INCIDENCE OF BESNOITIA IN CARIBOU OF THE CAPE BATHURST SUBPOPULATION OF THE BLUENOSE HERD

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ABSTRACT

Skin samples were collected from harvested caribou during winters 1994-95 and 1995-96. Samples were collected from caribou that were using the winter range of what has recently been delineated as the Cape Bathurst subpopulation of the Bluenose caribou herd (Nagy *et al.*, 1999). Samples were tested for the presence or absence of *Besnoitia* using a histological skin examination, therefore I report minimum prevalence. The fewest cysts evident in a positive assessment was 2. Prevalence was 78% from animals harvested in the Eskimo Lakes area in 1994-95 (n=40) and 75% prevalence in 1995-96 from animals harvested in the Old Man Lake area (n=8). Overall prevalence from the combined samples was 77%.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

From 8-10 February, 1995 a community caribou hunt was conducted in the Eskimo Lakes area south of Tuktoyaktuk. The Department of Resources, Wildlife and Economic Development (DRWED) attempted to collect as many biological samples from the harvested caribou as possible in order to assess disease, health and condition of the caribou (Larter and Nagy, 1996). From 11-13 March, 1996 students from the Renewable Resources Technology Program, Aurora College, Inuvik participated in a winter camp and harvested 8 caribou in the Old Man Lake area southeast of Tuktoyaktuk. Students attempted to collect as many biological samples from harvested caribou as possible and provided DRWED with additional biological samples from these harvested animals.

The issue of disease prevalence has been one aspect of the Bluenose Management Plan that required addressing. Prevalence of brucellosis in Bluenose caribou was reported by Larter and Nagy (1996). The levels of radionuclides and heavy metals in Bluenose caribou have also been reported (Macdonald, 1996; Larter and Nagy, in press). *Besnoitia* is a common disease found in barren ground caribou, however the prevalence of this disease in caribou from the Bluenose herd has not been documented nor has the species (B. Elkin, pers. comm.). This report documents the prevalence of *Besnoitia* in a sample of 48 caribou harvested in the wintering area of the Cape Bathurst subpopulation of the Bluenose herd (Nagy *et al.*, 1999). We discuss the prevalence in relation to sex, age, and data on condition indices of the harvested caribou.

METHODS

Hunting parties departed on snowmobiles from Tuktoyaktuk to the Eskimo Lakes area in search of caribou from 8-10 February. When groups were spotted, hunters stalked and shot as many caribou as the conditions permitted. Caribou carcasses were moved to a central location to be butchered. Skin samples were collected from the lower foreleg of 40 of the 53 animals harvested. The location of caribou groups that were harvested was marked on 1:250,000 National Topographic Service maps (Fig. 1). A more detailed account of the biological samples that were collected and the analyses that were completed is provided in Larter and Nagy (1996).

From 11-13 March 1996 eight caribou were harvested. The sex and an estimate of age was recorded for each animal. An array of biological samples were also collected including the kidney fat index (KFI) following Riney (1955) and the ratio of fat weight to kidney weight (A. Fehr, pers. comm.). The location of the groups from which animals were harvested was recorded on 1:250,000 National Topographic Service maps (Fig. 1).

Skin samples were kept frozen and forwarded to the Western College of Veterinary Medicine (which is now called Prairie Diagnostic Services) where they were histologically examined for the presence of *Besnoitia*. Briefly, portions of the skin and underlying tissue were fixed in 10% neutral buffered formalin. Four sections, 5 μm thick, were cut from each skin sample and stained with hematoxylin and eosin (H&E) (Wobeser, 1976; Ayroud *et al.*, 1995). Sections were examined under a microscope and the presence of *Besnoitia* cysts was recorded.

We used the Mann Whitney-U test to determine if Riney fat, the ratio of kidney fat:kidney, or age was different for those caribou testing positive for *Besnoitia* from those caribou testing negative for *Besnoitia*. Because the majority of collected animals were females we did not bother to test for differences in the prevalence of *Besnoitia* between sex.

RESULTS

The overall prevalence of *Besnoitia* in caribou lumped across years was 77% (37 of 48 individuals) (Appendix 1). Prevalence was similar between the two years even though sample size was quite different, 78% (31 of 40) in 1995 and 75 % (6 of 8) in 1996. The fewest number of cysts found per individual was 2.

