Potential Food Items Ingested by Wolves in the Dehcho

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ABSTRACT

From 2002-2013 wolf stomachs were collected from harvested wolves submitted to the Department of Environment and Natural Resources (ENR) by local hunters and trappers. During the same period, fresh wolf scats were opportunistically collected by ENR staff conducting field research for a variety of research programs in the Dehcho region. A total of 46 stomachs and 31 scats were examined macro and microscopically for hair, feather, bone fragments, plant and other material. Hair, feather and bone fragments were identified as closely as possible to species. Five stomachs were empty. The list of potential food items was extremely diverse. Counting human garbage, there were 24 different distinguishable items recorded including ungulates [boreal caribou (*Rangifer tarandus caribou*), moose (*Alces americanus*), wood bison (*Bison bison athabascae*) and deer (*Odocoileus* spp.)], furbearers and small mammals [marten (*Martesamericanus*), snowshoe hare (*Lepus americanus*), beaver (*Castor canadensis*), voles (*Myodes* or *Microtus* spp.)], birds, fish, vegetation, and one domestic dog. Most items were found in both stomach contents and scats with the exception of garbage, fish, lynx (*Lynx canadensis*), porcupine (*Erethizon dorsatum*), raptor, and domestic dog being reported only from stomach contents and deer, ants, and mink (*Vison vison*) only being reported from scat contents.

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INTRODUCTION

Knowledge of trophic interactions is crucial to our understanding of community dynamics. The impact of predators, usually wolf (*Canis lupus*) predation, on various ungulate populations in North America is important for management and becomes an increasingly important factor to understand in systems where some ungulates may be species at risk (Larter et al. 1994; SARC 2012). Wolves are opportunistic carnivores and consume a diversity of prey (Carnes 2004). Their diet may differ both spatially and temporally based upon the seasonal access to various prey items, including aquatic prey, and carrion (Adams et al. 2010). The vulnerability of their primary prey relative to alternate prey determines the impact of predation on the abundance of primary prey (Messier 1994).

For wide ranging carnivores the analysis of scats is a particularly useful, inexpensive and non-invasive method to study feeding ecology (Ciucci et al. 1996, Larter 2013) and has often been used to determine relative proportions of key ungulate prey items in the diet to assess the potential impacts of predation on the suite of prey in the system (Larter et al. 1994, Williams et al. 2012, Lafferty et al. 2014). Hair, feathers, bones (or bone fragments) and other prey remains pass through the digestive system relatively unaltered in carnivores (Kelley and Garton 1997).

In the Dehcho region, moose (*Alces americanus*), boreal caribou (*Rangifer tarandus caribou*), and wood bison (*Bison bison athabascae*) are the main ungulate prey species for wolves. Moose density is estimated at *ca*. 4-5 moose/100 km^2 (Larter 2009) and boreal caribou density is estimated at 2 boreal caribou/100 km^2 (R. Gau

unpublished data). The Nahanni wood bison population was estimated at 431 non-calves in 2011 (Larter and Allaire 2013) and inhabits the Liard River valley in the southwest.

We collected stomachs from wolf carcasses provided to the Department of Environment and Natural Resources (ENR) by local hunters and trappers and wolf scats collected opportunistically during field research programs from 2002-2013. The monetary incentive for trappers to provide carcasses was not the same for all years; in 2010/11, 2011/12 and 2012/13 there was a territorial-wide added monetary incentive of up $650/carcass. Scats and stomachs were analyzed for their contents primarily to document the different food items and occurrence in the diet of wolves in the Dehcho, with particular interest in ungulate prey species occurrence. In addition we wanted to: 1) compare the findings between scats and stomachs — there was ongoing debate as to whether stomach contents of trapped wolves were biased toward the diet of young and naïve animals, more closely associated with communities or trap lines, while opportunistic scat collection was more representative of the diet; and 2) document whether or not the number of carcasses received was influenced by the changes in monetary incentive.

