Synopsis Report 2018/19

Title: Arctic Caribou Contaminant Monitoring Program

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Abstract
This project studies contaminant levels in caribou in the Canadian Arctic to determine if these populations remain healthy (in terms of contaminant loads), whether these important resources remain safe and healthy food choices for northerners and if contaminant levels are changing over time. In 2018/19 samples were collected from 16 Qamanirjuaq, 4 Lorillard and 18 Forty-Mile caribou and 11 Sanikiluaq reindeer. Twenty kidneys from the Bathurst caribou were also included in the analysis. Sample analyses for these collections had not been completed at the time this report was prepared. Porcupine, Qamanirjuaq and Forty-Mile caribou samples collected in the 2017/18 year have been analyzed, and results are presented in this report. Toxic elements tended to be higher in cows than bulls, likely due to the relatively higher volume of food intake (and hence toxic element intake) by cows due to their smaller size and higher energetic requirements from parturition and lactation. Cadmium and zinc increased with age while mercury decreased with age in Porcupine caribou bulls. Lead continues to decline in both herds. Overall, mercury, selenium and zinc are increasing in the Qamanirjuaq caribou, although increases are slight and may be better described by a cyclic pattern, similar to that seen in the Porcupine caribou, which is not experiencing an overall increase in any of those elements. Toxic elements were present at very low concentrations in marrow from Porcupine caribou, much lower than those found in kidneys.

Perfluorinated sulfonic acids are declining over time in caribou liver (largely due to PFOS, which has been banned). Per- and polyfluorinated alkyl substances and polybrominated dipheynyl ethers were present at very low levels in caribou liver. Levels of most contaminants measured in caribou kidneys were not of concern toxicologically, although renal mercury and cadmium concentrations may cause some concern for human health depending on the quantity of organs consumed. Yukon Health has advised restricting intake of kidney and liver from Yukon caribou, the recommended maximum varying depending on herd (e.g. a maximum of 25 Porcupine caribou kidneys/year). The health advisory confirms that heavy metals are very low in the meat (muscle) from caribou and this remains a healthy food choice. There have been no health advisories issued for caribou in NWT or Nunavut.

Key Messages

- Levels of most contaminants measured in caribou tissues are not of concern, although kidney mercury and cadmium concentrations may cause some concern for human health depending on the quantity of organs consumed. Caribou meat (muscle) does not accumulate high levels of contaminants and is a healthy food choice.
- Mercury concentrations in the Porcupine and Qamanirjuaq caribou are stable over the long term, although there is considerable annual variation.
- Concentrations of PFASs and PBDEs are low with respect to potential toxicity to caribou or those

consuming caribou.

- This program will continue to monitor the Porcupine and Qamanirjuaq caribou herds annually to maintain confidence in this traditional food and to better understand the dynamics of contaminants within this ecosystem (particularly mercury).

Objectives

To determine levels of and temporal trends in contaminants in Arctic caribou to:

- provide information to Northerners regarding contaminants in these traditional foods, so that:
  - they may be better able to make informed choices about food consumption. This includes providing information for health assessments and/or advisories as required;
  - wildlife managers can assess possible health effects of contaminants on Arctic caribou populations;
- further understand the fate and effects of contaminant deposition and transport to the Canadian Arctic.

Introduction

Caribou provide an important food resource for Northerners across the Arctic, and the Porcupine and Qamanirjuaq caribou herds have been designated in the NCP blueprint for annual monitoring of mercury, inorganic elements, PBDEs (polybrominated diphenyl ethers) and PFASs (per- and polyfluoroalkyl substances). In addition, the blueprint specifies that one or two other herds will be monitored each year for the same list of contaminants. This year, those herds were the Lorillard caribou (Baker Lake, NU) and Sanikiluaq reindeer (Sanikiluaq, NU).

Activities in 2018/19

In the fall of 2018, samples were collected from 16 Qamanirjuaq caribou by local hunters in Arviat, NU and from 4 Lorillard caribou with the assistance of the Baker Lake Hunters and Trappers Organization (HTO). Samples were collected from 12 Sanikiluaq reindeer with the assistance of the Sanikiluaq HTO in January/February 2019. No samples were taken from the Porcupine caribou as their migration route did not take them through our sampling location in Old Crow, YT. Attempts were made to solicit samples from Alaskan harvesters, but these were unsuccessful. Shortfalls in sample numbers were completed with 18 samples from the Forty-Mile caribou herd, collected opportunistically by Yukon Environment in the fall of 2018. An additional 20 kidneys from the Bathurst herd collected in August 2011 by the Government of Northwest Territories (B Elkin) were included in the analysis. A range map for the major barren-ground herds is provided for reference (Figure 1).

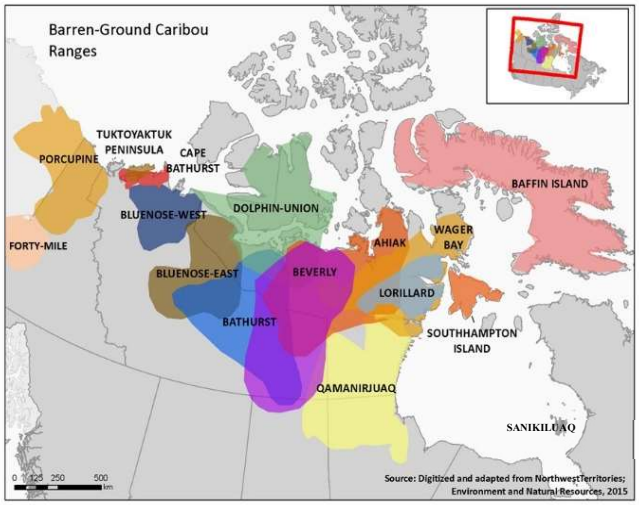

Figure 1. Home ranges of the major barren-ground caribou herds in Canada.

Current-year kidney samples are being analyzed for a suite of 34 elements using ICP-MS by NLET, Environment Canada, Burlington. Ten liver samples from each of the Forty-Mile and Qamanirjuaq herds and four from the Lorillard herd are being analyzed for PBDEs (including deca-BDE) and PFASs by a private laboratory (ALS Global). Liver and muscle samples will be archived at the National Wildlife Research Centre (Environment Canada). Incisors were used to analyze age of the animal using the cementum technique with the assistance of Environment Yukon (A Milani).

As methylmercury is the more toxic form of this element and we normally measure total mercury in caribou, we took advantage of the room in the analytical budget to analyze methylmercury in livers and kidneys from ten caribou from each of the Forty-Mile and Qamanirjuaq herds, four caribou from the Lorillard herd and in ten kidneys from the Bathurst herd (no livers were available from this collection).

Capacity Building

In September 2018, the PI participated in a wildlife contaminants workshop presented to the students of the Environmental Technology Program (ETP) of Arctic College in Iqaluit, providing information on contaminants in the general environment as well as in caribou specifically. This workshop will be offered again in September 2019.

In October 2018, the PI participated in a Wildlife Contaminants Workshop – building contaminants research capacity in Nunavut, in Arviat NU along with a team of ten other researchers. The workshop was designed to integrate experiences from past workshops, open houses and events that incorporate contaminants, wildlife ecology, physical processes in the Arctic, and climate change to be delivered to a range of community members in Arviat. An open house and evening gathering were held in Arviat in October 2018, that featured hands-on activities and presentations on three important wildlife species in the community: polar bears, seals and caribou, and featured NCP scientists from each project. About 75 community members (mostly students) came through the open house while about 150 participated in the evening gathering. An Inuit Qaujimajatuqangit (IQ) workshop was given to the visiting researchers by the Aqqiummarvik Society of Arviat, providing insight into new ways of developing research protocols in northern communities that will increasingly align with Inuit values and IQ principles and ensuring that northern research is carried out in a collaborative, respectful and effective manner.

Communications

Results of this project were communicated in the following ways: May 2018 – plain language summaries of contaminants in the Porcupine, Bluenose West, Ahiak, Qamanirjuaq and Dolphin & Union caribou were distributed widely (the latter four were provided both in English and Inuktitut); attended a two-day meeting of the Porcupine Caribou Herd Technical Committee to discuss contaminants in Porcupine caribou; provided E Kreummel with data (PFHxS) to be included in a risk profile for potential inclusion of this contaminant under the Stockholm Convention. June 2018 - included a discussion of contaminants in caribou in a radio interview with CBC. August 2018 – provided an update on contaminants in caribou to the State of the Environment Report (Environment Yukon). September 2018 – presented results to the Environmental Technology Program of Arctic College in Iqaluit as part of an NCP project: Wildlife Contaminants Workshop–linking wildlife and human health through a hands-on workshop. October 2018 – participated in the Wildlife Contaminants Workshop in Arviat (described in more detail in the Capacity Building section); Participated in a public caribou event at the Museum of Nature, Ottawa as part of the North American Caribou Workshop (brought displays of caribou clothing, toys made from caribou, caribou tissue processing for contaminant analysis and caribou tooth aging); met with territorial MLAs on Parliament Hill to discuss contaminants in the north. December 2018 – attended two-day AMAP meeting in Ottawa to contribute perspective on contaminants in caribou. January 2019 – attended a two-day caribou meeting with the Athabascan Denesuline in Wollaston Lake, SK to discuss contaminants in caribou. Feb 2019 – plain language summaries of contaminants in the Porcupine, Bluenose West, Ahiak, Qamanirjuaq and Dolphin & Union caribou were updated with most recent data (including outstanding PBDE and PFAS data) and distributed widely (the latter four were provided both in English and Inuktitut). Community visits to Taloyoak, Cambridge Bay and Kugluktuk, NU are planned for April 22-28, 2019. The Caribou Contaminant Facebook page is being used regularly to communicate results to a wider audience. A first draft of a manuscript entitled 'Perfluoroalkyl acids in Arctic Caribou and Reindeer' has been prepared by Anna Roos of the Swedish Museum of Natural History. Manuscripts are also being prepared on element profiles and differences among herds by Isabeau Pratte and Jennifer Provencher of the Canadian Wildlife Service and on environmental drivers of mercury in Arctic caribou by Jeremy Brammer of the

National Wildlife Research Centre.

Indigenous Knowledge Integration

This program relies on the indigenous knowledge when collecting samples from caribou for analysis. Local hunters use indigenous knowledge when hunting caribou and submitting samples as well as providing food for their families. Meetings between the PI and local HTOs provide an opportunity for the exchange of indigenous and western knowledge that enhances understanding of contaminants in caribou and facilitates the implementation of this project. When discussing the results of the sub-project to investigate whether mercury is precluding caribou from becoming pregnant, local hunters pointed out that the year we did that work was the second of two years that the caribou were in peak condition, as a result of windy summers that meant decreased insect harassment. This has provided an important insight into the interpretation of those results.

Results and Discussion

Elements

Element concentrations are presented for samples collected in the fall of 2017 (Porcupine, Qamanirjuaq and Forty-Mile herds) and for marrow collected from the Porcupine caribou in 2016 (Table 1). Although kidneys and marrow were analyzed for 34 elements, only results for 7 elements of concern were statistically analyzed in detail (arsenic [As], cadmium [Cd], copper [Cu], lead [Pb], mercury [Hg], selenium [Se] and zinc [Zn]). Porcupine and Qamanirjuaq results were analyzed for temporal trends.

Element concentrations in marrow from the Porcupine herd collected in 2016 were compared to those from the Qamanirjuaq herd collected in 2014. Most elements of concern (As, Cd, Cu, Se and Zn) were higher in the Qamanirjuaq caribou than the Porcupine caribou. However, concentrations of toxic elements were very low in both herds, much lower than levels found in kidneys.

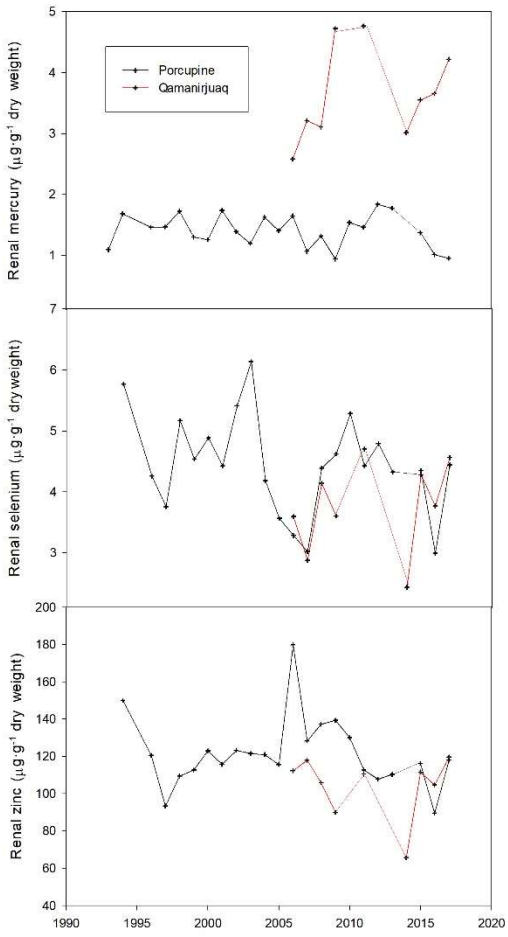

Figure 1. Renal concentrations of mercury, selenium and zinc in Porcupine and Qamanirjuaq caribou.