The Riney fat levels and the ratio of kidney fat weight:kidney weights were similar for animals testing positive and negative for *Besnoitia*; $P > 0.7$ and $P > 0.8$ respectively. The median age of animals testing negative for *Besnoitia* tended to be older than for those testing positive (medians 8.0 versus 4.5), but this difference was not significant ($P = 0.066$).

DISCUSSION

Besnoitia tarandi was first reported in Alaskan caribou and reindeer in the 1920's (Hadwen, 1922). Besnoitiosis was reported in barren-ground caribou in the Mackenzie River Delta in 1963 and Gibson Lake, in the Keewatin in 1966 (Choquette *et al.*, 1967). A severe case of besnoitiosis was reported in a woodland caribou found dead in northern Saskatchewan in 1976 (Wobeser, 1976). Gunn *et al.* (1991) found besnoitiosis in 6 of 82 caribou collected over a 4 year period from the Dolphin and Union herd.

Besnoitia tarandi is often referred to as "corn meal disease" because it causes bones and tendons to become roughened (Hadwen, 1922; Dau, 1981). When first reported in Alaskan caribou and reindeer it was believed that older animals were more intensively affected than young animals (Hadwen, 1922). Ayroud *et al.* (1995) found that the two youngest animals, separated at birth from infected mothers, did not have *Besnoitia* cysts. These animals were never exposed to biting flies and these findings are consistent with the observation that biting flies may serve as vectors of *Besnoitia* spp. between ungulate intermediate hosts (Pols, 1960). All animals we sampled had been exposed to biting flies for a minimum of one summer. Conversely, we found a trend toward a lower prevalence of *Besnoitia* in older animals.

The significance of *Besnoitia* in caribou populations remains unknown. It occurs commonly in caribou throughout the Northwest Territories and Nunavut (B. Elkin, pers. comm.), but rarely has prevalence been documented (Gunn *et al.*, 1991). Prevalence of *Besnoitia* from the Cape Bathurst subpopulation of the Bluenose caribou herd was 10 times that reported by Gunn *et al.* (1991) for the Dolpin-Union caribou herd. Because the presence of *Besnoitia* was determined by field examination for the Dolphin-Union caribou (Gunn *et al.*, 1991), not by histological examination as in this study, the number of infected Dolphin-Union caribou reported must be treated as a minimum. Prevalence of animals with *Besnoitia* cysts was likely underestimated; to what extent is unknown.

Clinical disease is limited to focal mild thickening of the skin with some encrustation and hair loss (Ayroud *et al.*, 1995). Severe clinical disease has been described for captive caribou (Glover *et al.*, 1990), however the factors determining whether *Besnoitia* spp. will cause disease especially in free-ranging animals remain unknown (Lewis, 1992). Besnoitiosis in male cattle has been reported to cause sterility (Kumi-Diaka *et al.*, 1981). It is conceivable that infection with *Besnoitia* spp. could cause sterility in male caribou (Ayroud *et al.*, 1995), but there are no data to support this contention.

Choquette *et al.* (1967), reporting for free-ranging caribou, and Ayroud *et al.* (1995), reporting for captive reindeer, found that animals positive for *Besnoitia* were all in excellent nutritional condition. We found that animals being both positive and negative for *Besnoitia* were of similar condition based upon kidney fat indices and the ratio of the weight of kidney fat:kidney weight. None of the animals we collected samples from was described as being in poor condition. Therefore, data supporting a positive cause-effect relationship between poor health and condition and the occurrence of *Besnoitia* are lacking.

RECOMMENDATIONS

1) Field biologists should work with the pathologists at Prairie Diagnostics (previously the Western College of Veterinary Medicine) to devise a method that would provide more quantitative information on the intensity of infection rather than a presence/absence result. This could be either by defining various categories of the intensity of the infection or by reporting the actual number of cysts per unit length of tissue sampled.

2) Whenever possible skin samples, to assess *Besnoitia,* should be collected during future caribou collections and/or community caribou harvests.