STUDY AREA

The study area included the entire Dehcho political region of the southwestern Northwest Territories (NWT), excluding the Mackenzie Mountains found east of the Liard and Mackenzie Rivers (Figure 1).

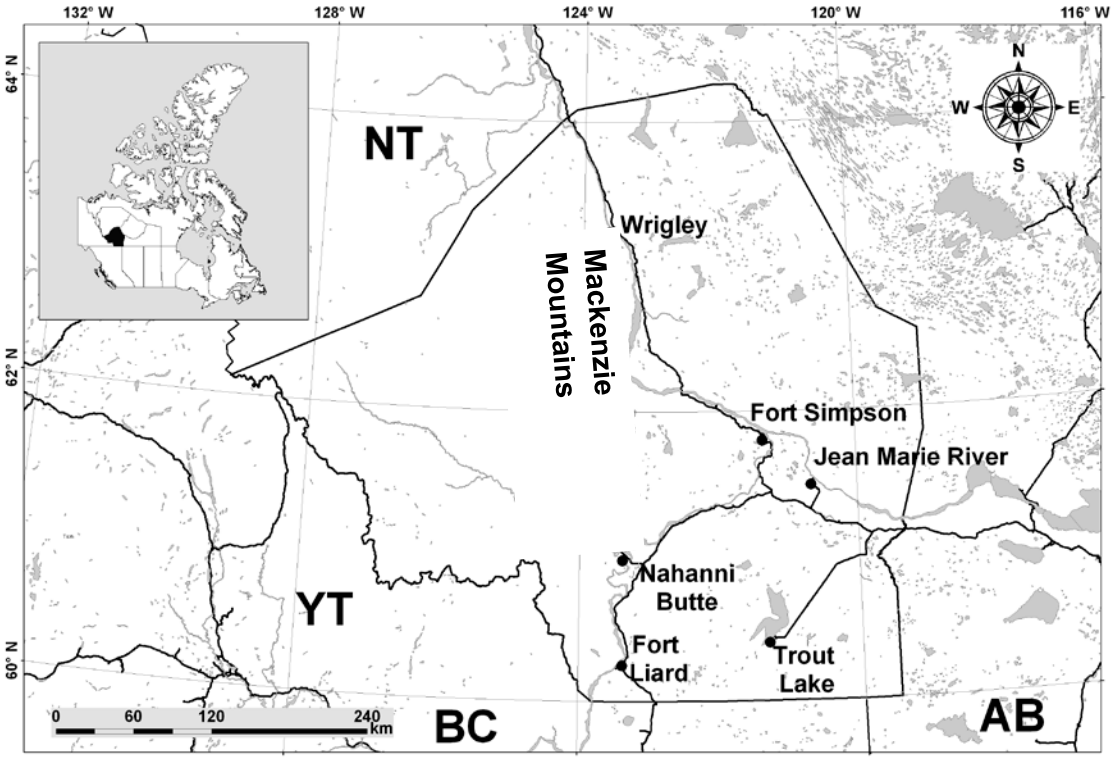

Figure 1. The Dehcho political region and the location of communities.

METHODS

Wolf carcasses were submitted to ENR Fort Simpson from 2002-2013. Harvesters received a monetary reimbursement ($50) for providing the carcasses with accompanying date and location of harvest information. In years when there was an additional territorial-wide incentive program (winters 2011/12 and 2012/13), the financial reimbursement for harvesters to provide carcasses increased by a minimum of $200 to a maximum of $650/carcass. Stomachs were tied off, removed from wolf carcasses, and kept frozen. As part of a larger study, the sex of each wolf was determined, a premolar tooth was taken for aging (Matson 1981), a small piece of muscle tissue for DNA and the tongue for *Trichinella* spp. screening (Larter et al. 2011) were also collected.

