



Wolastoqey Nation in New Brunswick (WNNB) Moose and Traditional Food Quality Study

Background:

The Wolastoqey Nation in New Brunswick (WNNB) provides technical advice to the communities of Madawaska Maliseet First Nation, Tobique First Nation, Kingsclear First Nation, St. Mary's First Nation and Oromocto First Nation. Traditional foods are a key dietary component for the Wolastoqey, with all of the 114 participants across the five WNNB communities (Madawaska, Tobique, Kingsclear, Oromocto and St. Mary's) indicating the consumption of at least one traditional food type.

In order to reaffirm moose as a high quality traditional food and to address concerns regarding the exposure to glyphosate through the consumption of moose meat, a moose tissue study was undertaken with the members of the WNNB. The study also re-evaluated previous traditional food quality data collected by the Maliseet Nation Conservation Council (MNCC) (2011, 2012, and 2014) and the Union of New Brunswick Indians (UNBI) (2009).

This study was done prior to the 2018 flooding of the Wolastoq watershed. On May 9, 2018, New Brunswick Emergency Measures Organization and the Department of Health issued a notification regarding the possibility of contamination of fiddleheads and other wild edible plants from the flood areas due to the potential of the flood waters containing untreated sewage, fuel or other contaminants. The notification indicated that individuals should not eat edible plants that may have been budding or have had contact with flood waters (GNB 2018a).

Important Findings of the Study:

- In 2017, glyphosate was not detected in any of the tissues samples. The study showed that moose meat is not a source of glyphosate in the diet of humans.
- The moose sampled for the study were safe to eat in the quantities reported by the WNNB community members.
- The measured metal concentrations in the traditional food items sampled were generally low for studies completed in 2009-2014.
- There was no significant change in food quality between 2012 and 2017 for moose muscle tissues.
- Consumption of metals at levels measured in the traditional foods is not greater than would occur as a result of the typical supermarket diet for the majority of foods analyzed.
- Consumption of game meat and fiddleheads, as analyzed in the traditional food studies, is safe in quantities in excess of the WNNB typical diet. Fiddleheads contaminated by floodwaters in 2018 should be avoided.
- Moose organ meat can be eaten in very small quantities on an occasional basis and from younger animals.



- Consumption of fish is currently under mercury related guidelines by New Brunswick Health, but the assessment would indicate that fish consumed within WNNB territory is safe in quantities in excess of the WNNB typical diet.
- Arsenic concentrations in fish varied depending on where the fish were from. In order to ensure that exposure to arsenic remains low, fish should be harvested from a variety of locations.
- The differences between this assessment and the MNCC (2011 and 2014) programs and the UNBI (2009) study relate to more metals being assessed and the use of different allowable daily limits.
- Given the widespread use of glyphosate, the study results with respect to glyphosate in moose tissues were not the result that the WNNB expected. We anticipate that the results of this study will not necessarily alleviate concerns regarding the impact of the use of the herbicide in WNNB territory.

Samples:

Hunters submitted samples from a total of 28 moose from across WNNB territory. Samples included muscle, liver, kidney, tongue, heart, lung and two udders of milk. Given the number of samples, the harvest locations of the animals were considered in order to have representative coverage of all of the harvesting areas. In total, samples from 16 of the moose were analyzed (Table 1). Hunters provided information regarding the age and sex of the animals.

Table 1 Moose Sample Questionnaire Results

<i>Moose ID#</i>	<i>Reported Age Descriptor¹</i>	<i>Reported Sex</i>	<i>Reported Harvesting Location</i>
#1	9-point bull	Male	Benton Ridge
#2	Calf	NR	Pocowagamis
#3	Dry cow	Female	Bloomfield
#4	Dry cow	Female	Woodstock
#5	Calf	NR	Kilfoil
#6	Wet cow	Female	Juniper
#8	17-point bull	Male	North lake
#11	Wet cow	Female	Flat Top west of Nackawic
#12	4-point bull	Male	Forest City
#13	20-point bull	Male	Mt. Carleton
#14	18-point bull	Male	Mt. Carleton
#16	12-point bull	Male	Canterbury
#18	14-point bull	Male	3rd Eel Lake
#23	23-point bull; 6-7 years old	Male	Between Mt Carleton and St. Quentin
#25	18-point bull; 4-5 years old	Male	Boisetown
#27	600 lb adult	NR	Mt. Pleasant

NR = Not Reported



Lab Results:

The moose tissues were analyzed for metals and glyphosate. While metals were commonly measured in moose tissues, glyphosate and its degradation product aminomethylphosphonic acid (AMPA) were not detected in any of the moose samples. The metals were measured at low levels in the muscle tissue; organs had higher levels of metals, particularly cadmium.

