Ice and mineral licks used by caribou in winter

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Abstract: In winter, barren-ground caribou obtain minerals from ice and soil licks. Between December and April we have seen caribou cratering on the surface of frozen lakes and licking the ice. Ice samples from eight licks on four lakes contained concentrations of calcium, magnesium, sodium, potassium, phosphorus, chloride and sulphate many times higher than in the surrounding unlicked ice or than would be expected in lake water. Soil licks being used in March and June had high concentrations of calcium, magnesium, sodium phosphorus and potassium. In winter caribou may be seeking supplements of all of the major mineral elements (calcium, magnesium, sodium and potassium) at ice and soil licks because lichens, their staple winter diet, are low in minerals and may also reduce the absorption of some minerals.

Key words: barren-ground caribou, Northwest Territories

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Introduction

The use of mineral licks by wild ungulates is generally confined to summer (Cowan and Brink 1949, Skoog 1968, Calef and Lortie 1975, Jones and Hanson 1985). In winter (December-April) we have observed barren-ground caribou *(Rangifer tarandus groenlandicus)* cratering on frozen lakes and licking the ice. This paper describes the chemical composition of lake ice and soil that caribou used as mineral licks in winter.

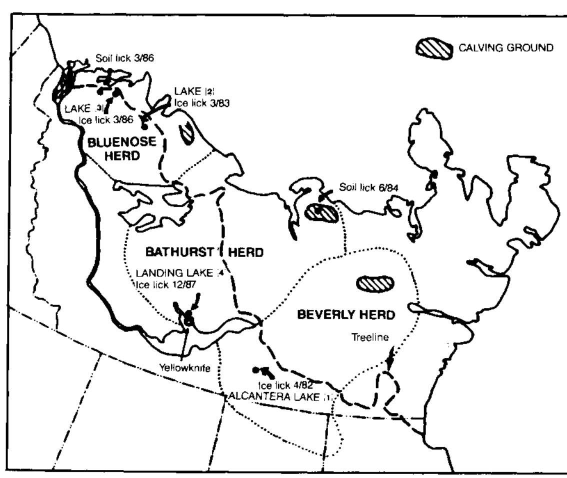

Figure 1. The location of ice and soil mineral licks sampled on barren ground caribou winter range.

Table 1. Mineral concentrations in ice licks, unlicked ice, caribou urine and representative water samples.

Sample type	Ice licks							Unlicked ice[1]		Caribou urine	Representative water[2]		
Sample number	1[3]	2	3	4	5	6	7+8[4]	9	10		W1	W2[5]	W3[6]
Lake number	1	2	2	3	4	4	4	4	4	4			
Measurement													
Sampling date	4/82	3/83	3/83	3/86	12/87						7/82	5	6
pH		7.7	8.4	8.0	9.6	9.7	9.8	6.6	6.3	5.0		7.5	6.6
Conductivity#		990	1 400	622	600	2 000	2 000	4.5	27	2 100		51	35
Turbidity@		1.4	0.5									2.3	
Colour		15	20									5	
Suspended solids		< 5	< 5		24	104	64	6.8	8.0	87		1.7	3
Disolved solids*		610	860	370	610	2 500	2 400	44	25	11 000		23.5	
Calcium*	62	34	34	17	20	28	33	4.5	2.7	180	3.8	4.6	4.4
Magnesium*	15	40	62	26	46	200	200	1.6	0.8	29	0.9	1.7	1.1
Hardness*	220	251	340		240	880	890	18	9.9	570	13	18.6	14.5
Alkalinity*		110	120		148	438	462	13	7.1	3.2		15.1	11.7
Sodium*	18	96	158	84	33	144	145	1.5	1.3	4.6	1.5	1.7	1.2
Potassium*	12	5.6	8.8	3.6	18	81	75	0.9	1.0	79	0.7	0.9	0.7
Chloride*		170	260	60	49	207	200	1.5	1.3	48	1.3	1.6	1.2
Sulphate*		110	170	170	92	400	350	4.2	2.9	105	3.0	3.1	3.0
Ammonia Nitrogen*		.08	.20		0.17	0.28	0.22	0.19	0.11	197		0	
Nitrate + Nitrite*		<.04	<.04									0.03	
Total Kjeldahl N*		1.4	1.7										
Phosphorus O-P*		<.05	<.05		0.063	0.25	0.19	.005	0.011	0.75		0.006	
Phosphorus Tot*		<.05	<.05		0.079	0.70	0.62	0.022	0.029	2.7		0.004	

μmho/cm   @ Jackson turbidity units   * mg/L

[1] Samples 9 and 10 were taken approximately 100 m from samples 5 and 6 respectively
[2] W1 is Porter Lake (60° 02'N × 109° 13'W); W2 is Yellowknife River (62° 30'N × 114° 18'W); W3 is Thoa River (60° 31'N × 109° 47'W)
[3] Sample volume too small to analyze for nitrogen and phosphorus.
[4] Samples 7 and 8 were combined to provide sufficient volume for analysis.
[5] Arithmetic mean of 6 samples taken between January and October 1987.
[6] Arithmetic mean of 7 samples taken between February 1986 and November 1987.