Fresh wolf scats were collected opportunistically during field research. When scats were found in the vicinity of a kill site only one scat was collected because we presumed that all scats would contain the contents of their last meal which was the animal most recently killed. Scats were placed in biohazard bags, tied off, and stored frozen. The date and location (from a hand-held global positioning system unit) was recorded for each scat collected.

Wolf stomachs and scats were kept frozen before being forwarded to the lab for analysis. Macro and microscopic prey items were identified as closely as possible to species by the analysis of hair, feather, and bone fragments (following Kennedy and Carbyn 1981).

RESULTS

A total of 46 stomachs and 31 scats were examined. Five of the stomachs were empty. If human garbage was used as an ingested food item, then a total of 24 different distinguishable food items were identified in the stomachs and scats examined (Table 1).

Table 1. A listing of all different food items identified in the stomachs and scats of wolves from the Dehcho. The frequency occurrence of each item in stomachs, scats, and stomachs and scats pooled is indicated.

Food Item	% Frequency Occurrence n=41 stomachs	% Frequency Occurrence n=31 scats	% Frequency Occurrence pooled n=72
Boreal Caribou	34.15	25.81	30.56
Moose	7.32	22.58	13.89
Wood Bison	9.76	3.23	6.94
Deer	0.00	3.23	1.39
Snowshoe Hare	14.63	3.23	9.72
Marten	12.20	9.68	11.11
Beaver	4.88	6.45	5.56
Muskrat	2.44	9.68	5.56
Mink	0.00	3.23	1.39
Lynx	2.44	0.00	1.39
Porcupine	4.88	0.00	2.78
Red Fox	4.88	3.23	4.17
Black Bear	4.88	3.23	4.17
Vole/Rodent	12.20	12.90	12.50
Squirrel	4.88	3.23	4.17
Chipmunk	2.44	3.23	4.17
Domestic Dog	2.44	0.00	1.39
Grouse	7.32	6.45	6.94
Unknown Bird	12.20	6.45	9.72
Raptor	2.44	0.00	1.39
Fish	4.88	0.00	2.78
Ants	0.00	6.45	2.78
Vegetation	14.63	12.90	13.89
Human Garbage	41.46	0.00	23.61

Of the 46 wolf stomachs collected, the age could be determined for 43 animals and ranged from 0-12.5 years. Stomachs were collected from 23 females and 23 males (Figure 2).

