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Prevalence of *Trichinella* spp. in Wildlife of the Dehcho

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ABSTRACT

Trichinella spp. is present in wolves, grizzly, and black bear populations in the Dehcho. Its presence in black bears is a food safety concern. *Trichinella* spp. prevalence in cohabiting wildlife in the Dehcho was unknown prior to this study, and represented a potential source of infection for wolves and bears. As part of a wildlife disease monitoring program, we opportunistically collected tongue samples (n=524 and n=1 masseter muscle) from 19 different species of wildlife resident in the Dehcho during 2001-2015. *Trichinella* spp. was present in samples from wolves (62%), red fox (40%), wolverine (24%), grizzly (50%) and black bears (4%). *Trichinella* spp. was absent in all samples from moose, Dall's sheep, mountain goat, northern mountain and barren-ground caribou, wood bison, lynx, marten, beaver, snowshoe hare, northern red-backed and meadow voles, deer mice, and shrews. Prevalence was lower ($p<0.01$) in black bears than in grizzly bear, wolves, wolverine, and red fox. Prevalence of *Trichinella* spp. in wolves resident in the Mackenzie Mountains (82%) was higher ($p<0.05$) than in wolves from the rest of the Dehcho (52%). The greatest intensity of infection (177.00 larva/g) was found in a black bear. Three black bears, eight grizzly bears, 34 wolves, ten wolverine, and two red fox samples had infection intensities >1 larva/g. *Trichinella* spp. presence in bears, wolves, wolverine, and foxes may be a result of ingesting infected carnivores and omnivores. Presence does not appear to have resulted from ingesting ungulate or small mammal prey.

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INTRODUCTION

Trichinella spp. is a genus of nematode found in a wide variety of mammalian species world-wide. It can cause disease in humans that consume raw or under-cooked meat infected with *Trichinella* spp. larvae. Previous studies have reported the prevalence of *Trichinella* spp. in black bears (*Ursus americanus*), grizzly bears (*Ursus arctos*), and wolves (*Canis lupus*) in the Dehcho region of the Northwest Territories (NWT) (Larter 2015; Larter et al. 2011) at 5%, 73%, and 52%, respectively. Although prevalence in black bears is low, the level of infection reported still indicates that *Trichinella* infections in black bears are a genuine food safety risk to harvesters in the Dehcho (Johnson et al. 2013). Larter (2015) recommended that in addition to continued documenting of the prevalence of *Trichinella* spp. in black bears, documenting the prevalence in other cohabiting wildlife, scavengers in particular, could help inform harvesters and enable measures to reduce the food safety risk.

As part of a wildlife disease monitoring program we opportunistically collected tongue samples from 2001-2015 of: 1) hunter-killed moose (*Alces americanus*), mountain goat (*Oreamnos americanus*), northern mountain caribou (*Rangifer tarandus caribou*), barren-ground caribou (*R. t. groenlandicus*), Dall's sheep (*Ovis dalli*), wolverine (*Gulo gulo*), marten (*Martes americana*), beaver (*Castor canadensis*), wood bison (*Bison bison athabascae*), lynx (*Lynx canadensis*), wolves, grizzly bear, black bear; 2) animals killed for public safety (nuisance animals) black bear, grizzly bear, wolves, red fox (*Vulpes vulpes*): 3) animals found dead or put down after motor vehicle accidents wood bison, grizzly bear, black bear,

wolves, Dall's sheep, red fox; and 4) animals sacrificed for wildlife research snowshoe hare (*Lepus americanus*), northern red-backed vole (*Myodes rutilus*) meadow vole (*Microtus pennsylvanicus*), deer mice (*Peromyscus* spp.), and shrew (*Sorex* spp.). This report documents the prevalence of *Trichinella* spp. found in a wide variety of scavenger and herbivorous wildlife that cohabit the Dehcho region with black bears, grizzly bears, and wolves. This report includes data from black bears, grizzly bears, and wolves that has previously reported in Larter et al. (2011) and Larter (2015).

Study Area

The study area included the entire Dehcho political administrative region of the southwestern NWT and also included Wildlife Management Area S/OT/01 of the Mackenzie Mountains in the Sahtú region (Figure 1).