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PERSONAL COMMUNICATIONS

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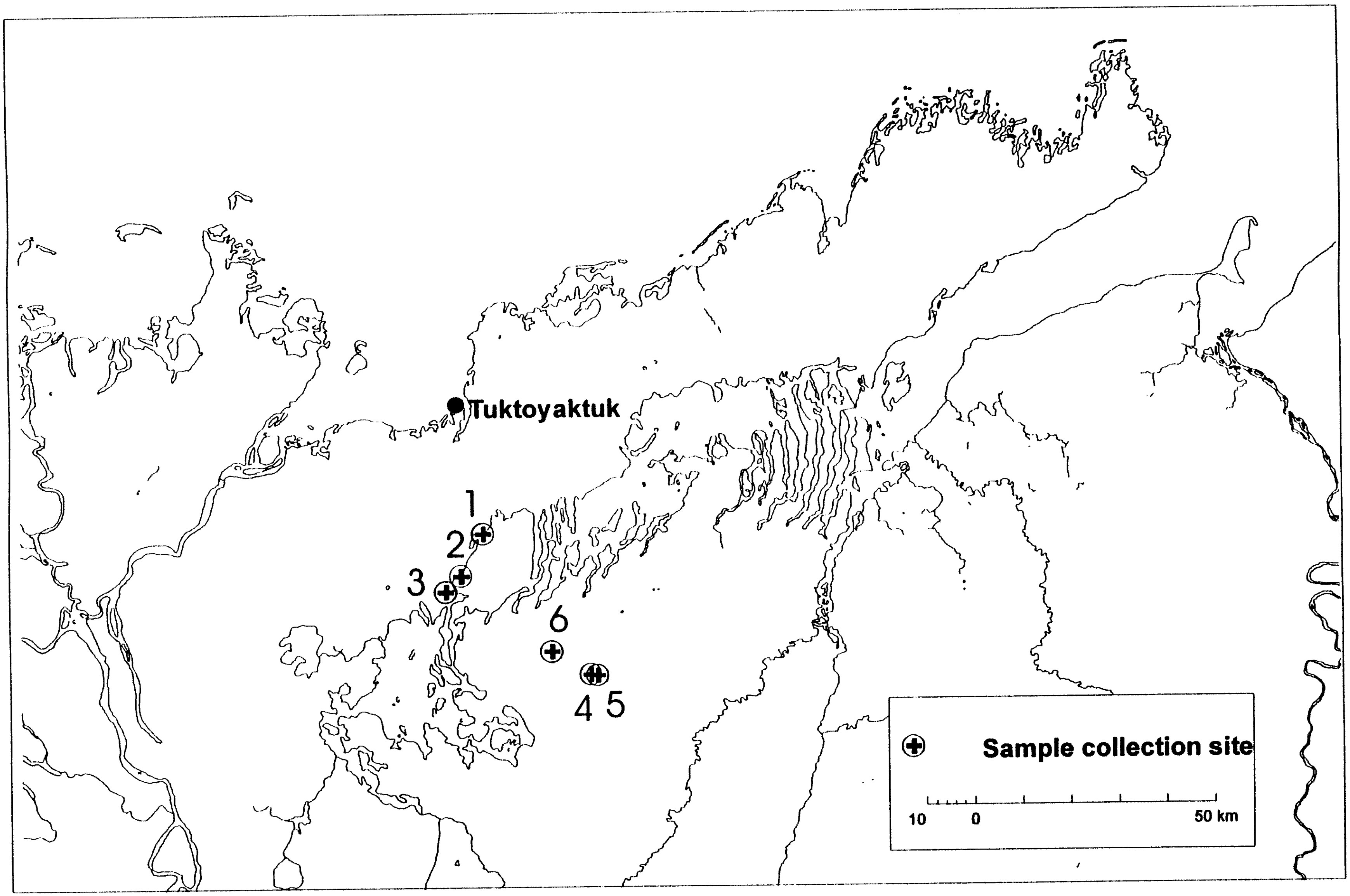
Figure 1. The locations where animals were collected. Locations 1-3 are from 1994-95 and locations 4-6 are from 1995-96.



