Project Title: Mercury in Seaweed, Lichens and Mushrooms from the Home Range of the Qamanirjuaq Caribou

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Abstract

Qamanirjuaq caribou have higher mercury concentrations than many other Arctic caribou herds. Usually, caribou get most of their mercury from lichens, but local elders described the Qamanirjuaq caribou eating seaweed from the seashore. Since seaweed is known to accumulate some metals, it was hypothesized that the caribou may be getting additional mercury from this source. Interviews with elders and hunters in four Kivalliq communities indicated that Qamanirjuaq caribou forage for lichens on the tundra and hilltops in the winter and for lichens and other vegetation (including seaweed) on lakes, rivers and the seashore in the summer. Mercury concentrations were significantly and consistently lower in seaweed than in mushrooms and lichens in four Kivalliq communities, suggesting that seaweed is not a major source of mercury for the Qamaniruaq caribou. Results of this project were presented to the five Kivalliq communities in the fall of 2017.

Key Messages

- Qamanirjuaq caribou forage for lichens on the tundra and hilltops in the winter and for lichens and other vegetation (including seaweed) on lakes, rivers and the seashore in the summer.
- Seaweed in the Kivalliq region is very low in mercury.
- Seaweed is not a major source of mercury to the Qamanrjuaq caribou.

Objectives

- To determine if seaweed is a major contributor of mercury to the Qamanirjuaq caribou
- To gather traditional knowledge about caribou foraging habits in the Kivalliq region
- To measure mercury concentrations in caribou forage from the Kivalliq region: lichen, seaweed and mushrooms
- To build capacity in the north in sample collection, mercury analysis and communications

Introduction

This is a project that was suggested and recommended by the Northern Contaminants Program Management Committee in 2015. The Qamanirjuaq caribou have higher mercury concentrations than many other Arctic caribou herds. Usually, caribou get most of their mercury from lichens, but at community meetings in Nunavut in the fall of 2014, elders described the Qamanirjuaq caribou eating seaweed from the seashore. Since seaweed is known to accumulate some metals (Chan *et al.* 1995), these caribou may be getting additional mercury from seaweed. This project was designed to explore the traditional knowledge held by hunters/elders from the Kivalliq region regarding caribou consuming seaweed, and then to use that knowledge in designing the collection protocols for seaweed in the five communities in the region. Samples were collected from four communities to determine variability in mercury concentrations among

communities. In Arviat, seaweed is currently being used as compost for growing vegetables. Measuring Hg in the seaweed will also provide information for this activity, adding value for this project to the community.

Lichens were also collected, to determine how much mercury is coming from that dietary source. Although mushrooms were not initially included in the sampling protocol, they were added because they can be an important source of mercury for caribou at certain times of the year. These extra samples could be accommodated since no samples were collected from Whale Cove (due to poor weather during the collection period) and no seaweed samples were collected from Baker Lake (since they do not exist there).

An important aspect of this project is the building of capacity in the North. Interviews with hunters and elders, sample collections and communications activities were conducted by three recent students of the Environmental Technology Program (ETP) at Arctic College in Iqaluit. In addition, with help from the Dept. of Education, they identified an individual interested in the sciences in each community who assisted in the sample collections. These activities will increase capacity in these young researchers and hence the capacity of their communities (Baker Lake and Arviat, NU).

Activities in 2017-18

Interviews were transcribed from Inuktitut to English (B Suluk, Arviat) and comments were coded by M Gamberg and L Qaqqaq. Results were analyzed for frequency of occurrence.

Vegetation samples were analyzed for total mercury, and a subset for methylmercury. Results were analyzed comparing vegetation type, community and distance from the ocean (lichens and mushrooms only).

Results of the project were presented in person to the five Kivalliq communities in the fall of 2017 by M Gamberg and L Qaqqaq.

Capacity Building

This project has a very strong aspect of training and building capacity in Nunavut. Two students from the ETP program in Iqaluit (E Kreuger and K Lindell) were the project researchers, giving them invaluable experience in conducting interviews, and doing research (collecting samples). Vegetation samples were collected in each of four communities with the assistance of a Nunavut beneficiary, recognized as an enthusiastic student who was experienced on the land and had an interest in science. This student was trained in vegetation and data collection as well as GPS use. L Qaqqaq assisted in those collections in Baker Lake and then participated in the communication of results of the study in the five communities in the Kivalliq region as well as at the NCP Results Workshop in Yellowknife in September 2017.