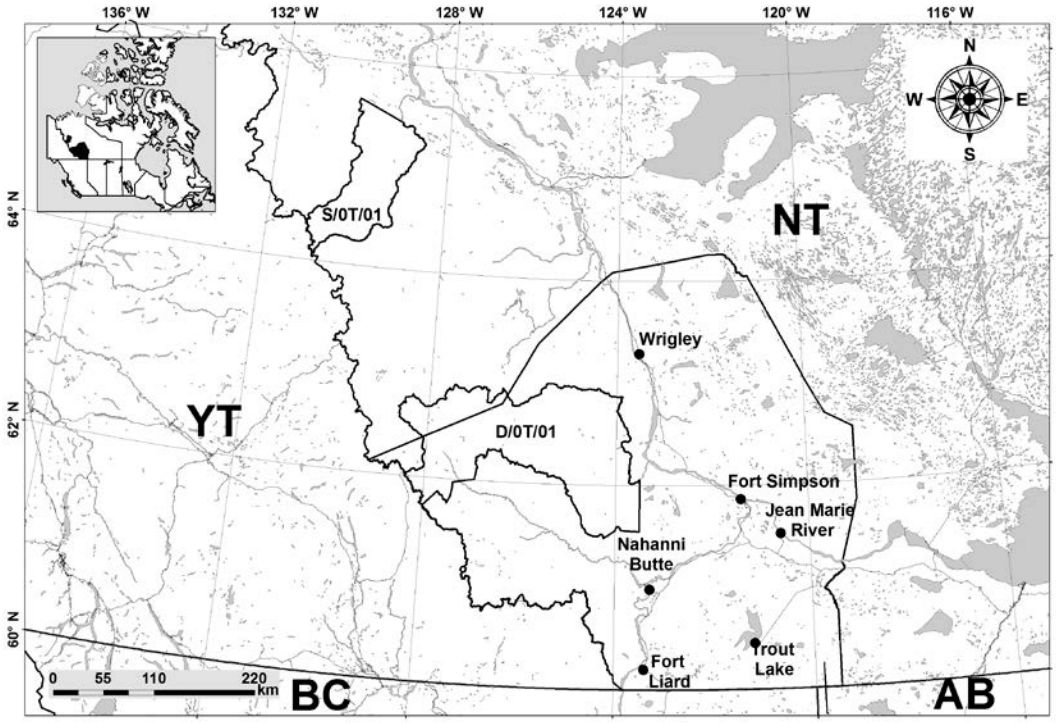

Figure 1. The Dehcho political administrative region, road system, Wildlife Management Areas S/OT/01, D/OT/01, and the location of communities.

METHODS

From 2001-2015 samples of tongue (n=524) and masseter muscle (n=1 black bear) were collected from 19 different wildlife species throughout the Dehcho (Table 1); samples from 13 wolves were collected from the Mackenzie Mountains in the Sahtú (zone S/OT/01). Tongue samples from shrews and rodents represent a pooling of two to five individual tongues. A location and date of death was collected for all animals sampled. The sex was recorded for all animals except the microtines and shrews. Ages were determined for Dall's sheep and mountain goat by counting horn annuli. The age was determined for most moose, caribou, and wood bison by cementum age analysis of incisor teeth, and for black bear, grizzly bear, wolverine and wolves by cementum age analysis of the first premolar tooth (Matson 1981). Animal age was not reported for lynx, red fox, marten, beaver, snowshoe hare, microtine rodents and shrews. Tongue samples were stored frozen in the regional office in Fort Simpson. Samples collected from 2001-2011 were forwarded to the Centre for Food-borne and Animal Parasitology, Canadian Food Inspection Agency, Saskatoon, Saskatchewan (SK) for analysis. Samples collected after 2011 were forwarded to the Veterinary Pathology Lab at the Western College of Veterinary Medicine, Saskatoon, SK for analysis.

Frozen tongue samples were thawed to room temperature and trimmed to remove fat and connective tissue. The digestion assay for the detection of *Trichinella* spp. larvae in muscle tissue followed Forbes and Gajadhar (1999) and Forbes et al. (2008). Weights of tested tongue varied both within and between species (Table 2). Because it is rare to find

Trichinella spp. in large ungulates, the digestion assay consisted of two to five individual samples pooled (Brent Wagner personal communication). Positive results were converted to larva/g (LPG) of muscle tested.