Element concentrations in kidneys collected in 2017 were compared among the Porcupine, Qamanirjuaq and Forty-Mile caribou. The Qamanirjuaq caribou had higher levels of Pb and Hg than the other two herds, while the other elements of concern (As, Cd, Cu, Se, Zn) did not differ among herds. Differences in element concentrations between sexes and trends over time and with age were analyzed using the Qamanirjuaq (2006-2017) and Porcupine (1990-2017) caribou datasets. Cows had higher concentrations of As, Cd, Pb and Hg in both herds than bulls. Cd and Zn increased with age while Hg decreased with age in Porcupine caribou bulls. Pb continues to decline in both herds. Overall, Hg, Se and Zn are increasing in the Qamanirjuaq caribou, although increases are slight and may be better described by a cyclic pattern, similar to that seen in the Porcupine caribou, which is not experiencing an overall increase in any of those elements (Figure 1).

Table 1. Element concentrations (X ± SD; $\mu g \cdot g^{-1}$ dry weight).

Year	N	Age	Arsenic	Cadmium	Copper	Lead	Mercury	Selenium	Zinc
Porcupine herd Kidneys; Fall-collected Males									
1997	14	4.1	0.42 ± 0.32	23.2 ± 12.1	21.2 ± 2.1	0.17 ± 0.11	1.47 ± 0.32	3.8 ± 0.6	93.4 ± 11.8
1998	14	4.7	0.19 ± 0.05	26.9 ± 21.0	25.6 ± 3.7	0.25 ± 0.28	1.76 ± 0.72	5.2 ± 1.2	108.4 ± 16.6
1999	11	4.7	0.08 ± 0.04	36.0 ± 25.9	23.5 ± 6.4	0.18 ± 0.09	1.23 ± 0.63	4.6 ± 0.8	113.5 ± 16.3
2000	8	4.8	0.30 ± 0.11	37.4 ± 17.6	25.1 ± 4.3	0.25 ± 0.39	1.23 ± 0.18	4.9 ± 1.0	121.6 ± 21.5
2001	12	5.1	0.36 ± 0.12	29.8 ± 11.9	22.5 ± 2.6	0.17 ± 0.15	1.74 ± 0.78	4.4 ± 1.1	115.8 ± 27.2
2002	9	5.6	0.18 ± 0.04	26.8 ± 8.4	25.1 ± 3.4	0.13 ± 0.05	1.39 ± 0.27	5.4 ± 0.6	123.3 ± 14.1
2003	23	5.8	0.25 ± 0.06	37.5 ± 18.1	25.4 ± 3.4	0.16 ± 0.18	1.19 ± 0.25	6.1 ± 0.7	121.6 ± 15.4
2004	16	4.9	0.05 ± 0.01	24.2 ± 13.8	22.8 ± 3.0	0.14 ± 0.04	1.62 ± 0.59	4.2 ± 0.6	121.0 ± 15.9
2005	14	3.5	0.05 ± 0.04	23.1 ± 14.8	23.1 ± 2.4	0.15 ± 0.04	1.81 ± 0.33	4.5 ± 0.6	121.9 ± 18.0
2006	9	5.1	0.07 ± 0.02	41.6 ± 23.7	24.9 ± 3.0	0.10 ± 0.02	2.18 ± 0.51	5.1 ± 0.6	130.6 ± 14.5
2007	12	4.7	0.04 ± 0.01	28.3 ± 12.2	24.5 ± 4.6	0.12 ± 0.08	1.58 ± 0.45	4.4 ± 0.7	120.0 ± 27.5
2008	20	6.1	0.03 ± 0.02	27.3 ± 16.8	26.7 ± 7.1	0.18 ± 0.38	1.34 ± 0.60	4.3 ± 0.5	138.4 ± 33.7
2009	21	6.3	0.05 ± 0.04	38.1 ± 16.6	24.6 ± 5.2	0.10 ± 0.06	0.98 ± 0.43	4.6 ± 0.7	139.5 ± 39.5
2010	4	6.8	0.07 ± 0.01	26.6 ± 9.9	21.3 ± 1.6	0.11 ± 0.03	1.53 ± 0.51	5.3 ± 0.8	130.1 ± 17.8
2011	11	4.9	0.05 ± 0.04	23.0 ± 12.7	22.8 ± 2.3	0.07 ± 0.03	1.42 ± 0.45	4.5 ± 0.6	112.8 ± 8.0
2012	20	6.2	0.11 ± 0.11	34.7 ± 21.9	22.8 ± 2.1	0.09 ± 0.03	1.84 ± 0.70	4.8 ± 0.5	107.8 ± 9.3
2013	22	5.3	0.04 ± 0.02	21.2 ± 9.2	24.3 ± 2.6	0.07 ± 0.02	1.79 ± 0.50	4.3 ± 0.5	109.4 ± 6.5
2015	15	5.2	0.04 ± 0.04	23.0 ± 10.6	24.6 ± 2.9	0.08 ± 0.03	1.37 ± 0.40	4.3 ± 0.4	116.2 ± 10.1
2016	23	6.6	0.05 ± 0.01	26.6 ± 9.4	25.6 ± 5.3	0.14 ± 0.14	1.53 ± 0.34	4.5 ± 0.4	135.0 ± 22.8
2017	5	7.4	0.045 ± 0.007	17.0 ± 2.7	23.6 ± 0.77	0.05 ± 0.00	0.95 ± 0.05	4.4 ± 0.0	118.1 ± 52.8
Porcupine herd Marrow; Fall-collected Males									
2016	12	6.7	<0.001 ± 0.00	0.003 ± 0.000	0.39 ± 0.05	0.00 ± 0.00	0.01 ± 0.00	0.1 ± 0.0	2.8 ± 0.8

Table 1 (continued). Renal element concentrations (X ± SD; $\mu g \cdot g^{-1}$ dry weight).

Year	N	Age	Arsenic	Cadmium	Copper	Lead	Mercury	Selenium	Zinc
Qamanirjuaq caribou Kidneys; Fall-collected									
Females									
2006	7	7.3	0.032 ± 0.007	18.7 ± 5.3	26.3 ± 0.76	0.58 ± 0.31	3.37 ± 0.36	3.6 ± 0.2	104.1 ± 3.2
2007	10	5.1	0.036 ± 0.003	24 ± 5.0	25.1 ± 2.8	0.44 ± 0.05	5.57 ± 0.74	4.1 ± 0.4	110.1 ± 9.6
2008	10	8.1	0.041 ± 0.005	29.7 ± 3.7	24.4 ± 1.28	0.36 ± 0.02	4.99 ± 0.50	4 ± 0.2	105.7 ± 5.1
2009	4	0.5	0.044 ± 0.009	19.8 ± 7.4	21.1 ± 1.71	0.25 ± 0.03	5.32 ± 1.08	3.5 ± 0.1	94.7 ± 5.6
2010	1		0.051	21.5	18.9	0.49	6.69	3.8	96.5
2011	17	6.0	0.04 ± 0.005	21 ± 6.0	22.0 ± 0.69	0.30 ± 0.03	5.04 ± 0.46	4.2 ± 0.1	107.9 ± 2.6
2013	4	5.5	0.034 ± 0.004	31.1 ± 17.6	27.2 ± 0.9	0.26 ± 0.05	3.96 ± 0.36	4.4 ± 0.1	120.5 ± 7.9
2014	10	10.0	0.035 ± 0.004	28.6 ± 4.4	19.9 ± 2.07	0.27 ± 0.07	5.45 ± 0.55	3.5 ± 0.3	98.2 ± 11.0
2015	9	7.1	0.03 ± 0.011	26.2 ± 9.8	25.8 ± 2.5	0.16 ± 0.03	5.22 ± 1.39	4.5 ± 0.4	117.7 ± 4.4
2016	8	7.6	0.02 ± 0.007	25.8 ± 14.8	27.6 ± 1.9	0.16 ± 0.04	6.79 ± 2.84	3.7 ± 0.5	117.0 ± 10.9
2017	7	5.6	0.044 ± 0.002	29.8 ± 7.3	25.2 ± 0.89	0.20 ± 0.04	5.86 ± 0.89	4.7 ± 0.2	122.7 ± 46.4
Males									
2006	14	5.8	0.014 ± 0.003	14 ± 2.4	25.8 ± 0.49	0.34 ± 0.07	2.58 ± 0.23	3.6 ± 0.1	112.3 ± 3.7
2007	8	4.0	0.033 ± 0.004	11.5 ± 2.9	20.8 ± 0.89	0.39 ± 0.08	4.23 ± 0.57	3.6 ± 0.2	94.2 ± 3.6
2008	11	5.0	0.028 ± 0.003	16.8 ± 2.8	24.4 ± 1.25	0.27 ± 0.03	3.10 ± 0.47	4.1 ± 0.1	105.8 ± 2.6
2009	1		0.04	3.8	22.4	0.36	4.72	3.6	90.0
2011	2	5.5	0.033 ± 0.014	15.3 ± 2.9	22.9 ± 1.28	0.25 ± 0.09	4.77 ± 1.94	4.7 ± 0.5	110.5 ± 2.6
2014	10	6.9	0.041 ± 0.004	19.2 ± 3.9	23.0 ± 3.11	0.18 ± 0.02	5.42 ± 0.68	4.1 ± 0.3	99.9 ± 3.5
2015	9	6.8	0.03 ± 0.011	17.1 ± 7.0	23.9 ± 2.5	0.15 ± 0.07	3.55 ± 1.18	4.3 ± 0.3	114.4 ± 6.2
2016	10	5.6	0.03 ± 0.01	8.0 ± 3.3	25.0 ± 2.3	0.14 ± 0.03	3.66 ± 1.43	3.8 ± 0.4	104.8 ± 9.9
2017	10	4.2	0.043 ± 0.003	17.9 ± 4.0	24.9 ± 1.31	0.24 ± 0.07	4.22 ± 0.49	4.6 ± 0.2	119.5 ± 37.8
Forty-Mile Kidneys; Fall Collected 2017									
Females	2		0.042 ± 0.014	43.9 ± 3.8	28.8 ± 4.14	0.06 ± 0	0.61 ± 0.05	3.8 ± 0.4	137.5 ± 97.3
Males	8		0.058 ± 0.009	26.4 ± 4.2	26.2 ± 1.22	0.06 ± 0.01	0.76 ± 0.11	3.7 ± 0.2	119.1 ± 42.1

Levels of most elements measured in these caribou herds were not of concern toxicologically, although renal Hg and Cd concentrations may cause some concern for human health depending on the quantity of organs consumed. Yukon Health has advised restricting intake of kidney and liver from Yukon caribou, the recommended maximum varying depending on herd (e.g. a maximum of 25 Porcupine caribou kidneys/year). Heavy metals are very low in the marrow and meat (muscle) from caribou and these remain healthy food choices.

Fluorinated compounds

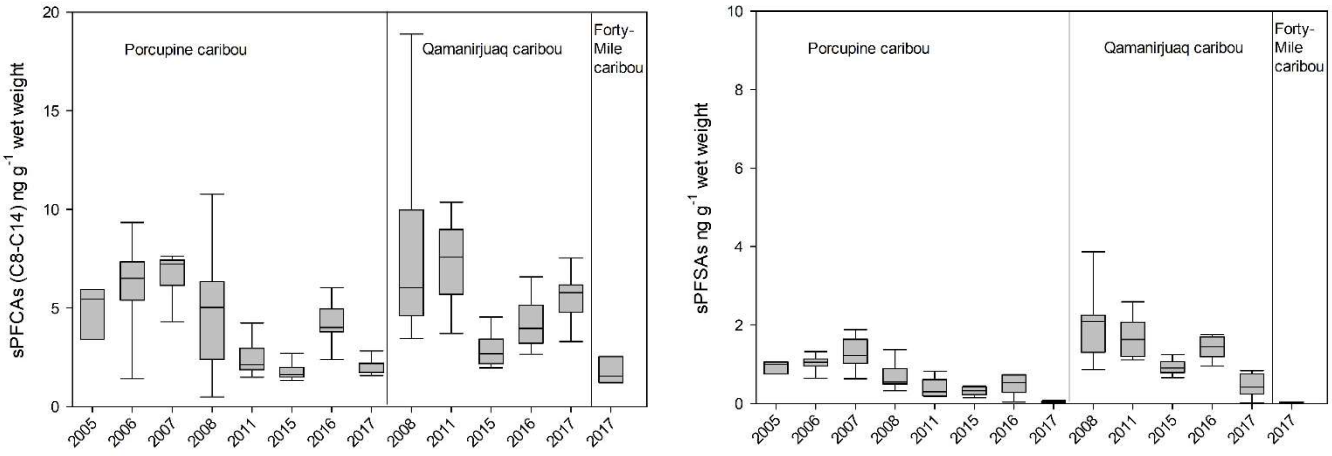

Figure 2. PFCAs and PFSAs in Arctic caribou liver.