Communications

L Qaqqaq and M Gamberg presented results of this project to HTOs in Baker Lake, Chesterfield Inlet, Rankin Inlet, Whale Cove and Arviat in September 2017. Results were also presented in poster format and a presentation by L Qaqqaq at the NCP Results Conference in Yellowknife in September 2017. A manuscript for publication is currently being prepared by L Qaqqaq and M Gamberg.

Indigenous Knowledge Integrations

This project hinges on the exploration of traditional knowledge about caribou foraging behavior, in particular with regard to the consumption of seaweed. Interviews with hunters/elders from each of the

communities within the home range of the Qamanirjuaq caribou herd informed the collection protocols for this project.

Results

Interviews

Most interviewees agreed that caribou eat mosses/lichens and seaweed. Mushrooms and shrubs/branches were mentioned by two and berries and bones/antlers by one elder. Seaweed was thought to be more commonly consumed in summer and mosses/lichens more in winter. There was less clarity on whether bulls and cows had a similar diet; one elder described bulls eating less during the rut and digging up plants from the clay at that time. Caribou were observed more in winter on tundra, lakes and hilltops and more in summer on lakes, rivers and the seashore. They were also observed in marshy areas.

Total mercury concentrations did not differ between lichen species (*Flavocetraria cuculatta* and *Cladonia mitis*), between seaweed species (*Laminaria digitate* and *Fucus distichus*) or between mushroom genera (*Boletus* and *Agaricus*). They also did not differ significantly among communities (Arviat, Rankin Inlet, Chesterfield Inlet and Baker Lake). Highest and most variable concentrations were found in mushrooms, and levels in seaweed were significantly lower than those in mushrooms and lichens (Figure 1). Methylmercury averaged 3% of total mercury (ranged from 1-7%); this proportion did not differ among lichen, mushrooms and seaweed.



Figure 1. Total mercury concentrations in vegetation from the Kivalliq region, NU.

In Arviat and Rankin Inlet, lichens and mushrooms were collected at four locations, starting at the seashore and then moving progressively inland. Mercury concentrations showed a general downward trend with distance from the shore in both mushrooms and lichens in Rankin Inlet. However, the relationship was not statistically significant for lichens and a statistical test was impossible for mushrooms since there were only three samples. Neither lichens or mushrooms showed any trend with distance from the shore in Arviat. (Figure 2).



Figure 2. Total mercury concentrations in mushrooms and lichens from Arviat and Rankin Inlet relative to distance from shore.

Discussion and Conclusions

Interviews with elders and hunters indicated that caribou eat mosses/lichens in the winter from the tundra and hilltops where they are more likely be to exposed. In the summer they eat other vegetation, including seaweed, in addition to the mosses/lichens and are more likely to be found by lakes, rivers or the seashore. Some suggestions were made that caribou eat seaweed to get salt, and one elder described multiple caribou on Coats Island dying as a result of eating too much seaweed. It could be that the seaweed itself was the cause of death (perhaps by altering the balance of electrolytes), and it is also possible that those caribou had no other forage available and starved since seaweed did not provide adequate nutrition for survival.

Total mercury concentrations in lichens and mushrooms did not decrease with distance from the seashore as was demonstrated by St. Pierre et al. (2015). It should be noted that in this study, only four locations with a maximum distance of 1.7 km from the ocean may not have been sufficient to show a possible trend.

Mercury concentrations were significantly and consistently lower in seaweed than in mushrooms and lichens. This suggests that even if similar quantities of these plant groups were consumed, seaweed would not be a major source of mercury for caribou. Indigenous knowledge indicates that seaweed is consumed incidentally by caribou in the Kivalliq region, and mushrooms are available seasonally and are dependent on wet weather. Therefore, we can conclude that seaweed is not a significant source of mercury for the Qamanirjuaq caribou and that lichens remain the most likely primary source of mercury for these caribou.

Expected Project Completion Date This project has been completed.

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