We used a proportion test to compare prevalence between and within species.

Table 1. The number of tongue samples tested for *Trichinella*, the years samples were collected, and the wildlife species tested.

Wildlife Species	Years Collected	Number of Samples
Black Bear	2002-2015	197[1]
Grizzly Bear	2003-2015	20
Wolf	2001-2015	81
Wolverine	2008-2013	49
Red Fox	2009-2015	5
Lynx	2008-2009	2
Marten	2010	1
Dall's Sheep	2011-2012	34
Mountain Goat	2011-2014	15
Wood Bison	2011-2015	12
Moose	2011-2013	39
Northern Mountain Caribou	2011-2013	34
Barren-Ground Caribou	2010	5
Beaver	2010, 2012	2
Snowshoe Hare	2008-2009	18
Northern Red-backed Vole	2006-2013	5[2]
Meadow Vole	2006-2013	2[2]
Deer Mouse	2006-2013	1[2]
Shrew	2006-2013	3[2]

[1] includes one masseter muscle sample
[2] indicates pooling of two to five tongues/sample.

RESULTS

No samples from lynx, marten, Dall's sheep, mountain goat, wood bison, moose, northern mountain caribou, barren-ground caribou, beaver, snowshoe hare, northern red-backed vole, meadow vole, deer mice or shrews tested positive for *Trichinella* spp. (Table 2). Prevalence from highest to lowest was 62% for wolves, 50% for grizzly bears, 40% for red fox, 24% for wolverine, and 4% for black bears. The grizzly bear samples included three cubs; none tested positive. Prevalence for adult grizzly bears was 59%. Prevalence was lower ($p<0.01$) in black bears than in grizzly bear, wolves, red fox, and wolverine. Prevalence of *Trichinella* spp. in wolves resident in the Mackenzie Mountains (22/27; 82%) was higher ($p<0.05$) than in wolves from the rest of the Dehcho (28/54; 52%).

For those animals that tested positive for *Trichinella* spp., the intensity of infestation ranged from 0.09–177.00 larva/g (LPG), with the greatest infestation in an 11-year-old male black bear shot in Fort Simpson, NWT on 25 June 2006 (Table 2; Appendix 1). Infection intensities >1 LPG are considered to pose a food safety risk. Three black bears, eight grizzly bears, 34 wolves, ten wolverines, and two red foxes had infestation intensities >1 LPG (Appendix 1).

Table 2. Wildlife species, range of sample weights (g), prevalence of *Trichinella* spp., range in the intensity of the infestation (LPG) and number of samples tested. [1] includes samples from three cubs-of-the-year all testing negative, adult prevalence would be 58.8% (10 of 17).

Wildlife Species	Sample weight range (g)	Prevalence	Range in LPG	N
Black Bear	0.2-62.2	4.1% n=8	0.10-177.00	197
Grizzly Bear[1]	2.6-100.2	50.0% n=10	0.50-17.57	20
Wolf	3.5-54.0	61.7% n=50	0.09-100.77	81
Wolverine	2.2-25.4	24.5% n=12	0.22-68.10	49
Red Fox	2.7-12.8	40.0% n=2	8.90-15.20	5
Lynx	n/a	0	n/a	2
Marten	n/a	0	n/a	1
Dall's Sheep	5.0-48.7	0	n/a	34
Mountain Goat	5.0-28.5	0	n/a	15
Wood Bison	11.0-16.5	0	n/a	12
Moose	10.0-28.9	0	n/a	39
Northern Mountain Caribou	5.5-29.3	0	n/a	34
B-Ground Caribou	n/a	0	n/a	5
Beaver	1.3	0	n/a	2
Snowshoe Hare	n/a	0	n/a	18
N. Red-backed Vole	0.1-1.8	0	n/a	5
Meadow Vole	0.15	0	n/a	2
Deer Mice	0.1-0.2	0	n/a	1
Shrew	0.1-0.8	0	n/a	3

DISCUSSION

In general, prevalence of *Trichinella* spp. infection is higher in furbearer, carnivore and omnivore species that scavenge, hunt or exhibit cannibalism than in small mammal species such as rodents (Appelyard and Gajadhar 2000, Schmidt et al. 1978). Our reported low prevalence in small mammals versus scavengers is consistent with what has been found elsewhere. The absence of the infection in large mammalian ungulates, and a variety of small mammals (Table 2) indicates that ingestion of these species as prey items is an unlikely source of *Trichinella* spp. for predators and scavengers, yet some of these predators and scavengers have a high prevalence of *Trichinella*.