Hepatic concentrations of PFASs are presented for the 2017 collections of the Porcupine, Qamanirjuaq and Forty-Mile herds, along with data from past years (Figure 2). Results for the short-chain PFCAs (perfluorinated carboxylic acids)(C4-C7) are not reported as they are currently being reanalyzed. Concentrations of total long-chain PFCAs (C8-14) have increased steadily from 2015 through 2017 in the Qamanirjuaq caribou in contrast to the Porcupine caribou which experienced a decline in 2017. These trends are driven by C9-11 which, together, make up just over 90% of the long-chain PFCAs. Concentrations of PFSAs (perfluorinated sulfonic acids) are generally declining in both herds, likely due to the implementation of international controls. The Forty-Mile herd had low concentrations of all PFASs as compared with the other two herds. Concentrations of all PFASs are low with respect to potential toxicity to caribou or those consuming caribou.

Brominated compounds

PBDE results are presented for the 2017 collections of the Porcupine, Qamanirjuaq and Forty-Mile herds, along with data from past years (Figure 3). There is no clear trend in total PBDEs over time in the Porcupine or Qamanirjuaq herds, but with only three years of data, any trend would be difficult to discern. The Forty-Mile caribou had concentrations of PBDEs similar to the other two herds. Concentrations of PBDEs are low with respect to potential toxicity to caribou or those consuming caribou.

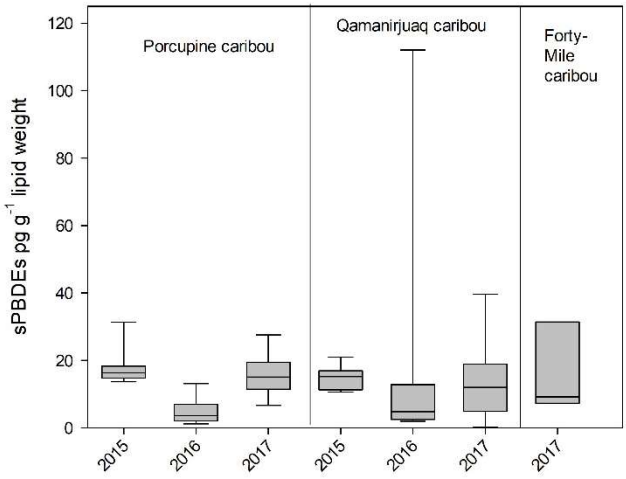

Figure 3. PBDEs in livers from Arctic caribou.

Data collected from this program continue to provide baseline data for contaminants in Arctic caribou as well as a valuable tissue archive for legacy and emerging contaminants. The ongoing nature of this program provides security and confidence for northerners using caribou as a food source and acts as an early warning system for wildlife managers. The length and consistency of this program also provides a valuable database for exploring the dynamics of contaminants of concern (eg. Hg) within the terrestrial ecosystem. This program will continue to collect and analyze samples from the Porcupine and Qamanirjuaq caribou herds (20 animals from each) as well as two additional herds in the coming fiscal year.

Expected Project Completion Date: This program is ongoing.

Acknowledgements
Many thanks to Yukon Environment staff: Martin Kienzler and Mike Suitor for providing samples from the Porcupine and Forty-mile caribou herds, Mary Vanderkop and Meghan Larivee for laboratory support, and Angela Milani for aging caribou teeth. I would also like to acknowledge the efforts of all hunters who have submitted samples to this program over the years – without them, this work would not be possible. A particular thank you goes to the Arviat Hunters and Trappers Association who organize collections of the Qamanirjuaq caribou annually, to Hugh Nateela for organizing collections of the Lorillard caribou and to Lucassie Arragutainaq for organizing collections of the Sanikiluaq reindeer. Also, thanks to Bobby Suluk who translated plain language summaries of this project into Inuktitut. It is with great sadness that I acknowledge the efforts of Frank Nutarasungnik of Arviat who passed away in December 2018. Frank was integrally involved in this project since it started in Arviat and has provided most of the samples from the Qamanirjuaq caribou herd for the last 12 years. He will be missed.

This project was funded by the Northern Contaminants Program, Indigenous and Northern Affairs Canada.

Project Statistics and Information: April 1, 2015 – March 31, 2016					
Engagement & Communication Indicators	**Description**	**Date**	**Location**	**Number** of people of materials	**Details** How were they involved?
Northerners engaged in your project	Workshops	Sept 2018	Iqaluit, NU	25	Nunavut Arctic College: Presentation and Discussion
		Oct 2018	Arviat, NU	150	Wildlife Contaminants Workshop
		Oct 2018	Ottawa, ON	150	Public event at Museum of Nature as part of North American Caribou Conference
	School visits				
	Meetings	May 2018	Whitehorse, YT	30	Porcupine Caribou Technical Committee Meeting
		Oct 2018	Ottawa, ON	7	Meeting with northern MLAs on Parliament Hill
		Dec 2018	Ottawa Tuktoyuktuk, NT	30	AMAP meeting (Mercury Assessment)
		Jan 2019	Wollaston Lake, SK	120	Athabascan Denesuline Caribou Meeting
	Consultations	Nov, Dec 2018	Old Crow, Dawson, Mayo, Whitehorse YT; Inuvik, Fort Macpherson, Aklavik, Tsiighetchic, Tuktoyuktuk, Yellowknife NT; Arviat, Whale Cove, Chesterfield Inlet, Rankin Inlet, Baker Lake, Iqaluit NU	105	Consultation with local HTOs, Renewable Resource Councils and Boards, First Nations, Regional contaminant committees, local and federal government agencies and Wildlife Management
	Part of your project team	ongoing	YT, NU	4	Biologists assisting with sampling
			YT, NU	4	Renewable Resource Board and HTO coordinators
			YT, NU	12	Hunters
	Hired				
	Other				

Students involved in your NCP project	Northern				
	Southern				
Distribution of project materials/ information and results	Reports to Hunters	March 2019	YT, NT, NU	5 plain language summaries	Distributed widely to stakeholder groups
	Newsletters				
	Posters				
	Other	Ongoing	Whitehorse, YT		Facebook Page
Publication & Data Indicators		**Details** Including references and links			
Citable publications	Journal articles	Perfluoroalkyl acids in Arctic Caribou and Reindeer *in prep* Element concentrations in circumpolar Arctic Caribou and Reindeer *in prep* Environmental drivers of mercury in circumpolar Arctic Caribou and Reindeer *in prep*			
	Conference presentations				
	Other				
Media articles (print/ online) related to your project	Radio	CBC radio interview August 2018			
Knowledge Integration Indicators		**Details**			
How are your project results, data, and information used, and by whom? (i.e., names/types of assessments, initiatives, *etc*, that will use your project results)	Local	State of the Environment Report, Yukon Environment			
	Regional/ National	CACAR Hg Assessment; Canadian Hg Science Assessment			
	International	Risk profile of PFHxS under Stockholm Convention; AMAP Hg Assessment			
Access to Data	Meta Data In Polar Data Catalogue	PDC Record # 12007			

Appendices

Plain language summaries for:

Ahiak Caribou – English, Inuktitut
Bluenose West Caribou – English
Dolphin & Union Caribou – English, Inuktitut
Porcupine Caribou – English
Qamanirjuaq Caribou – English, Inuktitut

Report to the Hunters of the Ahiak Caribou – Feb 2019

The Northern Contaminants Program monitors contaminants in Arctic Caribou in Canada. Each year, we monitor the Porcupine (western Arctic) and the Qamanirjuaq (eastern Arctic) caribou. Each year, we also monitor an additional two herds depending on availability and concern.

We use this information to

- Provide information to Northerners so that they may be better able to make informed choices about food consumption and
- Help guide policies that limit contamination of the environment.

ACTIVITIES IN 2017/18

- Hunters in Taloyoak collected samples from 7 cows and 3 bulls in the fall of 2017.
- The samples were sent to Whitehorse where they were processed before being sent to a lab in the south to be tested.
- Kidneys were tested for a range of metals, including mercury, cadmium, copper, arsenic, selenium and lead.
- Livers were tested for new contaminants that are found in stain guards and fire retardants.

WHAT DID WE LEARN?

- The caribou that were sampled for this project were all quite young. They ranged from calves to 5 years old.
- Contaminant levels in the Ahiak Caribou Herd are similar to those in other Arctic herds. This is good news!

We are continuing to monitor contaminants in the Arctic caribou to keep track of the levels of contaminants in their organs, and to try to better understand how and why they build up in caribou the way they do.

THIS PROJECT IS SUPPORTED BY THE NORTHERN CONTAMINANTS PROGRAM

For more information please contact Mary Gamberg, Gamberg Consulting
Phone: 867-334-3360 mary.gamberg@gmail.com

WHAT DO WE KNOW FROM STUDYING OTHER ARCTIC CARIBOU HERDS?

- Arctic caribou are largely free from contamination and are healthy to eat.
- Some caribou have mercury and cadmium in their organs. Some of the cadmium and mercury occurs naturally in the land, but some is brought here by wind from industry down south. Some mercury may also come from forest fires or volcanoes.
- Mushrooms may provide a pulse of mercury in the fall, because some mushrooms can build up large amounts of mercury and are a preferred food when they are available.
- Mercury is generally higher in the spring than the fall, because the caribou eat lichens through the winter which are higher in mercury than their summer foods of grasses and flowering plants.
- In the fall, mercury concentrations are higher in cows than in bulls, because cows are smaller and eat proportionally more food, therefore more mercury.
- In the spring, mercury may be lower in cows than in bulls, because some of the mercury is lost to the fetus and through milk production.
- Cadmium and mercury in caribou organs fluctuate over time but over the long term are remaining stable in the Porcupine and Qamanirjuaq caribou, so they are likely stable in other Arctic caribou.
- Mercury in the Arctic caribou may be affected by rain, snow, wind, temperature, migration patterns, time of green-up and forage quality as well as mercury emissions coming from industry, forest fires and volcanoes.
- PBDEs (polybrominated diphenyl ethers) are environmental abundant chemicals used in flame retardants. Levels in caribou are very low and have not changed significantly in the Porcupine and Qamanirjuaq caribou from 2015 through 2017.
- Per- and polyfluorinated alkyl substances (PFASs) are man-made chemicals that are used in things like water repellants, stain guards and fire-fighting foams. Levels in caribou liver are low and some (eg. PFSAs) are declining over time in the Porcupine and Qamanirjuaq caribou, likely due to legislation banning their use.
- **Caribou muscle (meat), marrow and brain have very low levels of contaminants.**

HOW OUR RESEARCH IS HELPING THE WORLD

Our monitoring program provided evidence for national and international agreements to limit the amount of mercury being deposited into the environment. The Minimata Convention on Mercury came into force on August 16, 2017 and will help ensure that Arctic caribou are not exposed to increasing levels of mercury.

This is a BIG SUCCESS for us!

ᐅᓂᒃᑳᖅᓯᒪᔪᖅ ᐊᖑᓇᓱᒃᑎᖏᓐᓄᑦ ᐊᕼᐊᓕᐊᖅ ᑐᒃᑐᖁᑎᖏᑕ – ᕖᑉᕈᐊᕆ 2019

ᐅᑭᐅᖅᑕᖅᑐᒧᒥ ᐃᓚᖁᑎᖃᕈᐊᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᖑᔪᖅ ᖃᐅᔨᓴᖅᐸᒃᐳᖅ ᐃᓚᖁᑎᑕᖅᐸᓕᐊᓂᖏᓐᓂᒃ ᐅᑭᐅᖅᑕᖅᑐᒥ ᑐᒃᑐᓂᒃ ᑲᓇᑕᒧᒥ. ᐅᑭᐅᑕᒪᕐ, ᖃᐅᔨᓴᖅᐸᒃᐳᒧᑦ ᐳᐊᑭᐸᐃᓐ (ᐊᐅᓕᓂᕐᒥ) ᐊᒻᒪ ᖃᒪᓂᕐᔪᐊᕐᒥ (ᐅᑭᐅᖅᑕᖅᑐᑉ ᑲᓇᖕᓇᖕᒐᓂ) ᑐᒃᑐᖁᑎᖏᓐᓂᒃ. ᐊᕙᑐᑕᒪᑦ ᒪᕈᐃᓂᒃ ᖃᐅᔨᓴᖅᐸᕿᕚᒧᑦ ᑐᒃᑐᓂᒃ ᐱᑕᖃᕋᖕᒐᑕ ᐃᓱᒪᑐᑕᐅᔭᕋᖕᒐᑕᓗ.

