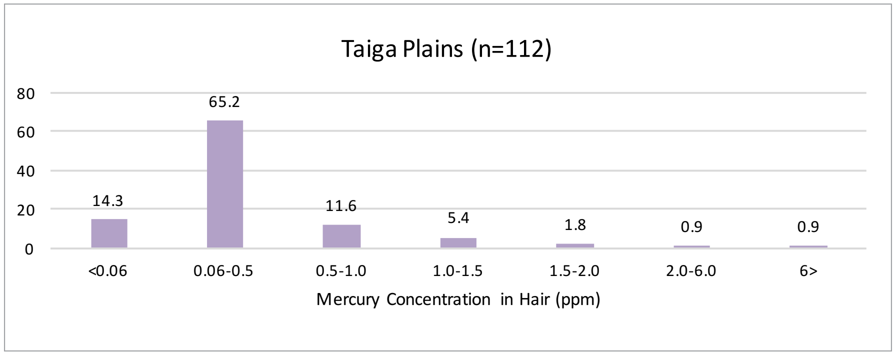


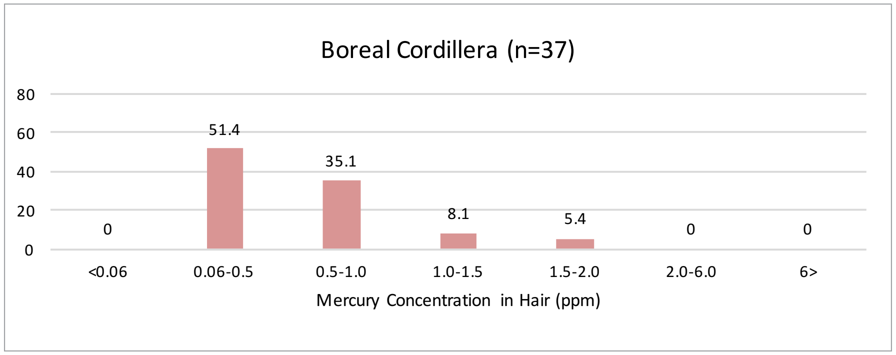
Mixedwood Plains (N=426)
Hair Mercury (ug/g)
Mercury Intake from Traditional Foods (ug/kg/d)
$y = 0.27 + 3.3 \cdot x, \ r^2 = 0.0694$

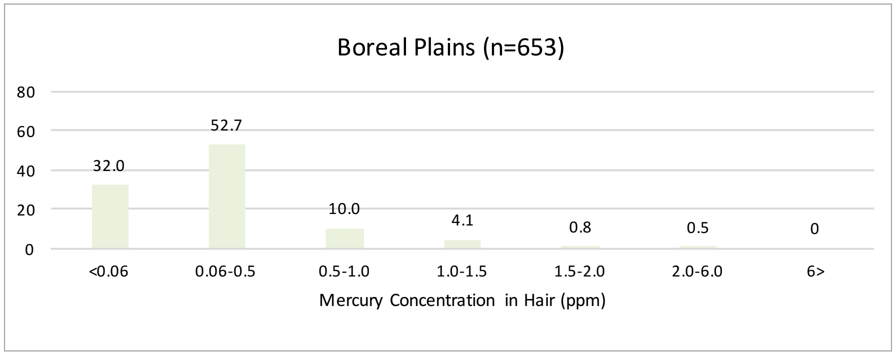

Atlantic Maritime (N=643)
y = 0.16 + 4.3 · x, r² = 0.0859
Hair Mercury (ug/g)
Mercury Intake from Traditional Foods (ug/kg/d)
0
1
2
3
0.00
0.05
0.10
0.15