Wolves

Wolves sampled from five southern provinces, mostly Alberta (AB), had a *Trichinella* prevalence of 4.2% (n=407; Appelyard and Gajadhar 2000). A more recent study with wolves sampled from British Columbia (BC), Yukon (YT), and Nunavut (NU) had a prevalence of 42.9% (n=28; Gajadhar and Forbes 2010). These data suggest that there is regional variation in the prevalence of *Trichinella* in wolves similar to that reported for black bears (Larter 2015). Our data show a higher prevalence 61.7% (n=81) than both of these studies. Similar to Gajadhar and Forbes (2010), we found that wolves testing positive also had high infestations; 68% (n=34) with infestations of >1 larva/g (LPG) from the Dehcho versus 67% (n=12) with infection intensities of >1 LPG from BC/YT/NU. We had four infestations higher than reported in Gajadahar and Forbes (2010) with the highest larval intensity (100.8 LPG) in a wolf that had frequented human garbage sites in Fort Simpson, NWT for months during winter 2014/15 (Appendix 1).

Our data support the hypothesis of regional variation in prevalence for wolves. Both *Trichinella* prevalence ($p<0.05$) and intensity is higher for wolves from the Mackenzie Mountains in comparison to wolves from the boreal forest region of the study area; 81.5% prevalence (n=27) and 77.3% positives with intensities > 1 LPG versus 51.9% prevalence (n=54) and 60.7% positives with intensities >1 LPG. This regional difference is likely because none of the mountain prey species (mountain goat, mountain caribou, Dall's sheep) harbour *Trichinella*. Cannibalism is rarely reported (Theberge and Theberge 1998) but may be common in wolves. Fights between large packs over territory are often quite deadly, and although carcasses are not ripped to shreds there is evidence of bites taken from them. In parts of Alaska (AK) up to 60% of wolf mortality has been attributed to other wolves (Mowry 2009). This scenario provides ample opportunity for wolves to ingest parts of other wolves which may have been infected. Possibly packs are larger and or more territorial in the Mackenzie Mountains than in the boreal forest so there is a higher probability of scavenging infected carcasses. Grizzly bears have a 50% prevalence of *Trichinella*, and are known to practice infanticide, cannibalism, and prey upon black bears (Mattson et al. 1992; McLellan 2005). The distribution of grizzly bears is restricted to the Mackenzie Mountains completely overlapping the distribution of wolves in the mountains but not the wolves from the boreal forest. This situation would also increase the probability of wolves in the mountains scavenging infected grizzly bear carcasses. Age may be a factor in acquiring infection, 38.5% (n=26) of aged positives were ≥4 years while 88.9% (n=27) of aged negatives were ≤3 years; the sex ratios were 15M:11F for positives and 12M:15F for negatives. Human consumption of wolves is not an issue as this species is not consumed.

Grizzly Bear

The prevalence of *Trichinella* in grizzly bears was 50% (n=20). Our sample included three young cubs-of-the-year, none of which tested positive. Therefore, prevalence from adult bears was 59% (10/17). Bears testing positive were generally male animals of age 10-20 years, most samples available for testing fit this description. The 59% prevalence we report is lower than the 81% (n=17) and 80% (n=5) prevalence reported from a study in the 1960s for grizzly bears in the Mackenzie Mountains of the YT and adjoining NWT, respectively (Chouquette et al. 1969). Rausch et al. (1956) reported 50% occurrence in brown bears (10/20) from AK. Gajadhar and Forbes (2010) reported 29% positive (n=68) where most bears (n=60) were from BC and suggested that prevalence might be lower in southern locations. Most grizzly bears testing positive had *Trichinella* infection intensities of >1 LPG (range 2.66-17.57; see Appendix 1). Human consumption of grizzly bears is not an issue as this species is not routinely consumed.