ᑕᒃᑯᐊ ᖃᐅᔨᓴᕐᓂᑯᑦ ᐊᑐᓚᐅᖅᐸᕖᑦ

- ᖃᐅᔾᒪᔪᑕᐅᒃᑐᑎᒃ ᐅᑭᐅᖅᑕᖅᑐᒥᐅᓄᑦ ᐃᓱᒪᓕᐅᕈᖕᓇᑎᐊᕐᑯᒃᑐᕆᑦ ᓂᕿᒃᓴᒥᖕᓂᒃ ᐊᒻᒪ
- ᒪᓕᒐᓕᐅᕈᖕᓇᑎᐊᕐᑐᑎᒃ ᐃᓚᖁᑎᖃᕈᐊᖅᑕᐃᓕᓂᕐᒧᑦ ᐊᕙᑎᒃᑎᖕᓄᑦ.

ᐱᓕᕆᐊᖑᓚᐅᖅᑐᑦ ᐃᓗᐊᓂ 2017/18

- ᐊᖑᓇᓱᒃᑎᑦ ᑕᓗᕐᔪᐊᕐᒥ ᑲᑎᖅᓱᐃᓚᐅᖅᐳᑦ ᖃᐅᔨᓴᒐᒃᓴᓂᒃ 7 ᓄᕙᓕᖕᓂᒃ ᐊᒪ 3 ᐸᖕᓂᕐᓂᒃ ᐅᑭᐅᖑᓐᓂ 2017.
- ᑕᒃᑯᐊ ᐊᐅᓚᖅᑎᑕᐅᓚᐅᖅᐳᑦ ᕙᐃᑉᕼᐅᐊᔅᒧᑦ ᓴᕙᑕᐅᒃᑐᑎᒃ ᖃᐅᔨᓴᕐᕕᖕᒧᑦ ᐊᐅᓚᖅᑎᑕᐅᓕᕐᑐᑎᒃ .
- ᑕᖅᑐᖏᑦ ᖃᐅᔨᓴᒐᐅᓚᐅᖅᐳᑦ ᓴᕕᒃᓴᓄᑦ, ᒧᑯᕆᓄᑦ, ᑳᓂᐊᒻᒧᑦ, ᑲᐊᐸᓄᑦ, ᐊᔅᓯᓂᒃᓄᑦ ᓯᓕᓂᐊᓄᓪᓗ.
- ᑎᖑᐃᑦ ᖃᐅᔨᓴᒐᐅᓚᐅᖅᐳᑦ ᓄᑕᓐᓂᒃ

ᓱᓇᓂᒃ ᐃᓕᑦᑎᓚᐅᖅᐱᑕ?

- ᑐᒃᑐᑦ ᖃᐅᔨᓴᒐᐅᓚᐅᖅᑐᑦ ᑕᒪᕐᒥᒃ ᐊᒃᑐᓗᐊᓚᐅᖏᑐᕐ. ᐅᑭᐅᖃᓚᐅᖅᑐᑦ ᓄᕙᕐᓂᑦ 5 ᐅᑭᐅᓐᓄᑦ.
- ᐃᓚᖁᑎᑦ ᐊᕼᐊᒃ ᑐᒃᑐᖁᑎᖏᓐᓂ ᐊᔾᐅᕗᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᑐᒃᑐᖁᑎᒋᔭᐅᔪᓂ. ᑕᒪᓇ ᑐᓴᕈᒥᓇᖅᑐᖅ!

ᖃᐅᔨᓴᖅᐳᒧᑦ ᓱᓕ ᓱᕈᕐᓇᖅᑐᓂᒃ ᐅᑭᐅᖅᑕᖅᑐᑉ ᑐᒃᑐᖁᑎᖏᑕ ᐃᓗᖏᓐᓂ ᑐᑭᓯᑲᓂᕈᒪᒃᑐᑕ ᖃᓄᖅ ᑐᒃᑐᓂ ᐱᕈᖅᐸᓕᐊᓱᕐᒪᖔᑕ ᓱᓇᒧᓪᓗ ᐱᕈᖅᐸᓕᐊᔪᑎᖃᔪᖕᒪᖔᑕ.

ᑕᒻᒪ ᐱᓕᕆᐊᖅ ᐃᑲᔪᕐᐅᓯᒪᔪᖅ ᐅᑭᐅᖅᑕᖅᑐᒥ ᓱᕈᖅᑕᐅᑕᐃᓕᓂᐅᑉ ᐱᓕᕆᐊᖏᓐᓄᑦ

ᑐᑭᓯᑲᓂᕈᐊᕐᓂᕈᕖᑦ ᑐᓴᖅᑎᒥᐊᕐᑐᒍ ᒥᐊᕆ ᑳᒻᐳᐊᒃ, ᑳᒻᐳᐊᒃ ᖃᐅᔨᒪᔨᖓ
ᐅᕐᑲᓗᑎᖓ: 867-334-3360 ᖃᕆᑕᐅᔭᑯᑦ ᑐᕙᕈᑎᖓ: mary.gamberg@gmail.com

ᓱᓇᓂᒃ ᖃᐅᔨᒪᓕᖅᐱᑕ ᐅᑭᐅᖅᑕᖅᑐᒥ ᑐᒃᑐᓂᒃ ᐃᓕᓐᓂᐊᖅᓱᑕ?

- ᐅᑭᐅᖅᑕᖅᑐᑉ ᑐᒃᑐᖏ ᓱᑭᕐᓇᖅᑐᖃᖏᑦᑐᑦ ᓂᕆᔭᐅᔪᓐᓇᖅᑐᓪᓗ.
- ᐃᓚᖏᑦ ᑐᒃᑐᑦ ᒧᑯᕆᖃᖅᑐᑦ ᑳᓂᐊᒻᖃᖅᓱᑎᒡᓗ ᐃᓗᖏᓐᓂ. ᑳᓂᐊᒻ ᐊᒻᒪ ᒧᑯᕆ ᓇᐸᖅᑐᓂᑦ ᓄᓇᐸᓗ ᓴᔾᐱᓕᖓᖓᓐᓂ ᐱᓱᖅᑐᑦ, ᑭᓯᐊᓂ ᐊᓄᕆᒧᑦ ᓱᐱᔾᔪᓱᖅᐳᑦ ᐱᓕᕆᕝᕙᒡᔪᐊᕐᓂᑦ ᖃᐸᓗᓇᑦ ᓄᓇᖓᓐᓂᑦ
- ᑐᒃᑐᑦ ᓂᕿᖏᑦ ᒧᑯᕆᖃᕈᖕᓇᖅᐳᑦ ᐊᖏᓗᐊᖏᑐᒥᒃ ᐅᑭᐊᒻᒥ, ᑕᐸᑯᐊ ᐱᕈᖅᑎᕗᓱᕐᒪᑕ ᓂᕆᔭᐅᓱᐊᒍᖕᒪᑕᓗ ᑐᒃᑐᓄᑦ ᐱᑕᖃᕆᖓᑦ.
- ᒧᑯᕆ ᐅᐱᕋᒃᓴᒥ ᐱᑕᖃᕐᔪᐊᕐᓂᖅᓴᐅᓱᖅᑐᖅ ᑐᒃᑐᑦ ᐅᑭᐅᒥ ᐱᕈᖅᑐᓂᒃ ᓂᕆᓱᕐᒪᑕ ᒧᑯᕆᖃᕐᓂᖅᓴᐅᐸᓗᑎᒃ ᐊᐅᔾᔪᒥ ᐱᕈᖅᓯᐊᓂᒃ ᓄᓇᒥᐅᑕᓂᒡᓗ.
- ᐅᑭᐊᒻᒥ ᒧᑯᕆᖃᕐᓂᖏᑦ ᐊᖏᓂᖅᓴᐅᐸᓗᑎᒃ ᓄᕋᓕᖕᓂ ᐸᖕᓂᕐᓂᑦ ᒥᑭᓂᖅᓴᐅᓂᖏᓐᓄᑦ ᓂᕆᒐᔪᖕᓂᖅᓴᐅᓂᖏᓐᓄᓪᓗ ᒧᑯᕆᑕᕋᓚᓂᖅᓴᐅᓕᖅᓱᑎᒃ.
- ᒧᑯᕆ ᐅᐱᕋᒃᓴᒥ ᐱᑕᖃᕐᔪᐊᕐᓂᖅᓴᐅᓱᖅᑐᖅ ᑐᒃᑐᑦ ᐅᑭᐅᒥ ᐱᕈᖅᑐᓂᒃ ᓂᕆᓱᕐᒪᑕ ᒧᑯᕆᖃᕐᓂᖅᓴᐅᐸᓗᑎᒃ ᐊᐅᔾᔪᒥ ᐱᕈᖅᓯᐊᓂᒃ ᓄᓇᒥᐅᑕᓂᒡᓗ..
- ᑳᓂᐊᒻ ᒧᑯᕆᓗ ᑐᒃᑐᑦ ᐃᓗᖏᓐᓂ ᐊᕙᖏᖏᐸᒃᐳᑦ ᑭᓯᐊᓐᓂ ᐅᑭᐅᓂ ᐊᒥᓱᓂ ᓱᓐᓂᓗᐊᖅᑕᖏᑦᑐᑦ ᐳᐊᑭᐸᐃᓐᓂ ᐊᒪ ᖃᒪᓂᕐᔪᑉ ᑐᒃᑐᖁᑎᖏᓐᓂ ᐱᑕᖃᐃᓐᓇᕐᓂᐊᖅᐳᑦ ᐅᑭᐅᖅᑕᖅᑐᒻᒥ.
- ᒧᑯᕆ ᐅᑭᐅᖅᑕᖅᑐᒻᒥ ᐊᒃᑐᐃᔪᓪᓗᐊᖅᐳᖅ ᓂᐸᓗᖕᓂᕐᒥᒃ, ᐊᐳᒻᒥᒃ, ᐊᓄᓂᒃᑯᑦ, ᐅᓇᓗᐊᕐᓂᑯᑦ, ᑐᒃᑐᑦ ᐱᓱᖕᓂᕆᑎᒧᑦ, ᖃᐸᓗᓇᑦ ᓄᓇᖓᓂ ᐱᓕᕆᐸᒡᔪᐊᕐᓂᑦ, ᓇᐸᖅᑐᑦ ᐃᑯᐊᓪᓚᖕᓂᖕᕆᑎᒧᑦ ᐊᒪ ᓴᔾᐱᓕᖕᓂᖓᒧᑦ ᓄᓇᐸ.
- PBDEs (polybrominated diphenyl ethers) ᓄᓇᒥᓯᐅᖅᐸᒃᑐᑦ ᐃᓚᕐᑯᑕᐅᕙᒃᑐᑦ ᖃᐱᑎᕈᑎᓂ. ᑐᒃᑐᓂ ᐊᖏᓗᐊᖏᑐᑦ ᐳᐊᑭᐸᐃᓐ ᐊᒪ ᖃᒪᓂᕐᔪᐊᐸᑕ ᑐᒃᑐᖁᑎᖏᓐᓂ ᑕᐃᑲᖓᑦ 2015 ᑎᑭᓗᒍ 2017.
- Per- and polyfluorinated alkyl ᐃᓚᕐᑯᑎᖏ (PFASs) ᓴᓇᔭᐅᕙᒃᑐᑦ ᐃᓄᖕᓄᑦ ᑭᓂᑎᕈᑎᑎᒍᑦ, ᕿᐸᓕᖅᓴᐅᑎᑎᒍᑦ, ᖃᐱᑎᕈᑎᑎᒍᓪᓗ. ᑐᒃᑐᑦ ᑎᖕᒍᐃᑦᓂ ᐊᖏᓗᐊᖏᑐᖅ ᐃᓚᖏᓐᓂᓗ (ᒪᑯᐊᑐᑦ PFSAs) ᑐᑦᓯᑕᐃᕈᑎᕙᓪᓕᐊᔪᑦ ᖃᒪᓂᕐᔪᐸ ᑐᒃᑐᖏᓐᓂ, ᒪᓕᒐᖅᑕᖃᓕᕐᒪᑦ ᐊᑐᕐᑯᔭᐅᖏᓗᑎᒃ.
- ᑐᒃᑐᑦ ᓄᕿᖏᑦ (ᓂᕿᖓ) ᐸᑎᖏ, ᖃᓇᑕᖓ ᓱᑭᕐᓇᖅᑐᖃᓗᐊᖏᑐᑦ.