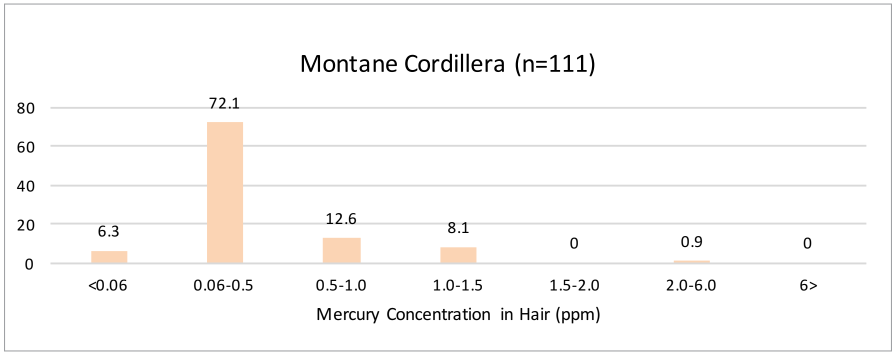
Mercury concentration in hair of participants living on reserve, by ecozone (percent, %)

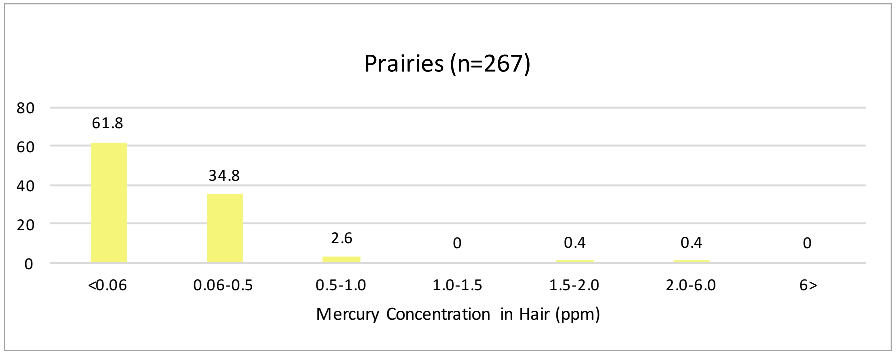


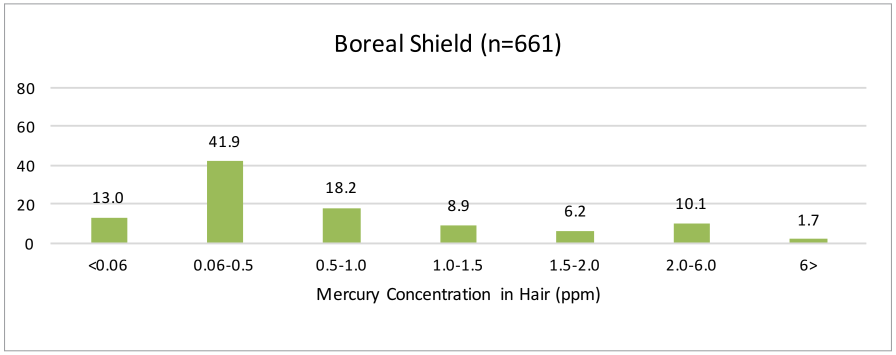


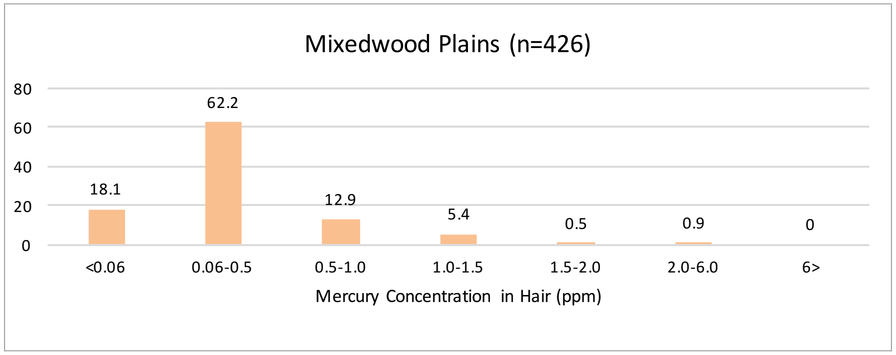


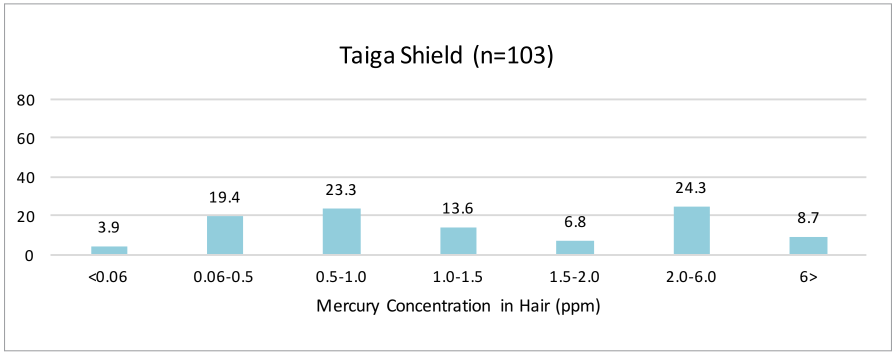