Metals enter the environment through various natural processes (erosion and sedimentation) and industrial activities (coal fired power generation, mining, road construction). People are exposed to very low levels of metals directly from the air, water and food.

Consumption Survey Results:

The community consumption survey was completed by 39 individuals from Tobique First Nation, 10 from Madawaska First Nation, 20 from Kingsclear First Nation, 35 from St. Mary’s First Nation and 10 from Oromocto First Nation, for a combined total of 114. Survey respondents provided information regarding sex, age, weight, pregnancy status, smoking status and the types, quantities and frequency of consumption of moose, deer, fiddleheads, trout and berries (Tables 2 and 3). All of the survey participants indicated they consumed traditional foods.

Moose, fiddleheads and berries were identified as the most frequently consumed traditional foods. In general men ate a greater amount of traditional foods per day while women ate traditional foods more times per year. The survey also asked what other traditional foods were consumed. The most frequently identified other foods were salmon, partridge, lobster and scallops.

Table 2 Amount and frequency of Traditional Food (TF) Consumption

<i>Respondent demographics</i>	<i>Total Participants</i>	<i>Male</i>	<i>Female</i>	<i>Not Specified</i>
Sex	114	72	41	1
Range of TF consumption (g/day)	6-725	8-400	6-725	20
Mean TF consumption (g/day)	109	115.4	100	20
Range of consumption frequency (times/year)	11-1511	11-849	17-1511	68
Mean consumption frequency (times/year)	228	202	279	68

**Table 3 Consumption Questionnaire Results**

Food	Number of Respondents	Proportion of n=114	Male	Female	N/S	Adult Consumption Rate (g/day)		
						Minimum	Maximum	Mean
Moose muscle	110	96%	70	39	1	0.63	452.7	43.3
Moose kidney	4	4%	3	1	-	1.2	11.3	4.1
Moose liver	6	5%	3	3	-	0.3	11.3	3.2
Trout	64	56%	41	43	-	0.2	53.4	10.5
Fiddleheads	107	94%	67	39	1	0.55	105	17.1
Deer	58	51%	37	21	-	0.3	141.8	15.7
Deer organs	7	6%	4	3	-	0.3	1.3	0.6
Blueberry	84	74%	50	34	-	0.23	83.8	11.6
Blackberry	73	64%	50	23	-	0.17	83.8	9.4
Raspberries	86	75%	55	30	1	0.23	83.8	11.5
Other berries	61	54%	36	25	-	0.47	83.8	11.3

N/S = not specified

Are the Foods Safe to Eat?

Yes.

- Moose meat can be eaten in quantities in excess of the reported average daily consumption amounts, or typical diet, and 96% of the respondents (n=110) reported eating moose muscle. The benchmark consumption quantity, or safe consumption amount, averages to 225g per day.
- Deer meat can be eaten in quantities in excess of the typical diet and 51% of the respondents reported eating deer meat. The benchmark consumption quantity is 225g per day.
- Six percent (6%) of the respondents indicated that they ate moose and deer organs and the majority indicated that they consumed the organ meat in the fall at the time of animal harvest. Organ meat consumption is the principal route of ingestion exposure to cadmium for non-smokers. There was a consumption advisory issued in 2005 by the Government of New Brunswick indicating that organ meat should not be consumed from moose and deer (GNB 2005); we are checking to see if this advisory is still in effect.
- Fiddleheads were consumed by 94% of the survey respondents and were the second most commonly consumed traditional food identified in the survey. The benchmark consumption quantity for an adult is approximately 100g per day of fiddleheads, uncontaminated by flood waters.



- Fiddleheads from areas of the Wolastoq watershed may be contaminated by raw sewage, fuel and chemicals and an advisory against consumption has been issued by New Brunswick Health (GNB 2018a).
- Public Health New Brunswick currently has a food handling brochure for fiddleheads which identifies that fiddleheads should be washed and prepared carefully prior to consumption to reduce foodborne illness and to remove soils and sediment (GNB 2018b).
- There is currently a consumption guideline for pregnant women, women of childbearing age and children under the age of eight for consumption of fish from lakes and rivers in New Brunswick and for fish over 29 cm in length; these guidelines include speckled or bull trout and are intended to avoid mercury exposure (GNB 2018c). We are checking to see how this advisory came into effect.
- Arsenic was measured in all of the fish. The highest arsenic concentrations were in a few fish harvested from around Oromocto. There were also some fish from each of Woodstock, Kingsclear, Oromocto and St. Mary's that had higher arsenic concentrations compared to most of the fish. Arsenic is naturally present in groundwater in New Brunswick (GNB 2018d) and many of the fishing locations were in areas where higher groundwater arsenic concentrations have been measured (NBDOE 2008). Many of the locations are also within the area identified by the Geological Survey of Canada as being slightly enriched in arsenic due to the presence of coal.
- For adults, the limiting metals were arsenic and mercury. The maximum reported consumption rate for fish was 60.5 g per day. The range of calculated benchmarks is within the range of reported fish consumption by WNNB and varied depending on the fishing location.