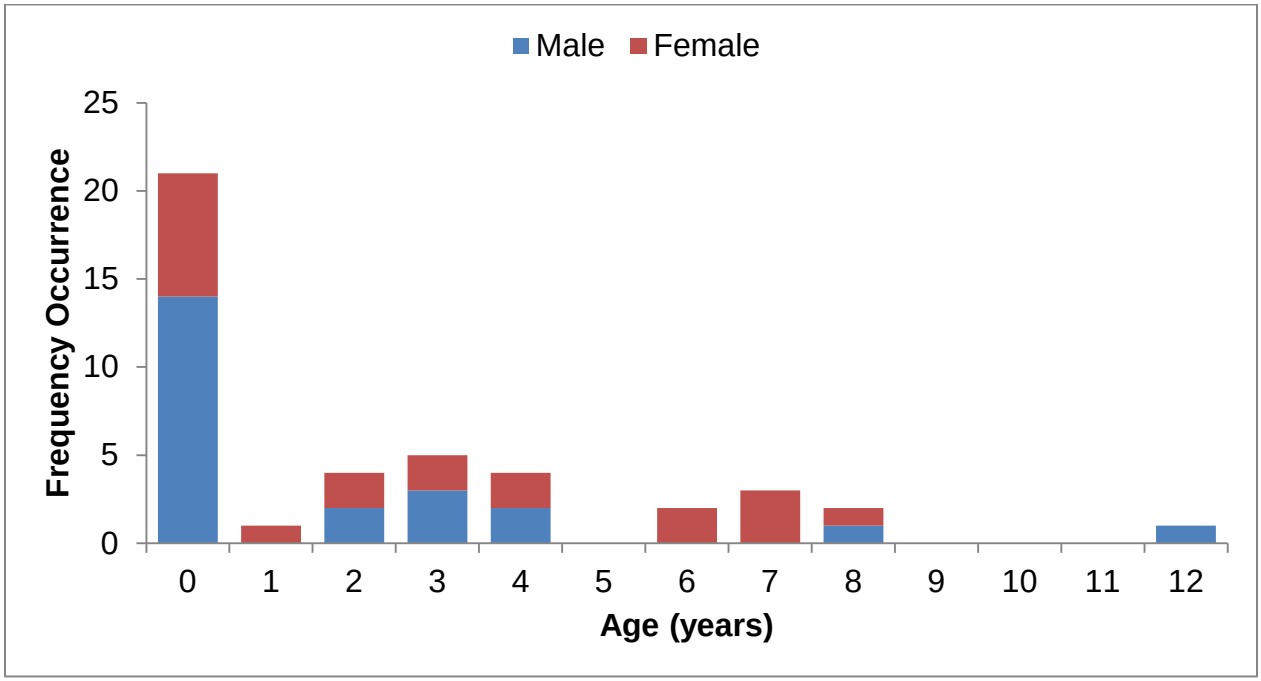

Figure 2. Sex and age distribution of wolves (n=43) from which stomach samples were collected and analyzed for food items.

DISCUSSION

The primary prey of wolves in the boreal forests of Canada is assumed to be the most locally abundant ungulate species, which is generally the moose (Messier 1994). Other ungulate species such as elk (*Cervus canadensis*), boreal caribou, mule (*Odocoileus hemionus*) and white-tailed deer (*Odocoileus virginianus*), and wood bison are alternate ungulate prey for wolves.

Elk and deer are virtually absent in the Dehcho. Moose and boreal caribou are distributed throughout the Dehcho, with moose density at least twice that of boreal caribou. Wood bison are locally abundant in the southwest along the Liard River Valley. Marten (*Martes americanus*) and beaver (*Castor canadensis*) are abundant in the Dehcho. Marten continue to be actively trapped but beaver trapping has declined dramatically over the last 10-15 years. Beaver are locally abundant and wolves have been observed killing and caching beaver carcasses in the fall (Victor Jumbo personal communication).

The analysis of wolf stomachs and scats collected in the Dehcho showed 24 different food items including human garbage. This demonstrates an extremely wide diversity of potential prey items. Most scats and stomachs had the remains of just one prey item in them but one stomach had evidence of five different prey items [snowshoe hare (*Lepus americanus*), wood bison, muskrat (*Ondatra zibethicus*), ruffed grouse (*Bonasa umbellas*), and vole (*Myodes* or *Microtus* spp.)], and one scat contained the remains of four different prey items (caribou, vegetation, rodent, unidentified bird). The two most abundant large ungulate prey, moose and boreal caribou, had the highest

frequency occurrence in wolf stomachs and scats (Figure 3). The leading cause of death for collared adult female boreal caribou in the Dehcho is wolf predation (Larter and Allaire 2015), so the frequency occurrence of caribou in wolf stomachs and scats is not surprising. The low occurrence of moose remains in stomachs versus scats is somewhat unexpected given moose and boreal caribou density. Surprisingly deer remains were found in one scat; deer are rarely observed in the Dehcho. The scat was collected near Poplar River about 80 km northeast of Nahanni Butte.