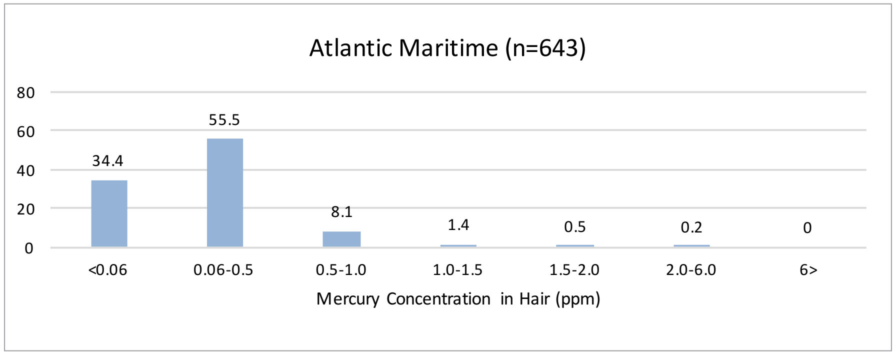


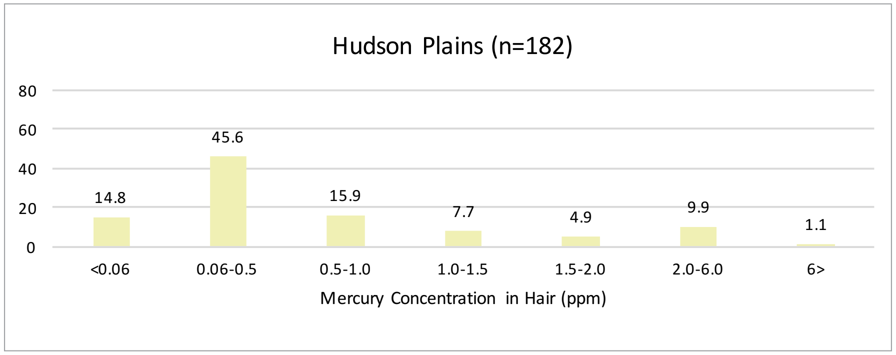



Boreal Shield (n=661)
80
60
40
20
0
13.0
41.9
18.2
8.9
6.2
10.1
1.7
<0.06
0.06-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-6.0
6>
Mercury Concentration in Hair (ppm)