ᖃᓄᖅ ᖃᐅᔨᓴᕐᓂᖅᐳᑦ ᐃᑲᔪᕐᒪᖓᑦ ᓯᓚᕐᔪᐊᕐᒥᒃ ᖃᐅᔨᓴᕈᑎᕗᑦ ᑐᑭᓯᓇᖅᑕᔪᕗᖅ ᑲᓇᑕᒥ ᓯᓚᕐᔪᐊᕐᒥᓗ ᐊᖏᕈᑎᓂᒃ ᒧᑯᓂᐊᖃᓗᐊᖅᑕᐃᓕᓂᕐᒧᑦ ᐊᕙᑎᑉᑎᖕᓄᑦ. ᒥᓂᒪᑕ ᐊᖏᕈᑎᖓ ᓯᓚᕐᔪᐊᕐᒥ ᒧᑯᕆᖃᕐᓂᕐᒧᑦ ᐊᑐᓇᐊᓚᐅᖅᓯᒪᕗᖅ ᐊᐅᒍᔅ 16, 2017 ᐃᑲᔪᕈᑕᐅᓂᐊᖅᓱᓐᓂ ᑐᒃᑐᑦ ᒧᑯᕆᖃᕐᓂᕐᒧᑦ ᐱᔭᐅᑕᐃᓕᕐᑯᑉᓗᒋᑦ..

ᑕᒪᓇ ᐅᕙᑎᓐᓄᑦ ᑲᔪᓯᑎᐊᕐᓂᐅᔪᖅ!

Report to the Hunters of the Bluenose West Caribou – Feb 2019

The Northern Contaminants Program monitors contaminants in Arctic Caribou in Canada. Each year, we monitor the Porcupine (western Arctic) and the Qamanirjuaq (eastern Arctic) caribou. Each year, we also monitor an additional two herds depending on availability and concern.

We use this information to

- Provide information to Northerners so that they may be better able to make informed choices about food consumption and
- Help guide policies that limit contamination of the environment.

ACTIVITIES IN 2017/18

- The following samples from the Bluenose West Caribou Herd were contributed to our program by GNWT
  - 13 cows collected in spring 2005
  - 1 cow and 9 bulls collected in spring 2014
- Kidneys were analyzed for a range of metals, including mercury, cadmium, copper, arsenic, selenium and lead.
- Livers were analyzed for new contaminants that are found in stain guards and fire retardants.

WHAT DID WE LEARN?

- Contaminant levels in the Bluenose West Caribou Herd are similar to those in other Arctic herds.
- Because age and gender can affect the level of contaminants in a caribou, we were unable to compare our results to those from previous studies on the Bluenose West Caribou.

We are continuing to monitor contaminants in the Arctic caribou to keep track of the levels of contaminants in their organs, and to try to better understand how and why they accumulate in caribou the way they do.

THIS PROJECT IS SUPPORTED BY THE NORTHERN CONTAMINANTS PROGRAM

For more information please contact Mary Gamberg, Gamberg Consulting
Phone: 867-334-3360 mary.gamberg@gmail.com

WHAT DO WE KNOW FROM STUDYING OTHER CARIBOU HERDS?

- Arctic caribou are largely free from contamination and are healthy to eat.
- Some caribou have mercury and cadmium in their organs. Some of the cadmium and mercury occurs naturally in the land, but some is brought here by wind from industry down south. Some mercury may also come from forest fires or volcanoes.
- Mushrooms may provide a pulse of mercury in the fall, because some mushrooms can accumulate large amounts of mercury and are a preferred food when they are available.
- Mercury is generally higher in the spring than the fall, because the caribou eat lichens through the winter which are higher in mercury than their summer foods of grasses and flowering plants.
- In the fall, mercury concentrations are higher in cows than in bulls, because cows are smaller and eat proportionally more food, therefore more mercury.
- In the spring, mercury may be lower in cows than in bulls, because some of the mercury is lost to the fetus and through milk production.
- Cadmium and mercury in caribou organs fluctuate over time but over the long term are remaining stable in the Porcupine and Qamanirjuaq caribou, so they are likely stable in other Arctic caribou.
- Mercury in the Arctic caribou may be affected by rain, snow, wind, temperature, migration patterns, time of green-up and forage quality as well as mercury emissions coming from industry, forest fires and volcanoes.
- PBDEs (polybrominated diphenyl ethers) are environmental abundant chemicals used in flame retardants. Levels in caribou are very low and have not changed significantly in the Porcupine and Qamanirjuaq caribou from 2015 through 2017.
- Per- and polyfluorinated alkyl substances (PFASs) are man-made chemicals that are used in things like water repellants, stain guards and fire-fighting foams. Levels in caribou liver are low and some (eg. PFSAs) are declining over time in the Porcupine and Qamanirjuaq caribou, likely due to legislation banning their use.
- **Caribou muscle (meat), marrow and brain have very low levels of contaminants.**

HOW OUR RESEARCH IS HELPING THE WORLD

Our monitoring program provided evidence for national and international agreements to limit the amount of mercury being deposited into the environment. The Minimata Convention on Mercury came into force on August 16, 2017 and will help ensure that Arctic caribou are not exposed to increasing levels of mercury.

This is a BIG SUCCESS for us!

Report to the Hunters of the Dolphin & Union Caribou – Feb 2019

The Northern Contaminants Program monitors contaminants in Arctic Caribou in Canada. Each year, we monitor the Porcupine (western Arctic) and the Qamanirjuaq (eastern Arctic) caribou. Each year, we also monitor an additional two herds depending on availability and concern.

We use this information to

- Provide information to Northerners so that they may be better able to make informed choices about food consumption and
- Help guide policies that limit contamination of the environment.

The Dolphin & Union Caribou Herd was sampled for this program in 2006 and again in 2015. There were some problems in the lab getting the last set of samples tested, so it has taken a long time to get results! We compared all of those data to earlier GNWT data from 1993 to see if any of the contaminants are changing over time.

RECENT ACTIVITIES

- Hunters in Kugluktuk and Cambridge Bay collected samples from 14 bulls in the fall of 2015.
- The samples were sent to Whitehorse where they were processed before being sent to a lab in the south to be tested.
- Kidneys were tested for a range of metals, including mercury, cadmium, copper, arsenic, selenium and lead.
- Livers were tested for new contaminants that are found in stain guards and fire retardants.

WHAT DID WE LEARN?

- Contaminant levels in the Dolphin & Union Caribou Herd are similar to those in other Arctic herds.
- Arsenic and lead are decreasing over time in the Dolphin & Union caribou, like they are in the Porcupine herd. This is likely due to reductions in emissions since the shift to unleaded gasoline and away from pesticides containing arsenic.
- Mercury is not changing over time and cows have higher levels in their kidneys than bulls. This has also been seen in the Porcupine caribou and is likely because cows are smaller and eat proportionally more food, therefore more mercury.
- Cadmium is not changing over time in the Dolphin & Union caribou, likely because cadmium use by industry (the main source of contamination) remains relatively consistent.

We are continuing to monitor contaminants in the Arctic caribou to keep track of the levels of contaminants in their organs, and to try to better understand how and why they build up in caribou the way they do.

WHAT DO WE KNOW FROM STUDYING OTHER ARCTIC CARIBOU HERDS?

- Arctic caribou are largely free from contamination and are healthy to eat.
- Some caribou have mercury and cadmium in their organs. Some cadmium and mercury occurs naturally and can come from forest fires or volcanoes, but some is brought here by wind from industry down south.
- Mushrooms may provide a pulse of mercury in the fall, because some mushrooms can build up large amounts of mercury and are a preferred food when available.
- Mercury is generally higher in the spring than the fall, because the caribou eat lichens through the winter which are higher in mercury than their summer foods of grasses and flowering plants.
- In the spring, mercury may be lower in cows than in bulls, because some of the mercury is lost to the fetus and through milk production.
- Mercury in the Arctic caribou may be affected by rain, snow, wind, temperature, migration patterns, time of green-up and forage quality as well as mercury emissions coming from industry, forest fires and volcanoes.
- PBDEs (polybrominated diphenyl ethers) are environmental abundant chemicals used in flame retardants. Levels in caribou are very low and have not changed significantly in the Porcupine and Qamanirjuaq caribou from 2015 through 2017.
- Per- and polyfluorinated alkyl substances (PFASs) are man-made chemicals that are used in things like water repellants, stain guards and fire-fighting foams. Levels in caribou liver are low and some (eg. PFSAs) are declining over time in the Porcupine and Qamanirjuaq caribou, likely due to legislation banning their use.
- **Caribou muscle (meat), marrow and brain have very low levels of contaminants.**

HOW OUR RESEARCH IS HELPING THE WORLD

Our monitoring program provided evidence for national and international agreements to limit the amount of mercury being deposited into the environment. The Minimata Convention on Mercury came into force on August 16, 2017 and will help ensure that Arctic caribou are not exposed to increasing levels of mercury.

This is a BIG SUCCESS for us!

Continued monitoring will make sure that laws controlling pollution are effective enough to protect Arctic wildlife.

THIS PROJECT IS SUPPORTED BY THE NORTHERN CONTAMINANTS PROGRAM

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ᐅᓂᑲᖅᓯᒪᔪᖅ ᒪᖃᐃᑎᖕᒋᓐᓄᑦ ᑐᕓᓐ ᐊᒪ ᔪᓂᐊᓐ ᑐᒃᑐᖁᑎᖕᒋᑕ – ᕕᑉᐳᐊᕆ 2019

ᐅᑭᐅᖅᑕᖅᑐᒧᒥ ᐃᓚᖁᑎᖃᕆᐊᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᖑᔪᖅ ᖃᐅᔨᓴᖅᐸᒃᐳᖅ ᐃᓚᖁᑕᖅᐸᓕᐊᓂᖕᒋᓐᓂᒃ ᐅᑭᐅᖅᑕᖅᑐᒥ ᑐᒃᑐᓂᒃ ᑲᓇᑕᒥ. ᐅᑭᐅᑕᒪᑦ, ᖃᐅᔨᓴᖅᐸᒃᐳᒧᑦ ᐳᐊᑭᐸᐃᓐ (ᐊᐅᓕᓂᕐᒥ) ᐊᒻᒪ ᖃᒪᓂᕐᔪᐊᕐᒥ (ᐅᑭᐅᖅᑕᖅᑐᑉ ᑲᓇᖕᓇᖕᒐᓂ) ᑐᒃᑐᖁᑎᖕᒋᓐᓂᒃ. ᐊᕋᒍᑕᒪᑦ ᒪᕈᐃᓂᒃ ᖃᐅᔨᓴᖅᐸᑭᕗᒧᑦ ᑐᒃᑐᓂᒃ ᐱᑕᕐᑲᕋᖕᒐᑕ ᐃᓱᒪᓗᑕᐅᔭᕋᖕᒐᑕᓗ.

ᑕᐹᑯᐊ ᖃᐅᔨᓴᕐᓂᑯᑦ ᐊᑐᓚᐅᖅᐸᕗᑦ

- ᖃᐅᔨᒪᔪᑕᐅᑉᓗᑎᒃ ᐅᑭᐅᖅᑕᖅᑐᒥᐅᓄᑦ ᐃᓱᒪᓕᐅᕈᖕᓇᑎᐊᕐᑯᑉᓗᒋᑦ ᓂᕿᒃᓴᒥᖕᓂᒃ ᐊᒻᒪ
- ᒪᓕᒐᓕᐅᕈᖕᓇᑎᐊᕐᓗᑎᒃ ᐃᓚᖁᑎᖃᕐᓗᐊᖅᑕᐃᓕᓂᕐᒧᑦ ᐊᕙᑎᑉᑎᖕᓄᑦ.

ᑐᕓᓐ ᐊᒪ ᔪᓂᐊᓐ ᑐᒃᑐᖁᑎᖕᒋ ᖃᐅᔨᓴᑦᐅᓚᐅᕐᒪᑕ ᓯᕗᓪᓕᕐᒥᒃ 2006 ᐊᒻᒪ ᓱᓕ 2015. ᖃᐅᔨᓴᕈᑎᑦ ᑎᑭᓐᓇᓴᓗᓗᐊᕐᓂᖕᒋᓐᓄᑦ ᐅᑕᕐᑭᖃᑦᑕᓚᐅᖅᐳᒧᑦ ᖃᐅᔫᓐᓂᑯᓂᒃ! ᖃᐅᔨᓴᓚᐅᖅᐸᕗᑦ ᓯᕗᓂᖕᒐᓂ ᓄᓇᕙᐊᑉ ᓴᕗᒻᒥᒃᑦ ᖃᐅᔨᓴᕐᓂᑯᖕᒋᓐᓂᑦ 1993-ᒥᑦ ᐊᔾᔨᒌᖕᐸᓕᐊᖕᒪᖕᒐᑕ ᐅᑭᐅᓐᓂ ᖃᖕᒋᖅᑐᓂ.