Trichinella infections in grizzly bears from the Mackenzie Mountains is unlikely to come from ingesting any of the various mammalian prey species as none of the potential prey species samples in this or other studies have tested positive (Appelyard and Gajadhar 2000; Alaska Department of Fish and Game 2010; Gajadhar and Forbes 2010). Cannibalism and infanticide is well documented in grizzly bears (Mattson et al. 1992; McLellan 2005). It is possible that cannibalism could maintain the infection. Wolves found in the Mackenzie Mountains have a high prevalence of *Trichinella*; ingestion of infected carcasses could also maintain the infection. Grizzly bears prey upon black bears (Mattson et al. 1992). Black bears are present, although uncommon in the Mackenzie Mountains (Larter and Allaire

2015). Prevalence of *Trichinella* is low in black bears but is persistent and a potential source of infection for grizzly bears.

Black Bears

Black bears are a human food source in many jurisdictions in North America. Sampling intensity varies widely across jurisdictions as does the reported prevalence. In general prevalence is low. No positive reports have been documented from AB (n=265), Manitoba (MB) (n=1), the island of Newfoundland (NL) (n=66), Nova Scotia (NS) (n=51) or Prince Edward Island (PEI) (n=1) (Butler and Khan 1992; Appelyard and Gajadhar 2000). Mortenson et al. (2014) reported no positives (n=250) for black bears in Oregon using the muscle digestion technique, but two positives (n=103) based on serology. Prevalence in Ontario (ON), Quebec (QC), New Brunswick (NB) and Labrador were 2.7% (n=73), 1% (n=258), 0.4% (n=569) and 1% (n=96), respectively (Appelyard and Gajadhar 2000, Butler and Khan 1992). Gajadhar and Forbes (2010), found 7.3% prevalence (n=193) black bears sampled between 1998 and 2007 from the NWT, BC, SK and QC. The highest reported prevalence was 12% (n=193) from black bears in the Kootney region of BC (Schmidt et al. 1978). The 4.1% (n=197) prevalence we report falls within the range of those reported by other jurisdictions in North America.

Zarnke et al. (1997) reasoned that sources of *Trichinella* infections are food-related and in black bears likely due to scavenging, ingestion of infected rodents and cannibalism of other infected black bears. We tested for a variety of rodents, small mammals and ungulate prey that could be scavenged or ingested by black bears but found no infection in any of the samples. A low prevalence could be maintained by cannibalism. The consumption of

infected wild carnivore and omnivore carcasses (most likely grizzly bears, wolves, wolverine and fox based on these study results) is also a potential source of *Trichinella* infection. The vast majority (92%; n=197) of the black bears we sampled were bears that had been killed for public safety (nuisance bears) and had the opportunity to scavenge from dump sites or around cabins and residences. If infected wild carnivores or omnivores, whole or in part, are found or placed in these areas they could serve as a potential risk of exposure.

Although prevalence is low, the highest infestation we found in any of our 525 samples was in a male black bear from the Fort Simpson area aged 11 years with an intensity of 177 LPG. It is relatively rare that intensities are >100 LPG (Gajadhar and Forbes 2010), possibly access to infected human garbage was a factor.

Schad et al. (1986) also reported low prevalence with high infestations in black bears harvested in Pennsylvania. Of the 37 positive cases (n=2056), 23 had intensities >1 LPG, six had intensities ≥300 LPG, and the highest infestation intensity was 912 LPG. Black bears in Pennsylvania have access to local slaughtering plants and garbage dumps where discarded offal can be scavenged. Scavenged carrion may have included red fox (*Vulpes vulpes*). Although the actual source of the infection for black bears was uncertain, these were considered potential sources of the infection in black bears in Pennsylvania (Schad et al. 1986).

Infestations of >1 LPG were recorded in three of the eight black bears testing positive for *Trichinella*. Human infection remains a potential risk associated with the ingestion of raw undercooked black bear meat in this study as was the conclusion in the Pennsylvania study (Schad et al. 1986). Black bear meat should be cooked to an internal temperature of 77°C prior to consumption (Food Safety Network 2009).

A sylvatic cycle of *Trichinella* spp. is well recognized in black bears in North America, where black bears act as the natural host. Sylvatic infections of black bears in Canada have been either *Trichinella nativa* (T2) or *Trichinella* genotype T6, with *T. nativa* being more common (Gajadhar and Forbes 2010). Larter et aI. (2011) found bears from the Dehcho were infected either with *T. nativa* (T2) or *Trichinella* T6. *T. nativa* (T2) is cold-adapted and found in wild mammals from the Arctic or subarctic zones of North America, Europe and Asia; it is more resistant to freezing temperatures. *Trichinella* T6 is the most common genotype observed in sylvatic infections of Canadian wildlife and has a wider documented host distribution compared to *T. native* (T2) (Gajadhar and Forbes 2010).