Methods

We collected ice samples from the bottom of eight craters on four different lakes where we saw caribou licking the ice (Figure 1). For comparison, samples were collected from below undisturbed snow about 100 m from two ice licks. Ice samples were melted and analyzed by the Water Resources Laboratory, Department of Indian Affairs and Northern Development, Yellowknife.

We collected two lumps of caribou urine frozen in the snow from Landing Lake near sample six to determine if caribou urine was a component of the ice licks. The urine samples were

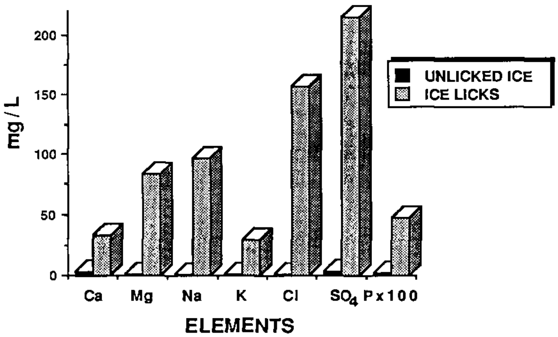

Figure 2. A comparision of the mineral composition of unlicked ice with ice at ice licks.

combined to obtain sufficient volume for analysis.

We collected soil samples from three locations (Figure 1). Four soil samples were taken from one of the five known mineral licks on the Bathurst herd's calving ground. For comparison, a single soil sample was collected at our camp 25 km to the east. We collected one soil sample near the Kugalik River on the Bluenose caribou herd's winter range where caribou were seen licking the exposed ground. Soil analysis was carried out by the Manitoba Provincial Soil Testing Laboratory in Winnipeg.

Results and discussion

Caribou demonstrated strong attraction to the lick sites by permitting us to approach within 30-100 m before moving away, by returning to the lick immediately after we left and by aggressively displacing other caribou from the lick craters.

Ice that was being licked at the bottom of craters was either clear or was tinged with yellow, orange or brown in contrast to lake ice which is normally clear. The discoloured ice on Landing Lake (samples 5-8) formed a relatively soft 1 to 5 cm thick layer on the surface of clear ice.

Ice from licks contained concentrations of calcium, sodium, phosphorus, chloride and sulphate many times higher than in the surrounding unlicked ice or than would be expected in lake water (Table 1, Figure 2).

We do not know how those elements became incorporated into the ice surface but the low concentrations of ammonia nitrogen in the lick indicated that it was not contaminated by caribou urine (Table 1 and Fraser et al. 1980). Water had not flowed onto the ice from streams or from the adjacent land. There were no streams nearby and the discoloured ice did not extend from the lick to shore. Possibly gaseous upwelling from anaerobic decomposition of vegetation on the lake bottom had brought organic material to the water-ice interface. This may later have risen to the ice surface as overflow (water that seeped to the surface through cracks in the ice). Because ice licks were about 100m from shore and the nearest emergent vegetation, we deduced that the water was probably too deep to freeze all the way to the bottom, so that decomposition could proceed throughout the winter. We have no data with which to judge the plausibility of this suggestion.

The soil lick being used in March 1986 had higher concentrations of calcium, magnesium, sodium, phosphorus and potassium than licks used in the summer (Table 2). Minerals from the calving ground lick were probably sought for the same reasons as in March because caribou were still on their winter diet during calving. Although soil at the calving ground lick had lower mineral concentrations than at the Kugalik River, concentrations were generally 2 to 3 meters higher than in the unlicked soil sample (Table 2).

Ice licks are apparently also used by caribou in other areas. Edwards and Ritcey (1960) in British Columbia and Skoog (1968) in Alaska assumed caribou were eating snow from the ice-covered surface of lakes but the behaviour they describe was similar to our observations at ice licks.

In winter caribou may be seeking supplements of all of the major mineral elements (calcium, magnesium, sodium and potassium) at ice and soil licks because lichens, their staple

Table 2. Mineral composition of the soil lick being used in March 1986 near the Kugalik River and on the Bathurst herd's calving ground compared to unlicked soil and to summer caribou licks.

Measurement	Kugalik River lick	Bathurst Herd calving ground lick[1]	Bathurst Herd calving ground control	Summer licks
Sampling date	3/86	19/6/84	19/6/84	
Calcium (me/100 g)	61	4.9	2.5	20.4*
Magnesium (me/100 g)	35	3.8	1.4	7.2*
Sodium (me/100 g)	90	0.7	0.3	1.3*
Potassium (me 100 g)	1.8	0.89	0.27	0.38*
Phosphorus (ppm)	43.6	24.8	4.0	1.0#
Nitrate (ppm)	19.2	7.4	6.0	226#
Copper (ppm)	0.5	4.3	1.7	
Iron (ppm)	21	464	385	
Manganese (ppm)	7.0	3.3	1.0	
Zinc (ppm)	0.86	0.67	0.24	
Sulphate (ppm)		20	2.4	880#

[1] Geometric mean of 4 samples from one lick
* Geometric mean of 1090 samples from 5 licks (Jones and Hanson 1985)
# Data from Calef and Lortie (1975); sample number 5 at one lick.

winter diet (Thomas and Hervieux 1986) are low in minerals and may also lower the absorption of some minerals (Staaland et al. 1986).

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