- ᐊᕝᕙᓇᓯᒃᑎᑦ ᖁᕐᓗᖅᑐᒥ ᐃᖃᓗᒃᑐᑎᐊᒥᓗ ᑲᑎᖅᓱᐊᖅᑐᖅᑐᖅᐳᑦ ᖃᐅᔨᓴᑲᒃᓴᓂᒃ 14 ᐸᖕᓂᕐᓂᒃ ᐅᑭᐊᖕᒐᓂ 2015.
- ᑕᐹᑯᐊ ᐊᐅᓚᖅᑎᑕᐅᓚᐅᖅᐳᑦ ᕚᐃᑉHᐅᐊᔅᒧᑦ ᓴᕙᑕᐅᑉᓗᑎᒃ ᖃᐅᔨᓴᕐᕕᖕᒧᑦ ᐊᐅᓚᖅᑎᑕᐅᓕᕐᓗᑎᒃ.
- ᑕᖅᑐᖕᒋᑦ ᖃᐅᔨᓴᑦᐅᓚᐅᖅᐳᑦ ᓴᕕᒃᓴᓄᑦ, ᒧᑯᓇᓄᑦ, ᑲᒃᓂᐊᒻᒧᑦ, ᑲᐊᐸᓄᑦ, ᐊᓯᐅᓂᒃᓄᑦ ᓯᓕᓂᐊᓄᓪᓗ.
- ᑎᖕᒌᐃᑦ ᖃᐅᔨᓴᑦᐅᓚᐅᖅᐳᑦ ᓄᑕᓂᒃ ᓄᑕᓐᓂᒃ ᐃᓚᖁᑎᖃᕐᓂᖕᒋᓐᓂᒃ ᓴᓗᒻᒪᖅᓴᐅᑎᓂᒃ ᐃᑯᐊᓚᒃᑕᐃᓕᔪᑎᓂᓪᓗ

ᓱᓇᓂᒃ ᖃᐅᔮᓚᐅᖅᐱᑕ?

- ᐃᓚᖁᑎᑦ ᓇᒻᒪᖕᒋᑐᑦ ᑐᕓᓐ ᐊᒪ ᔪᓂᐊᓐ ᑐᒃᑐᖁᑎᖕᒋᓐᓂ ᐊᔾᔫᖕᒪᑕ ᐅᑭᐅᖅᑕᖅᑐᒥ ᑐᒃᑐᒋᔭᐅᔪᓄᑦ.
- ᐊᓯᓂᒃ ᓴᕕᒃᓴᐃᓪᓗ ᓄᖕᒍᐸᓕᐊᕗᑦ ᑐᕓᓐ ᐊᒪ ᔪᓂᐊᓐ ᑐᒃᑐᖁᑎᖕᒋᓐᓂ ᐳᐊᑭᐸᐃᓐ ᑐᒃᑐᖁᑎᖕᒋᑎᑐᑦ. ᓄᖕᒍᓕᐊᑐᐃᓐᓇᕐᓂᐊᖅᐳᑦ ᐃᓚᖁᑎᖃᓗᐊᖕᒋᑐᓂᒃ ᐅᖅᓱᓂᒃ ᐊᒻᒪ ᓴᓗᒻᒪᖅᓴᐅᑎᓂᒃ ᐃᓚᖁᑎᖃᖕᒋᑐᓂᒃ ᐊᓯᓂᖃᓗᐊᖅᑐᓂᒃ ᐊᑐᖅᐸᓕᐊᓕᕐᒪᑕ.
- ᒧᑯᓇᖃᕐᓂᖕᒋ ᐊᔾᔨᒌᖕᐸᓕᐊᓗᐊᖕᒋᑐᖅ ᓄᕋᓕᑦ ᐱᖃᕐᓂᖅᓴᐅᓂᖕᒋᓐᓄᑦ ᐸᖕᓂᕐᓂᑦ. ᑕᒪᓇ ᖃᐅᔨᔭᐅᓯᒪᕗᖅ ᐳᐊᑭᐸᐃᓐ ᑐᒃᑐᖕᒋᓐᓂ ᓄᕋᓕᑦ ᒥᑭᓂᖅᓴᐅᖕᒪᑕ ᓂᕆᒍᓂᖅᓴᐅᒪᖅᑯᑎᒃᑯ, ᒧᑯᓇᑕᕋᓕᓂᖅᓴᐅᖕᒪᑕ.
- ᑲᑦᓂᐊᒻ ᐊᔾᔨᒌᖕᐸᓕᐊᖕᒋᑐᖅ ᑐᕓᓐ ᐊᒪ ᔪᓂᐊᓐ ᑐᒃᑐᖁᑎᖕᒋᓐᓂ ᑲᑦᓂᐊᒻ ᐊᑐᓚᐅᕐᓯᒪᑦ ᐱᓕᕆᑉᕕᒃᔪᐊᕐᓂ (ᓴᓗᒪᐃᓕᑎᑦᓯᓗᐊᖅᑐᓂ) ᐊᑐᓚᐅᓂᖕᒪᓗ ᑲᔪᓯᓐᓇᖅᓱᓐᓂ.

ᓱᓇᓂᒃ ᑐᑭᓯᓯᒪᓕᖅᐱᑕ ᖃᐅᔨᓴᕐᓂᑯᑦ ᐊᓯᖏᓐᓂᒃ ᐅᑭᐅᖅᑕᖅᑐᒥ ᑐᒃᑐᓂᒃ?

- ᐅᑭᐅᖅᑕᖅᑐᑉ ᑐᒃᑐᖏ ᓱᕈᕐᓇᖅᑐᖅᑲᖏᑐᑦ ᓂᕆᔭᐅᔾᖕᓇᖅᑐᓪᓗ.
- ᐃᓚᖏᑦ ᑐᒃᑐᑦ ᒧᑯᕆᖅᖄᑦ ᑲᑦᓂᐊᒻᖃᖅᑰᑎᒡᓗ ᐃᓗᖏᓐᓂ. ᑲᑦᓂᐊᒻ ᐊᒻᒪ ᒧᑯᕆ ᓇᐸᖅᑐᓂᑦ ᓄᓇᐸᓗ ᓴᔪᒃᐱᓚᖕᓂᖖᒐᓂ ᐱᓱᖅᑐᑦ, ᑭᓯᐊᓂ ᐊᓄᕆᒧᑦ ᓱᐱᔭᐅᓱᖅᐳᑦ ᐱᓕᕆᕝᕙᔾᔪᐊᕐᓂᑦ ᖃᐸᓗᓇᑦ ᓄᓇᖕᒐᓂᑦ.
- ᑐᒃᑐᓄᑦ ᓂᕿᒋᓂᕋᖅᑕᐅᔾᑦ ᒧᑯᕆᖅᖄᑐᓗᐊᕐᒪᑕ ᐅᑭᐊᒥ ᑐᒃᑐᑦ ᓂᕆᓱᐊᒍᓂᖅᓴᐅᖕᒪᑎᒋᒃ ᐱᑕᕐᑲᕋᖕᒐᑕ.
- ᒧᑯᕆ ᐅᐱᕋᒃᓴᒥ ᐱᑕᕐᑲᕐᔾᔪᐊᕐᓂᖅᓴᐅᓱᖅᑐᖅ ᑐᒃᑐᑦ ᐅᑭᐅᒥ ᐱᕈᖅᑐᓂᒃ ᓂᕆᓱᕐᒪᑕ ᒧᑯᕆᖃᕐᓂᖅᓴᐅᐸᓗᑎᒃ ᐊᐅᔭᒥ ᐱᕈᖅᓯᐊᓂᒃ ᓄᓇᒥᐅᑕᓂᒡᓗ.
- ᐅᐱᕋᒃᓴᒥ ᓄᕋᓕᑦ ᑐᒃᑐᑦ ᒧᑯᕆᖃᓗᐊᖏᓂᖅᓴᐅᓱᖅᑐᑦ ᐸᖕᓂᕐᓂᑦ ᒧᑯᕆ ᓄᖑᐸᓕᐊᓂᖅᓴᐅᓱᕐᒪᑦ ᐃᒡᓕᐊᖏᓐᓂ ᐃᒻᒧᓕᐅᕐᓂᖏᓐᓂᓗ.
- ᒧᑯᕆ ᐅᑭᐅᖅᑕᖅᑐᒥ ᐊᒃᑐᐃᔫᓗᐊᖅᐳᖅ ᓂᐸᓗᖕᓂᕐᒥᒃ, ᐊᐳᒥᒃ, ᐊᓄᕆᒃᑯᑦ, ᐅᓇᓗᐊᕐᓂᑯᑦ, ᑐᒃᑐᑦ ᐱᓱᖕᓂᒋᑎᒧᑦ, ᖃᐸᓗᓇᑦ ᓄᓇᖕᒐᓂ ᐱᓕᕆᕝᕙᔾᔪᐊᕐᓂᑦ, ᓇᐸᖅᑐᑦ ᐃᑯᐊᓪᓚᖕᓂᖏᑎᒧᑦ ᐊᒪ ᓴᔪᒃᐱᓚᖕᓂᖖᒎᑦ ᓄᓇᑉ.
- PBDEs (polybrominated diphenyl ethers) ᓄᓇᒥᓱᐅᖅᐸᒃᑐᑦ ᐃᓚᕐᑯᑕᐅᕚᒃᑐᑦ ᖃᐸᑎᕈᑎᓂ. ᑐᒃᑐᓂ ᐊᖏᓗᐊᖏᑐᑦ ᐳᐊᑭᐸᐃᓐ ᐊᒪ ᖃᒪᓂᕐᔪᐊᐸᑕ ᑐᒃᑐᕐᑯᑎᖏᓐᓂ ᑕᐃᑲᖓᑦ 2015 ᑎᑭᓗᒍ 2017.
- Per- ᐊᒻᒪ polyfluorinated alkyl substances (PFASs) ᓴᓇᔭᐅᕚᒃᑐᑦ ᐃᓄᖕᓄᑦ ᑭᓂᑎᕈᑎᑎᒍᑦ, ᕿᐸᓕᖅᓴᐅᑎᑎᒍᑦ, ᖃᐸᑎᕈᑎᑎᒍᓪᓗ. ᑐᒃᑐᑦ ᑎᖑᐃᓪᓂ ᐊᖏᓗᐊᖏᑐᖅ ᐃᓚᖏᓐᓂᓗ (ᒪᑯᐊᑐᑦ PFSAs) ᑐᖏᑕᐃᕈᑎᕙᓪᓚᐊᔪᑦ ᖃᒪᓂᕐᔪᐸᐸ ᑐᒃᑐᖏᓐᓂ, ᒪᓕᒐᖅᑕᖃᓕᕐᒪᑦ ᐊᑐᕐᑯᔭᐅᖏᓗᑎᒃ.
- **ᑐᒃᑐᑦ ᓄᑭᖏᑦ (ᓂᕿᖏᓐᓂ), ᐸᑎᖏᓐᓂ ᖃᓇᑕᖏᓂᓗ ᓱᕈᕐᓇᖅᑐᖃᓗᐊᖏᑐᕐ.**

ᖃᓄᖅ ᖃᐅᔨᓴᕐᓂᖅᐳᑦ ᐃᑲᔪᕐᒪᖔᑦ ᓯᓚᕐᔪᐊᕐᒥᒃ

ᖃᐅᔨᓴᕈᑎᕚᑦ ᑐᑭᓰᓇᖅᑕᔪᖅ ᑲᓇᑕᒥ ᓯᓚᕐᔪᐊᕐᒥᓗ ᐊᖏᕈᑎᓂᒃ ᒧᑯᕆᐊᕐᑲᓗᐊᖅᑕᐃᓕᓂᕐᒧᑦ ᐊᕙᑎᑉᑎᖕᓄᑦ. ᒥᓂᒪᑕ ᐊᖏᕈᑎᖓ ᓯᓚᕐᔪᐊᕐᒥ ᒧᑯᕆᖃᕐᓂᕐᒧᑦ ᐊᑐᕆᐊᓚᐅᖅᓯᒪᔫᖅ ᐊᐅᒍᓯ 16, 2017 ᐃᑲᔪᕈᑕᐅᓂᐊᖅᓱᓐᓂ ᑐᒃᑐᑦ ᒧᑯᕆᖃᕐᓂᕐᒧᑦ ᐱᔭᐅᑕᐃᓕᕐᑯᑉᓗᒋᑦ.