Furbearers

The 40% (n=5) prevalence we report for red fox is based upon a small sample size, however both positive samples had infection intensities of >1 LPG of muscle tissue. Both positive samples came from males; two females and one male tested negative. Appleyard and Gajadhar (2000) reported prevalence in red fox of 10.5% (n=19) from NWT; they did not report larval intensities. Prevalence from across the southern provinces was much lower at 1.5% (n=405). In Pennsylvania Schad et al. (1984) reported 15.1% prevalence

(n=73) in red fox with a mean infection intensity of 37 LPG and suggested an active cycle of sylvatic trichinosis (Schad et al. 1984).

The 24.5% (n=49) prevalence we report for wolverine is less than the 76.7% (n=111) reported by Gajadhar and Forbes (2010) from samples collected from BC, YT, and NWT. However, larval intensity levels are similarly high; 83.3% of the positives from the Dehcho had >1 LPG (maximum 68.1) compared to 80.5% (maximum 522 LPG) reported by Gajadhar and Forbes (2010). Prevalence was higher in males (28%; n=29) than in females (20%; n=20).

Gajadhar and Forbes (2010) reported a prevalence of 6.5% (n=107) for lynx collected from BC, NU with a range of 0.34-21 larvae/g and four of the seven having intensities of >1 LPG. Neither of the two male lynx in our study tested positive.

Appleyard and Gajadhar (2000) tested beaver samples (n=41) from BC, SK, ON and QC. All tested negative. Both our samples (one male and one female) also tested negative. No muskrats (n=201) tested positive in a Pennsylvania study (Schad et al. 1984).

Gajadhar and Forbes (2010) reported a prevalence of 3% (n=101) for marten collected from BC and NU. All three positives had intensities of >1 LPG (range 17-191 LPG). Our one male marten tested negative. Human consumption should not be an issue with red fox, wolverine or marten as these species are not routinely consumed by people. In AK, both black bear and lynx meat are considered potentially infected by *Trichinella* and suggest ensuring that black bear and lynx meat is thoroughly cooked before being consumed (Alaska Department of Fish and Game 2016).

Small Mammals

All 25 Arctic hares from the NWT tested negative (Appleyard and Gajadhar 2000). Similarly, all 18 of snowshoe hares we tested were negative for *Trichinella*. Appleyard and Gajadhar (2000) reported all 21 lemmings from NWT tested negative and a 0.3% prevalence for shrews (n=330) from BC. No vole (n=7), mice (n=1), or shrew (n=3) samples tested positive in our study.

Ungulates

Because the consumption of *Trichinella*-infected meat by an animal host is required for transmission of infection, ungulates are unlikely to harbor *Trichinella*. None of the 139 samples from five different ungulate species tested positive for *Trichinella* (Table 2.). Although herbivores are atypical hosts, deer have been experimentally infected (Oksanen et al. 2000) and implicated in at least one case of *Trichinella* in humans in the United States (Wilson et al. 2015). The Alaska Department of Fish and Game does not consider moose, mountain goat, Dall's sheep, bison or caribou to harbor *Trichinella* (Alaska Department of Fish and Game 2016). However, moose meat has been implicated in one case of trichinellosis reported during 2005-2014 (McLaughlin and Castrodale 2015).

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PERSONAL COMMUNICATIONS

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APPENDIX 1

Tongue samples showing infestation intensities of >1 larvae/g by species with date and general location of sample collection, and sex and age of species sampled.