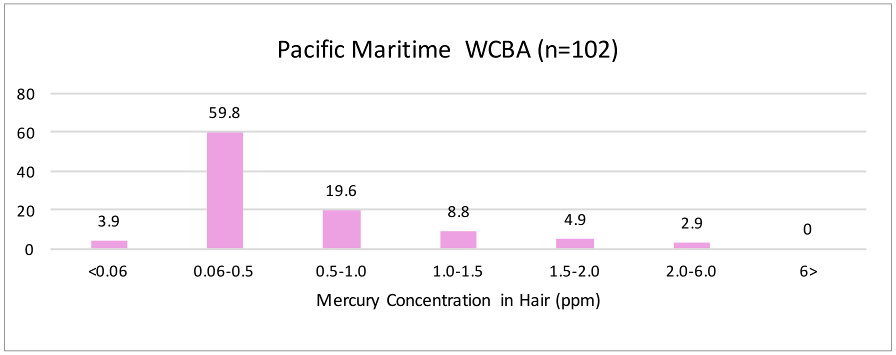

Mixedwood Plains (n=426)
80
60
40
20
0
18.1
62.2
12.9
5.4
0.5
0.9
0
<0.06
0.06-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-6.0
6>
Mercury Concentration in Hair (ppm)

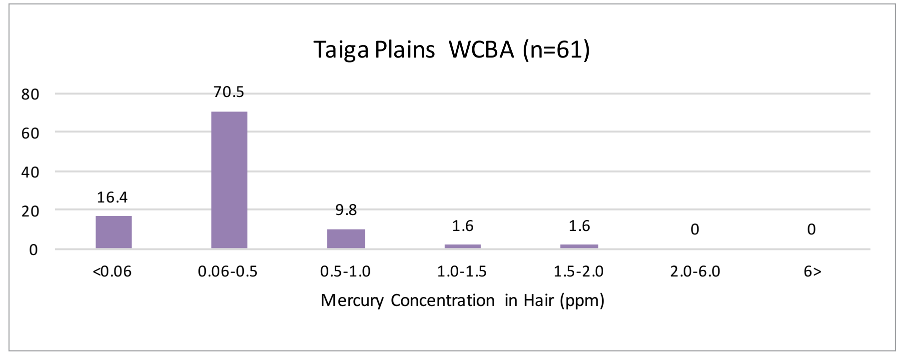

Taiga Shield (n=103)
80
60
40
20
0
3.9
19.4
23.3
13.6
6.8
24.3
8.7
<0.06
0.06-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-6.0
6>
Mercury Concentration in Hair (ppm)

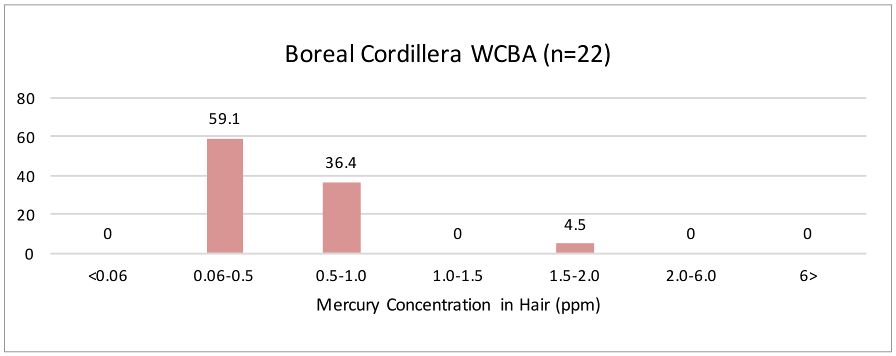

Atlantic Maritime (n=643)
80
60
40
20
0
34.4
55.5
8.1
1.4
0.5
0.2
0
<0.06
0.06-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-6.0
6>
Mercury Concentration in Hair (ppm)

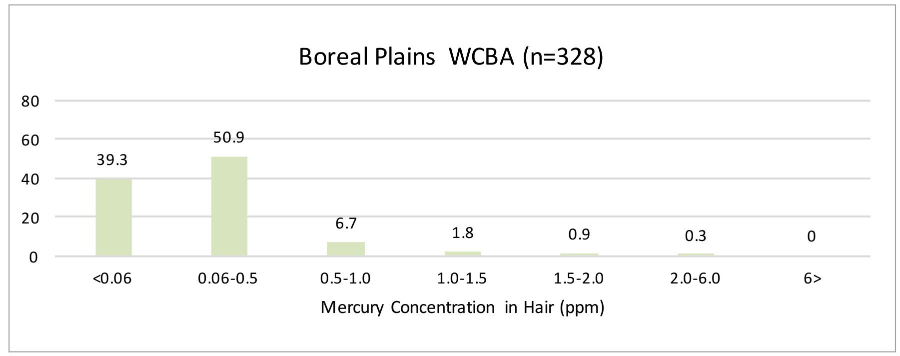

Hudson Plains (n=182)
80
60
40
20
0
14.8
45.6
15.9
7.7
4.9
9.9
1.1
<0.06
0.06-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-6.0
6>
Mercury Concentration in Hair (ppm)