APPENDIX 1

The presence of *Besnoitia*, sex, age, KFI, fat weight:kidney weight, pregnancy and location of individual caribou.

id#	*Besnoitia*	Sex	Age	KFI	Fat:Kidney	Pregnant	Lat.	Long.
95-1	N	F	3 yr	58.7	0.777	Y	69 13	132 48
95-2	Y	F	9 yr	81.7	0.965	Y	69 13	132 48
95-3	Y	F	2 yr	55.8	0.754	Y	69 13	132 48
95-4	Y	F	3 yr	50.0	0.699	Y	69 13	132 48
95-5	Y	M	3 yr	43.9	0.573	n/a	69 13	132 48
95-6	Y	F	2 yr	60.0	0.701	Y	69 13	132 48
95-7	N	F	6 yr	56.3	0.665	Y	69 13	132 48
95-8	N	F	13 yr	21.2	0.212	Y	69 13	132 48
95-9	Y	F	4 yr	101.4	1.179	Y	69 13	132 48
95-13	Y	F	5 yr	50.6	0.803	Y	69 8	133 53
95-14	Y	M	4 yr	24.8	0.257	n/a	69 8	133 53
95-15	N	F	8 yr	75.5	0.870	N	69 8	133 53
95-16	N	F	9 yr	34.2	0.431	Y	69 8	133 53
95-17	Y	F	4-5 yr	85.1	0.902	Y	69 8	133 53
95-18	Y	M	2-3 yr	30.9	0.327	n/a	69 8	133 53
95-19	Y	F	2 yr	20.6	0.241	Y	69 8	133 53
95-20	Y	F	9-10 yr	39.0	0.390	Y	69 8	133 53
95-23	Y	F	4 yr	54.9	0.823	Y	69 8	133 53
95-24	Y	F	6 yr	99.4	1.118	Y	69 8	133 53
95-26	Y	M	2 yr	48.1	0.492	n/a	69 8	133 53

id	*Besnoitia*	Sex	Age	KFI	Fat:Kidney	Pregnant	Lat.	Long.
95-27	Y	F	1 yr	73.9	0.844	Y	69 8	133 53
95-31	Y	F	n/a	25.7	0.330	Y	69 6	133 57
95-32	Y	F	9 yr	n/a	n/a	Y	69 6	133 57
95-33	Y	M	10 yr	n/a	n/a	n/a	69 6	133 57
95-34	Y	F	3 yr	76.9	0.909	Y	69 6	133 57
95-35	Y	F	6 yr	71.3	0.746	Y	69 6	133 57
95-36	N	F	8-9 yr	38.6	0.576	Y	69 6	133 57
95-37	N	F	6-8 yr	73.3	0.927	Y	69 6	133 57
95-38	Y	F	4 yr	41.3	0.489	Y	69 6	133 57
95-39	Y	F	3 yr	48.5	0.558	Y	69 6	133 57
95-40	Y	F	8-9 yr	34.1	0.522	N	69 6	133 57
95-41	Y	F	11 yr	n/a	n/a	Y	69 6	133 57
95-42	Y	F	7 yr	86.8	0.941	Y	69 6	133 57
95-43	Y	F	5 yr	50.4	0.820	Y	69 6	133 57
95-44	Y	F	7-8 yr	70.2	0.758	Y	69 6	133 57
95-45	Y	F	6-7 yr	65.7	0.723	Y	69 6	133 57
95-46	Y	F	6 yr	54.6	0.694	Y	69 6	133 57
95-47	N	F	8 yr	78.1	1.055	Y	69 6	133 57
95-48	Y	F	4 yr	68.0	0.763	Y	69 6	133 57
95-49	Y	F	11-12 yr	n/a	n/a	Y	69 6	133 57
95-50	N	F	5 yr	53.5	0.636	Y	69 6	133 57
96-1	Y	M	Subadult	34.0	.434	n/a	68 59	132 15
96-2	N	M	Subadult	28.0	.280	n/a	68 59	132 15
96-3	Y	M	n/a	10.2	.141	n/a	68 59	132 15
96-4	Y	F	Calf	18.8	.269	n/a	68 59	132 15

id	*Besnoitia*	Sex	Age	KFI	Fat:Kidney	Pregnant	Lat.	Long.
96-5	Y	M	Adult	55.9	.777	n/a	68 59	132 7
96-6	Y	M	Adult	38.4	.428	n/a	68 59	132 7
96-7	N	F	Calf	14.1	.355	n/a	69 1	132 22
96-8	Y	M	Subadult	21.4	.715	n/a	69 1	132 22