Species	Infestation	Date	Location	Sex	Age
Black Bear 36	13.00	15-Aug-03	Nahanni Butte	U	5
Black Bear 60	177.00	25-Jun-06	Fort Simpson	M	11
Black Bear 115	1.90	15-Feb-10	N Jean Marie River	F	4
Grizzly Bear 3	8.00	13-Sep-04	Pass Creek	M	10
Grizzly Bear 6	4.30	21-Sep-06	Area D/OT/01	M	21.5
Grizzly Bear 9	4.30	05-Sep-07	South Nahanni River	M	13
Grizzly Bear 11	3.00	07-Sep-07	Root River	F	13
Grizzly Bear 12	17.00	01-Aug-08	Tungsten	M	4
Grizzly Bear 14	3.16	25-Sep-11	Root River	M	15.5
Grizzly Bear 15	17.57	03-Sep-12	Redstone Plateau	M	17
Grizzly Bear 18	2.66	16-Sep-15	N Kotaneelee Range	M	13
Wolf 11	2.30	20-Dec-03	W Checkpoint	F	3
Wolf 13	3.10	21-Mar-04	Muskeg River	F	0
Wolf 15	2.40	06-Apr-04	Fort Liard	U	n/a
Wolf 21	58.30	13-Feb-05	Trout Lake	M	8
Wolf 25	21.60	27-Jul-05	Kakisa	M	3
Wolf 47	4.20	15-Feb-07	Trout Lake	F	0
Wolf 63	14.80	03-Aug-08	Nahanni Butte	F	2
Wolf 78	8.80	16-Sep-09	Zone D/OT/01	M	4
Wolf 81	3.20	05-Jan-10	Wrigley	M	n/a
Wolf 83	1.50	02-Feb-10	Nahanni Butte	M	n/a
Wolf 90	9.50	04-Oct-10	Area D/OT/01	F	n/a
Wolf 91A	6.46	23-Nov-10	Wrigley	F	0
Wolf 94	13.48	28-Nov-10	Fort Liard	M	7
Wolf 96	17.67	22-Dec-10	Fort Simpson	M	7
Wolf 102	36.14	16-Mar-11	Manners Creek	M	4
Wolf 109	76.84	24-Sep-11	Area D/OT/01	M	n/a
Wolf 110	1.16	11-Sep-11	Area D/OT/01	M	n/a
Wolf 111	4.81	4-Oct-11	Area D/OT/01	F	n/a
Wolf 121	11.62	13-Apr-12	Area S/OT/01	M	0
Wolf 123	1.69	20-Sep-12	Area D/OT/01	F	n/a
Wolf 124	11.40	23-Sep-12	Area D/OT/01	M	n/a
Wolf 126	82.36	12-Dec-12	E Jean Marie River	F	0
Wolf 129	6.15	19-Jan-13	Willowlake River	F	8
Wolf 131	1.38	31-Mar-13	Area S/OT/01	F	n/a
Wolf 134	1.50	08-Apr-13	Canol Trail mile 70	F	n/a
Wolf 135	2.60	19-Apr-13	Fort Simpson	F	0
Wolf 139	4.50	08-Sep-13	Area D/OT/01	M	n/a
Wolf 141	4.33	01-Apr-14	Area S/OT/01	F	n/a

Species	Infestation	Date	Location	Sex	Age
Wolf 143	23.14	02-Apr-14	Area S/OT/01	F	n/a
Wolf 144	1.92	02-Apr-14	Area S/OT/01	F	n/a
Wolf 155	100.77	20-Jan-15	Fort Simpson	M	2
Wolf 159	9.53	19-Sep-15	Area D/OT/01	F	n/a
Wolf 160	10.76	6-Sep-15	Area D/OT/01	M	n/a
Wolf 162	3.52	9-Sep-15	Area D/OT/01	M	n/a
Wolverine 9109	2.60	25-Feb-10	NW Jean Marie River	F	2
Wolverine 91010	1.40	03.Mar-10	NW Jean Marie River	M	5
Wolverine 91011	68.10	11-Mar-10	N Jean Marie River	M	2
Wolverine 91013	4.80	26-Dec-09	S Fort Liard	F	8
Wolverine 91015	3.80	03-Nov-09	S Fort Liard	M	1
Wolverine 101115	19.65	07-Jan-11	McGill Lake	F	1
Wolverine 101116	1.99	17-Feb-11	E Trout Lake	M	2
Wolverine 101118	16.45	7-Feb-11	SE Bovie Lake	M	1
Wolverine 11125	9.75	29-Jan-12	SE Fort Liard	F	5
Wolverine 11128	1.36	17-Mar-12	S Fort Liard	M	1
Red Fox 1	8.90	29-Jan-10	Checkpoint	M	n/a
Red Fox 2	15.20	18-Dec-09	NW Checkpoint	M	n/a