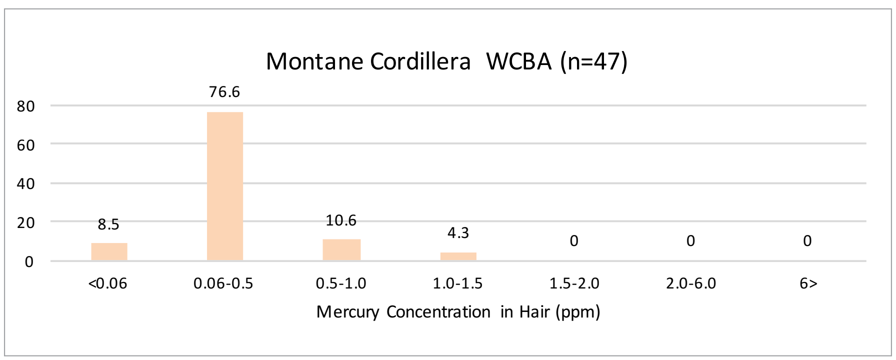
Mercury concentration in hair of women of childbearing age (WCBA), by ecozone (percent, %)

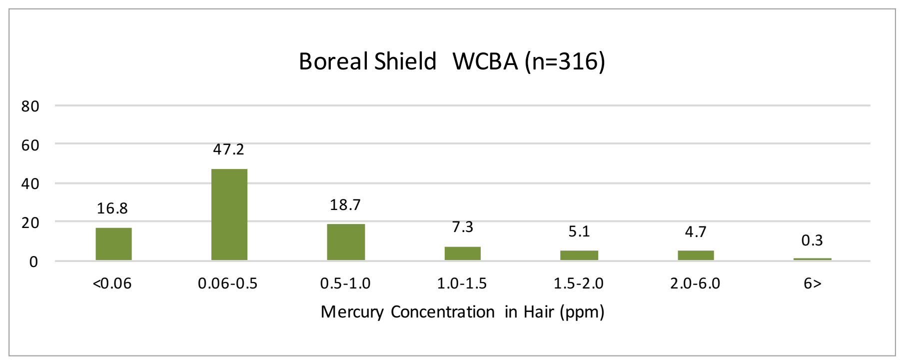


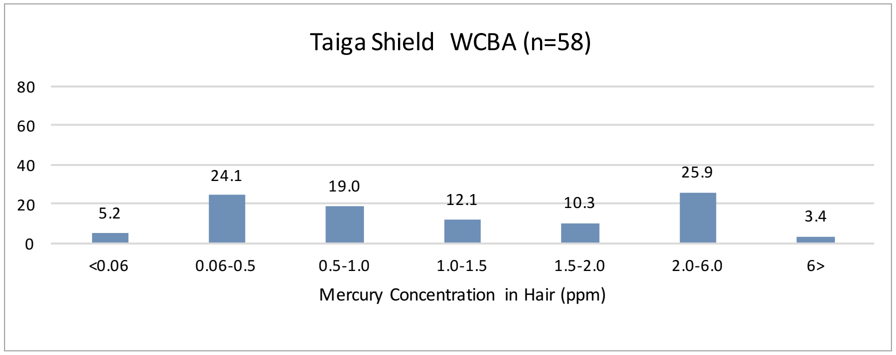


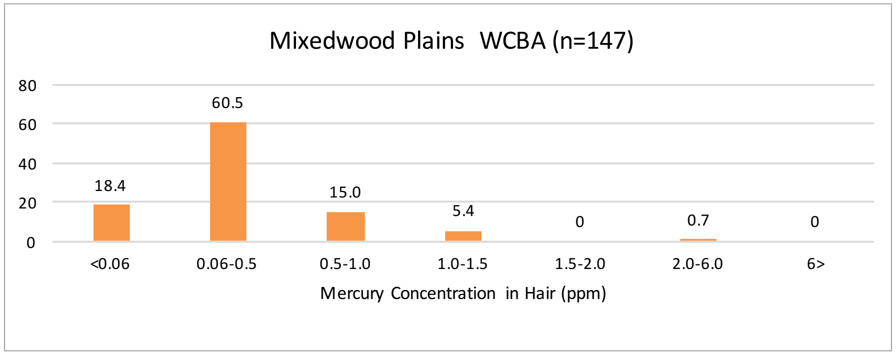


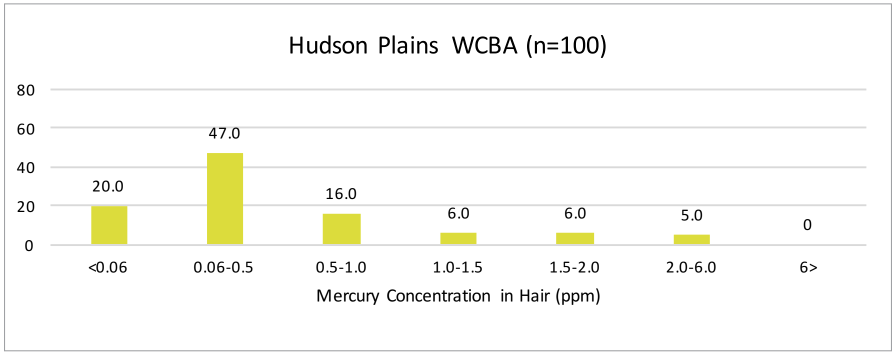


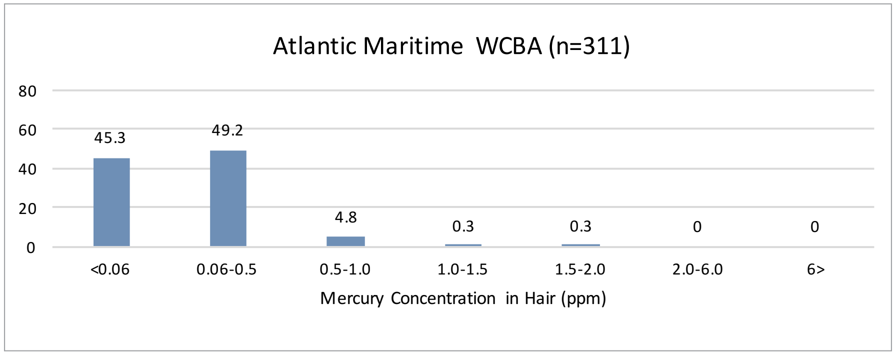





Taiga Shield WCBA (n=58)
80
60
40
20
0
5.2
24.1
19.0
12.1
10.3
25.9
3.4
<0.06
0.06-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-6.0
6>
Mercury Concentration in Hair (ppm)


Mixedwood Plains WCBA (n=147)
80
60
40
20
0
18.4
60.5
15.0
5.4
0
0.7
0
<0.06
0.06-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-6.0
6>
Mercury Concentration in Hair (ppm)


Hudson Plains WCBA (n=100)
80
60
40
20
0
20.0
47.0
16.0
6.0
6.0
5.0
0
<0.06
0.06-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-6.0
6>
Mercury Concentration in Hair (ppm)


Atlantic Maritime WCBA (n=311)
80
60
40
20
0
45.3
49.2
4.8
0.3
0.3
0
0
<0.06
0.06-0.5
0.5-1.0
1.0-1.5
1.5-2.0
2.0-6.0
6>
Mercury Concentration in Hair (ppm)

fnfnes.ca