ᑕᒻᓇ ᐊᔪᖏᓐᓂᖃᑦᑎᐊᖅᑐᖅ ᐅᕙᑎᖕᓄᖅ!

ᑲᔪᓯᔪᒻᒥᒃ ᖃᐅᔨᓴᕐᓂᖅ ᒪᓕᒐᐃᑦ ᒥᐊᓂᖅᓯᓂᖏᓐᓂᒃ ᓱᕈᕐᓇᖅᑐᑦ ᑎᑭᑕᐅᑕᐃᓕᓂᖏᓐᓂᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᓂᕐᔪᑎᓄᑦ.

ᑕᒻᓇ ᐱᓕᕆᐊᖅ ᐃᑲᔪᕐᕈᐅᓯᒪᔪᖅ ᐅᑭᐅᖅᑕᖅᑐᒥ ᓱᕈᖅᑕᐅᑕᐃᓕᓂᐅᑉ ᐱᓕᕆᐊᖏᓐᓄᑦ
ᑐᑭᓯᑲᓂᕈᐊᕐᓂᕈᕕᑦ ᑐᓴᖅᑎᒥᐊᕐᓗᒍ ᒥᐊᕆ ᒐᒻᐳᐊᒃ, ᒐᒻᐳᐊᒃ ᖃᐅᔨᒪᔨᖓ
ᐅᖃᓗᑎᖓ: 867-334-3360 ᖃᕆᑕᐅᔭᒃᑯᑦ ᑐᕌᕈᑎᖓ: mary.gamberg@gmail.com

Report to the Hunters of the Porcupine Caribou – February 2019

With the help of local hunters, we have been taking samples of the Porcupine caribou since 1991. We collect these samples to study changes in the level of contaminants kidneys and livers of caribou. Since 2015, these samples are also being tested every year for 'new' contaminants (like stain repellents and flame retardants). One of the things we look for are contaminants carried to the Arctic by wind.

Photo credit: Peter Mather

ACTIVITIES IN 2018/19

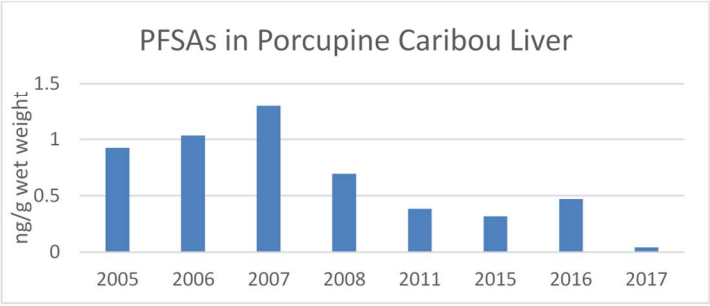
- No samples were collected in the fall of 2018 since the caribou did not come through Old Crow.
- We received and analyzed results from the 2017 collection.

WHERE IS THIS STUDY BEING DONE?

Samples for this study are collected from Old Crow, Yukon.

WHAT WE HAVE LEARNED NEW THIS YEAR

- Toxic elements (mercury, cadmium, arsenic, lead) are very low in marrow from Porcupine caribou (much lower than levels in kidneys).
- PBDEs (polybrominated diphenyl ethers) are environmental abundant chemicals used in flame retardants. Levels in the Porcupine caribou are very low and have not changed significantly from 2015 through 2017.
- Per- and polyfluorinated alkyl substances (PFASs) are man-made chemicals that are used in things like water repellants, stain guards and fire-fighting foams. Levels in caribou liver are low and some groups are declining over time in caribou, likely due to legislation banning their use.



WHAT WE HAVE LEARNED FROM THIS WHOLE PROJECT

- Porcupine caribou are largely free from contamination and are healthy to eat.
- Some caribou have mercury and cadmium in their organs. Some of the cadmium and mercury occurs naturally in the land, but some is brought here by wind from industry down south.
- Cadmium and mercury in caribou organs fluctuate over time but over the long term are remaining stable.
- The Porcupine caribou do not show high levels of radioactivity due to the nuclear accident at Fukushima, Japan in 2011.
- In the fall, mercury concentrations are higher in cows than in bulls, because cows are smaller and eat proportionally more food, therefore more mercury.
- In the spring, mercury may be lower in cows than in bulls, because some of the mercury is lost to the fetus and through milk production.
- Mercury is generally higher in the spring than the fall, because the caribou eat lichens through the winter which are higher in mercury than their summer foods of grasses and flowering plants.
- Mushrooms may provide a pulse of mercury in the fall, because some mushrooms can accumulate large amounts of mercury and are a preferred food when they are available.
- Mercury in the Porcupine caribou may be affected by rain, snow, wind, temperature, migration patterns, time of green-up and forage quality as well as mercury emissions coming from industry, forest fires and volcanoes.

We are continuing to monitor contaminants in the Porcupine Caribou to keep track of the levels of contaminants in their organs, and to try to better understand how and why they accumulate in caribou the way they do.

Photo credit: Peter Mather

HOW OUR RESEARCH IS HELPING THE WORLD

More than two decades of contaminant data from the Porcupine caribou were part of the evidence that led the United Nations Environmental Program to create the Minimata Convention on Mercury. This is a global agreement that will limit mercury emissions to the environment and ultimately reduce the mercury in Arctic caribou. 92 countries (including Canada and the United States) have ratified the Convention that came into force on August 16, 2017.

THIS PROJECT IS SUPPORTED BY THE NORTHERN CONTAMINANTS PROGRAM

For more information please contact Mary Gamberg Phone: 867-334-3360
mary.gamberg@gmail.com

Report to the Hunters of the Qamanirjuaq Caribou – Feb 2019

With the help of local hunters, we have been taking kidney, liver and muscle samples of Qamanirjuaq caribou since 2006. We collect these samples to study changes in the levels of contaminants in kidneys and livers of caribou. These contaminants may be carried to the Arctic by wind. Since 2015, these samples are also being tested every year for 'new' contaminants (like stain repellents and flame retardants).

We use this information to:

- Provide information to Northerners so that they may be better able to make informed choices about food consumption and
- Help guide policies that limit contamination of the environment.

WHERE IS THIS STUDY BEING DONE?

Samples for this study are collected from Arviat. Although we could sample the herd anywhere within its range, we can be most effective by working with hunters from one community so that the hunters become very familiar with the samples we need.

ACTIVITIES IN 2018/19

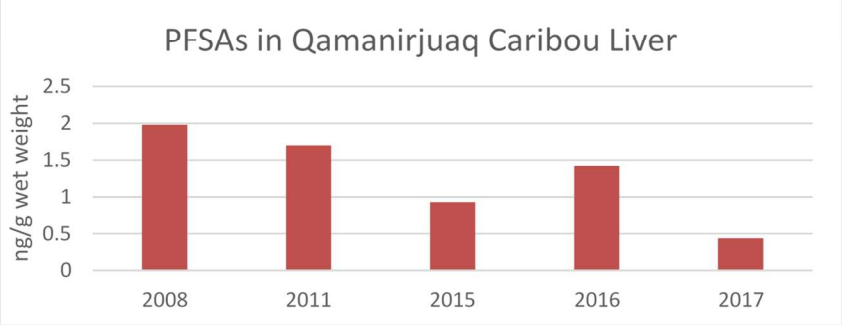
- Samples from 16 caribou (8 bulls; 8 cows) were collected from Arviat in the fall of 2018.
  - Kidneys were tested for a range of contaminants including mercury, cadmium, copper, arsenic, selenium and lead as they are every year.
  - Livers are being tested for new contaminants.
  - We choose kidneys and livers for analysis because that is where the contaminants tend to build up.
- We received and analyzed results from the 2017 collection.

WHAT WE HAVE LEARNED FROM THIS WHOLE PROJECT

- Some caribou have mercury and cadmium in their organs. Some of the cadmium and mercury occurs naturally in the land, but some is brought here by wind from industry down south. Some mercury may also come from forest fires or volcanoes.
- Caribou muscle (meat), marrow and brain have very low levels of contaminants.
- Mushrooms may provide a pulse of mercury in the fall, because mushrooms build up large amounts of mercury and are a preferred food when they are available.
- Seaweed does not provide a significant amount of mercury to the Qamanirjuaq caribou.

WHAT WE HAVE LEARNED NEW THIS YEAR

- Overall, mercury, selenium and zinc are increasing in the Qamanirjuaq caribou, although increases are slight and may be better described by a cyclic pattern, similar to that seen in the Porcupine caribou.
- PBDEs (polybrominated diphenyl ethers) are environmental abundant chemicals used in flame retardants. Levels in the Porcupine caribou are very low and have not changed significantly from 2015 through 2017.
- Per- and polyfluorinated alkyl substances (PFASs) are man-made chemicals that are used in things like water repellants, stain guards and fire-fighting foams. Levels in caribou liver are low and some (eg. PFSAs) are declining over time in Qamanirjuaq caribou, likely due to legislation banning their use.



We are continuing to monitor contaminants in the Qamanirjuaq Caribou to keep track of the levels of contaminants in their organs, and to try to better understand how and why they build up in caribou the way they do.

HOW OUR RESEARCH IS HELPING THE WORLD

Our monitoring program provided evidence for national and international agreements to limit the amount of mercury being deposited into the environment. The Minimata Convention on Mercury came into force on August 16, 2017 and will help ensure that Arctic caribou are not exposed to increasing levels of mercury.

This is a BIG SUCCESS for us!

Continued monitoring will make sure that laws controlling pollution are effective enough to protect Arctic wildlife.

THIS PROJECT IS SUPPORTED BY THE NORTHERN CONTAMINANTS PROGRAM

For more information please contact Mary Gamberg, Gamberg Consulting
Phone: 867-334-3360 mary.gamberg@gmail.com

ᐅᓂᑉᑳᖅᓯᒪᔪᖅ ᒪᕐᑲᐃᑎᖏᓐᓄᑦ ᖃᒪᓂᕐᔪᐊᑉ ᑐᒃᑐᕐᑯᑎᖏᑕ – ᕙᑉᐳᐊᕆ 2019

ᐃᑲᔪᒐᐅᑉᐳᑎᒃ ᓄᓇᓕᖕᒥ ᒪᕐᑲᐃᑎᓄᑦ, ᐱᖅᓯᑕᓚᐅᖅᐳᒍᑦ ᑕᖅᑐᖏᓐᓂᒃ, ᑎᙳᐃᓂᒃ, ᓄᑭᖏᓐᓂᒡᓗ ᖃᒪᓂᕐᔪᐊᑉ ᑯᒃᑯᕐᑯᑎᖏᓐᓂᑦ ᑕᐃᒪᖓᒎᑦ 2006. ᑕᑯᐊ ᑲᑎᖅᓱᓚᐅᕋᑉᑎᒍ ᖃᐅᔨᓴᕐᓗᑕ ᓱᐳᕐᓇᖅᑐᕐᑲᕐᒪᖓᑕ ᑕᖅᑐᖏᑦ ᑎᙳᐃᓗ ᑐᒃᑐᑦ. ᑕᑯᐊ ᓱᐳᕐᓇᖅᑐᑦ ᓇᒃᓴᒐᐅᔪᓪᓗᐊᕐᒪᑕ ᐅᑭᐅᖅᑕᖅᑐᒨᑦ ᐊᓄᓃᑦ. ᑕᐃᒪᖓᒎᑦ 2015, ᑕᑯᐊ ᖃᐅᔨᓴᕐᓂᑯᑦ ᐊᕋᒍᑕᒪᑦ ᖃᐅᔨᓴᒐᐅᑕᖅᐳᑦ "ᓄᑕᓐᓂᒃ" ᓱᐳᕐᓇᖅᑐᓂᒃ (ᐅᑯᐊᑐᑦ ᕿᑉᐱᖅᓴᐅᑎᑦ ᐃᑯᐊᓚᒋᒃᑯᑎᓪᓗ).

ᐅᑯᓄᖓ ᐊᑐᒐᐅᓱᖅᐳᑦ ᖃᐅᔨᓴᕐᓂᑯᑦ:
- ᑐᑭᓯᑲᓂᕈᑕᐅᑉᐳᑎᒃ ᐅᑭᐅᖅᑕᖅᑐᒥᐅᓄᑦ ᖃᐅᔨᒪᑲᓂᕐᑯᑉᐳᒋᑦ ᓂᕿᑲᓇᐊᕐᑲᕐᓂᕐᒥᒃ ᐊᒻᒪ
- ᒪᓕᒐᓕᐅᕈᖕᓇᑎᐊᕐᓂᕐᒥᒃ ᓱᐳᕐᓇᖅᑐᓄᑦ ᐊᕙᑎᒨᑦ.