Conclusions:

The 2017 results showed that, in general, the metal concentrations in the moose muscle tissues were low and representative of meats available in Canadian supermarkets. The consumption of organ meat from younger moose is recommended over the consumption of the organs of older animals, which are expected to have higher concentrations of cadmium in their organs because they have had longer to accumulate cadmium through their diet. The consumption of game meat, fish and vegetation is safe in quantities in excess of the typical diet, while moose organ meat should only be eaten in very small quantities on an occasional basis. In order to ensure that exposure to arsenic remains low, fish should be harvested from a variety of locations.

Differences between this assessment and the MNCC and UNBI programs relate to the expansion of the number of metals that were assessed, and the use of different toxicological reference values to characterize the risks. The re-evaluation used Health Canada toxicological reference values. The metal concentrations in all of the traditional foods were consistent between all of the studies conducted in the WNNB territory; UNBI (2009) and MNCC (2011, 2012 and 2014) and the WNNB study of this year.

**References:**

- Government of New Brunswick (GNB). 2018a. Public Advisories & Alerts - Wild, edible plants exposed to floodwater may be unsafe. Available at:
http://www2.gnb.ca/content/gnb/en/news/public_alerts/public_alert.2018.05.0556.html
- Government of New Brunswick (GNB). 2018b. Fiddleheads and Food Safety. Available at:
<http://www2.gnb.ca/content/dam/gnb/Departments/h-s/pdf/en/HealthyEnvironments/Food/FiddleheadsAndFoodSafety.pdf>
- Government of New Brunswick (GNB). 2018c. Mercury in Fish. Available at:
http://www2.gnb.ca/content/gnb/en/departments/erd/natural_resources/content/fish/content/MercuryInFish.html
- Government of New Brunswick (GNB). 2018d. Facts on Drinking Water – Arsenic. Available at:
<http://www2.gnb.ca/content/dam/gnb/Departments/h-s/pdf/en/HealthyEnvironments/water/Arsenice.pdf>
- MNCC (Maliseet Nation Conservation Council). 2011. Evaluation of the level of contaminants, Mercury, Arsenic, Nickel and Cadmium in fiddleheads, New Brunswick.
<https://static1.squarespace.com/static/5850400020099e838d6872a7/t/5854310ebe6594ee22fafcc8/1481912591370/Fiddleheads-Contaminants-Study-revised.pdf>
- MNCC (Maliseet Nation Conservation Council). 2012. Evaluation of the level of contaminants, cadmium, mercury and arsenic in the muscle tissue and the organs of moose.
<https://static1.squarespace.com/static/5850400020099e838d6872a7/t/585430ac6b8f5beba7efd691/1481912493749/Moose-Contaminants-Study.pdf>
- MNCC (Maliseet Nation Conservation Council). 2014. Environmental contaminants in speckled trout and deer. Available at:
<https://static1.squarespace.com/static/5850400020099e838d6872a7/t/5854304415d5dbff94fad72f/1481912390181/Environmental-contaminants-in-trout-and-deer.pdf>
- New Brunswick Communications (2005). Health and Wellness Public Health Advisory / Hunters and wildlife diseases (2005/09/16). Accessed at
<http://www.gnb.ca/cnb/news/he/2005e1188hw.htm>
- New Brunswick Department of Environment (NBDOE). 2008. New Brunswick Groundwater Chemistry Atlas: 1994-2007. Sciences and Reporting Branch, Sciences and Planning Division, Environmental Reporting Series T2008-01.
<http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Groundwater-CompositionChimiqueLeau/GroundwaterChemistryAtlas-AtlasChimiqueLeauSouterraine.pdf>
- Union of New Brunswick Indians (UNBI). 2009. Mapping of the Contaminants affecting the health of First Nations in New Brunswick. Environmental Contaminants and Human Health. North Shore District Council and the Union of New Brunswick Indians