ᓇᓂᓯᐅᕐᓂᐊᖅᐸ ᑕᒻᓇ ᖃᐅᔨᓴᕐᓂᖅ?

ᖃᐅᔨᓴᕐᓂᑯᑦ ᑲᑎᖅᓱᒐᐅᓚᐅᖅᐳᑦ ᐊᕐᕕᐊᓐᓂᑦ. ᓇᑭᒥᐊᖅ ᖃᐅᔨᓴᐳᖕᓇᕋᓗᐊᕐᓗᑕ, ᐱᐅᓂᖅᓴᐅᕗᖅ ᐱᓕᕆᖃᑎᖃᕐᓂᕐᒥᒃ ᒪᕐᑲᐃᑎᓂᒃ ᖃᐅᔨᒪᓕᐳᖕᓇᕐᒪᑕ ᓱᓇᓂᒃ ᐱᓯᐊᕐᒪᖔᑉᑕ.

ᐱᓕᕆᐊᖑᓂᐊᖅᑐᖅ ᐃᓗᐊᓂ 2018/19

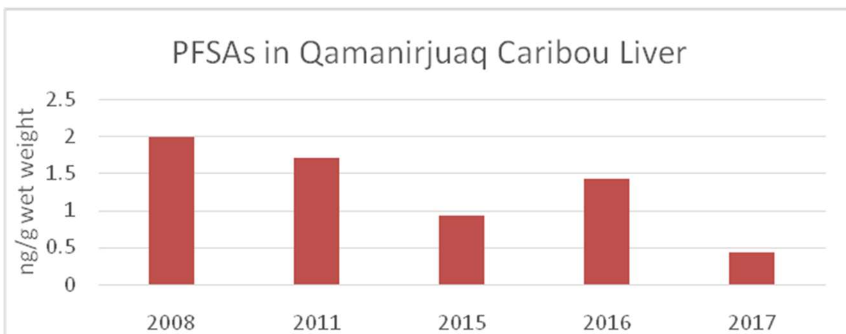
- ᖃᐅᔨᓴᒐᐅᓚᖅᐳᑦ 16 ᑐᒃᑐᑦ (8 ᐸᖕᓂᑦ; 8 ᓄᕋᓕᑦ) ᐊᕐᕙᐊᓂᑦ ᑲᑎᖅᓱᒐᐅᑉᐳᑎᒃ ᐅᑭᐊᖑᑎᓪᓗᒍ 2018.
  - ᑕᖅᑐᖏᑦ ᖃᐅᔨᓴᒐᐅᓚᐅᖅᐳᑦ ᐱᑕᕐᑲᕐᒪᖓᑕ ᓱᐳᕐᓇᖅᑐᓂᒃ ᒧᑯᓇᓂᒃ, ᑲᑦᓂᐊᒻᓂᒃ, ᑲᐊᐸᓂᒃ, ᐊᔅᓯᓂᒃᓂᒃ ᓴᕙᒡᓂᒡᓗ ᐊᕋᒍᑕᒪᑦ.
  - ᑐᙳᐃ ᖃᐅᔨᓴᒐᐅᑉᐳᑎᒃ ᓄᑕᓐᓂᒃ ᓱᐳᕐᓇᖅᑐᕐᑲᕐᒪᖔᑕ.
  - ᑕᖅᑐᖏᑦ ᑎᙳᐃᓪᓗ ᖃᐅᔨᓴᒐᐅᓱᖅᐳᑦ ᓱᐳᕐᓇᖅᑐᑦ ᐱᒋᐊᔪᖕᒪᑕ ᑕᐃᑯᓇᖓᑦ.
- ᖃᐅᔨᓴᕐᓂᑯᓂᒃ ᐱᓚᐅᖅᐳᒍᑦ ᑕᐃᑲᖓᑦ 2017 ᑲᑎᖅᓱᕐᓂᑯᓂᑦ.

ᐱᓕᕆᐊᕐᒥᑦ ᓱᓇᓂᒃ ᐃᓕᑦᑎᓯᓯᒪᓕᕐᒪᖔᑉᑕ

- ᑐᒃᑐᑦ ᐃᓚᖏᑦ ᒧᑯᓇᕐᑲᔪᖕᒪᑕ ᑲᑦᓂᐊᒻᕐᑲᖅᕗᑎᒡᓗ ᐃᓗᖏᓐᓂ. ᑲᑦᓂᐊᒻ ᐃᓚᖏ ᒧᑯᓇᓪᓗ ᓄᓇᒥᓯᐅᖅᐸᒃᐳᕐ, ᑭᓯᐊᓐᓂ ᐊᓄᓃᑦ ᑎᑭᑉᐸᒃᕗᑎᒃ ᐱᓕᕆᕙᕐᔪᐊᕐᓂᑦ ᖃᑉᑐᓇᑦ ᓄᓇᖓᓐᓂ. ᐃᓚᖏᑦ ᒧᑯᓇ ᓇᐸᖅᑐᓂᑦ ᐱᕙᒃᐳᑦ ᓄᓇᑉᑐᕙᓭᒃᐱᓚᖕᓂᖓᓐᓂᑦ.
- ᑐᒃᑐᑦ ᓄᑭᖏᑦ (ᓂᕿᖏᓐᓂ) ᐸᑎᖏᓐᓂ ᖃᓇᑕᖏᓐᓂᓗ ᓱᐳᕐᓇᖅᑐᖅᑕᕐᑲᓗᐊᖏᑐᖅ.
- ᑐᒃᑐᑦ ᓂᕿᖏᑦ ᒧᑯᓇᐊᕐᑲᖅᓯᓇᓇᐊᓕᑦ ᐅᑭᐅᒥ, ᐱᐳᖅᑎᕴᐊᓚᔫᒃᔫᒃᒪᑕ ᒧᑯᓇᓐᓂᒃ ᓂᓇᓯᐊᒍᒪᑎᒋᒡᓗ ᑐᒃᑐᑦ ᐱᑕᕐᑲᕋᖖᒑᑕ.
- ᕿᑦᕐᑯᐊᑦ ᒧᑯᓇᕐᑲᕐᓂᖏᓐᓂᒃ ᑐᒃᑐᓄᑦ ᖃᒪᓂᕐᔪᐊᕐᒥ ᖃᐅᔨᓐᓇᓗᐊᖏᑐᑦ.

ᓱᓇᓐᓂᒃ ᐃᓕᑎᓯᒪᓕᕐᒪᙱᑉᑕ ᐅᑭᐅᒻᒥ ᓄᑕᒻᒥ

- ᑕᑯᓗᒃᑕᖅᑐᒍ, ᒨᑯᕆ, ᓯᓚᓐᓂᐊᒻ ᐊᒻᒪ ᔨᓐᒃ ᐊᒡᓕᕚᓪᓕᐊᑐᐃᓐᓇᖅᐳᑦ ᖃᒪᓂᕐᔪᐊᑉ ᑐᒃᑐᖁᑎᖏᓐᓂ, ᐱᕈᖅᐸᓕᐊᓂᖏᑦ ᐊᖏᓗᐊᖏᑲᓗᐊᖅᑐᑎᒃ ᖃᐅᔨᒪᓐᓇᖅᑐᓂᓗ ᐊᔾᔨᒻᒥᒃ ᐱᕙᓪᓕᐊᓂᖅᑲᖅᑐᔭᕐᒪᑕ, ᑎᐊᓐᓇᑐᑦ ᐳᐊᑭᐸᐃᓐ ᑐᒃᑐᖁᑎᖏᓐᓂ.
- PBDEs (polybrominated diphenyl ethers) ᓄᓇᒥᓯᐅᕈᐊᒍᔪᑦ ᐃᓚᕐᑯᑎᑦ ᐃᑭᑦᑕᐃᓕᔪᑎᓂᓯᐅᖅᑐᑎᒃ. ᐳᐊᑭᐸᐃᓐᓇ ᑐᒃᑐᖁᑎᖏᓐᓂ ᐊᖏᓗᐊᖏᑐᑦ ᑭᓯᐊᓂ ᐊᔾᔪᓗᐊᖅᓯᒪᖏᖅᑐᑎᒃ ᑕᐃᒪᖓᑦ 2015 ᑎᑭᓗᒍ 2017.
- Per- ᐊᒻᒪ polyfluorinated alkyl substances (PFASs) ᓴᓇᕙᐅᕙᒃᑐᑦ ᐃᓄᖕᓄᑦ ᑭᓂᑎᕈᑎᑎᒍᑦ, ᖄᐸᓕᖅᓴᐅᑎᑎᒍᑦ, ᖃᐸᑎᕈᑎᑎᒍᓪᓗ. ᑐᒃᑐᑦ ᑎᖑᐃᓪᓂ ᐊᖏᓗᐊᖏᑐᖅ ᐃᓚᖏᓐᓂᓗ (ᒪᑯᐊᑐᑦ PFSAs) ᑐᑦᓯᑕᐃᕈᑎᕙᓪᓕᐊᔪᑦ ᖃᒪᓂᕐᔪᐸᑉ ᑐᒃᑐᖏᓐᓂ, ᒪᓕᒐᖅᑕᖅᑲᓕᕐᒪᑦ ᐊᑐᕐᑯᔭᐅᖏᓗᑎᒃ.



ᖃᐅᔨᓴᖅᐳᒍᑦ ᓱᓕ ᓱᕈᕐᓇᖅᑐᓂᒃ ᖃᒪᓂᕐᔪᐊᑉ ᑐᒃᑐᖁᑎᖏᑕ ᐃᓗᖏᓐᓂ ᑐᑭᓯᑲᓂᕈᒪᐸᓗᑕ ᖃᓄᖅ ᑐᒃᑐᓂ ᐱᕈᖅᐸᓕᐊᓱᕐᒪᖔᑕ ᓱᓇᒧᓪᓗ ᐱᕈᖅᐸᓕᐊᓱᕐᒪᖔᑕ.

ᖃᓄᖅ ᖃᐅᔨᓴᕐᓂᖅᐳᑦ ᐃᑲᔪᕐᒪᖔᑦ ᓯᓚᕐᔪᐊᕐᒥᒃ

ᖃᐅᔨᓴᕈᑎᖕᑦ ᑐᑭᓯᓐᓇᖅᑕᔪᙵᖅ ᑲᓇᑕᒥ ᓯᓚᕐᔪᐊᕐᒥᓗ ᐊᖏᕈᑎᓂᒃ ᒨᑯᕆᐊᖃᓗᐊᖅᑕᐃᓕᓂᕐᒧᑦ ᐊᕙᑎᑉᑎᖕᓄᑦ. ᒥᓂᒪᑕ ᐊᖏᕈᑎᖓ ᓯᓚᕐᔪᐊᕐᒥ ᒨᑯᕆᖅᑲᕐᓂᕐᒧᑦ ᐊᑐᕆᐊᓚᐅᖅᓯᒪᙳᖅ ᐊᐅᒍᓯ 16, 2017 ᐃᑲᔪᕈᑕᐅᓂᐊᖅᑐᓐᓂ ᑐᒃᑐᑦ ᒨᑯᕆᖃᕐᓂᕐᒧᑦ ᐱᔭᐅᑕᐃᓕᕐᑯᐸᓗᑦ.

ᑕᒪᓇ ᐊᔪᖏᓂᖃᖏᐊᖅᑐᖅ ᐅᕙᑎᖕᓄᑦ!

ᑲᔪᓯᔪᒻᒥᒃ ᖃᐅᔨᓴᕐᓂᖅ ᒪᓕᒐᐃᑦ ᒥᐊᓂᖅᓯᓂᖏᓐᓂᒃ ᓴᓗᒪᐃᓐᓂᐅᐸ ᑎᑭᑕᐅᑕᐃᓕᓂᖏᓐᓂᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᓂᕐᔪᑎᓄᑦ.

ᑕᒪᓇ ᐱᓕᕆᐊᖅ ᐃᑲᔪᑕᐅᓯᒪᔪᖅ ᐅᑭᐅᖅᑕᖅᑐᒥ ᓴᓗᒪᐃᓕᑕᐃᓕᓂᐅᐸ ᐱᓕᕆᐊᖏᓐᓄᑦ
ᑐᑭᓯᑲᓂᕈᐊᕐᓂᕈᕕᑦ ᑐᓴᖅᑎᒥᐊᕐᓗᒍ ᒥᐊᕆ ᒐᒻᐳᐊᒃ, ᒐᒻᐳᐊᒃ ᖃᐅᔨᒪᔨᖑ
ᐅᖃᓗᑎᖓ: 867-334-3360 ᖃᕆᑕᐅᔭᑯᑦ ᑐᕋᕈᑎᖓ: mary.gamberg@gmail.com