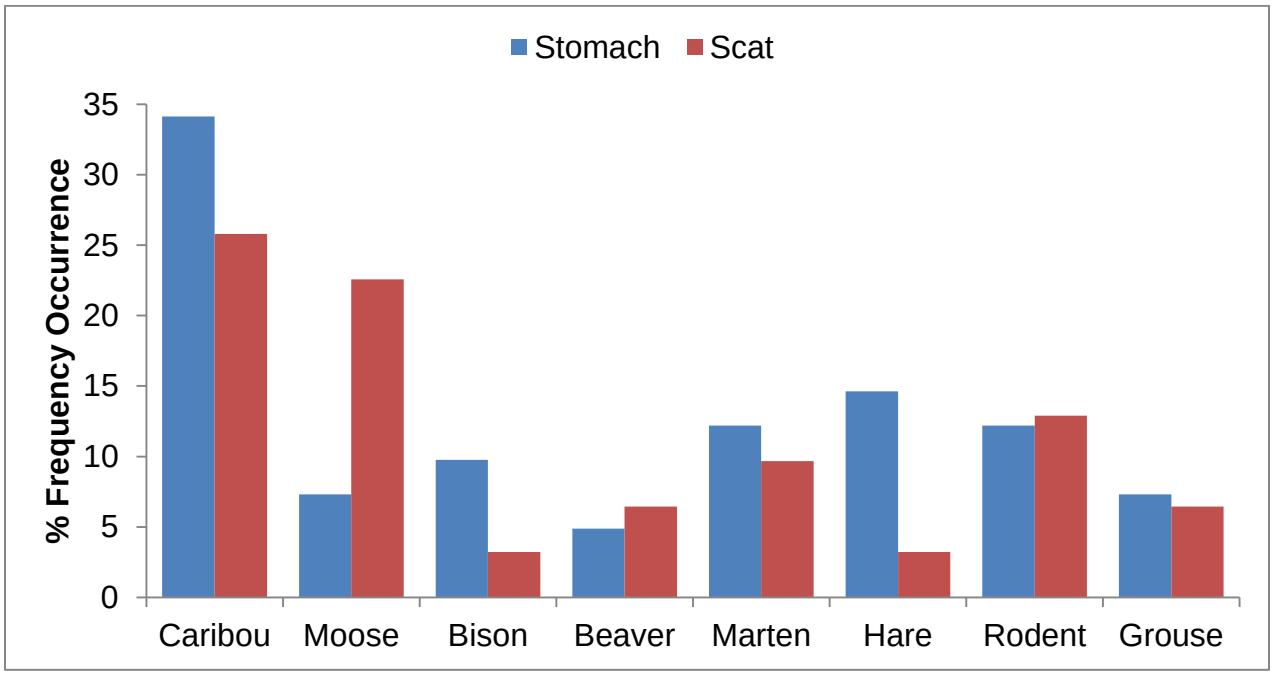

Figure 3. Percent frequency occurrence of some prey items in the stomachs (n=41) and scats (n=31) of wolves from the Dehcho.

Bison remains were found in one scat and the stomachs of three wolves. The scat was collected near Wrigley and two stomachs were collected from wolves trapped in the Wrigley area; one stomach came from a wolf trapped near Fort Simpson. The Wrigley locations are 200 km north of the range of the Nahanni wood bison population and likely demonstrate scavenging carrion. Bison drown during floods and the winter freshet. Carcasses of drowned bison have been documented in the Mackenzie River as

far north as Tulít'a in the Sahtú. Bison carcasses are large, can remain relatively intact when in the river and provide a good scavenging opportunity. However, wolves are quite capable of covering the distance from Wrigley to the range of the Nahanni wood bison population and back again. Wolves collared in Fort Nelson, British Columbia (BC), have travelled to the Arrowhead region of the NWT, some 225 km straight line distance (Brad Culling personal communication). Over a six week period, a wolf pack with individuals collared on the Petitot River in northeast BC travelled a minimum of 500 km in an area that extended 100 km north of the 60th parallel (Conrad Thiessen personal communication).

Birds, including grouse, and small mammals were relatively common food items with a frequency occurrence of 15-20%; beaver remains were found in two scats and two stomachs. Two scats, both collected along Liard Hwy between km 200 and 220 in July 2006, contained ants. For one, the majority of scat contents (85%) were of worker and soldier ants. For the other ants, were 5% of scat contents.

Although 22 of the 43 stomachs analyzed were from wolves aged one year or less, stomachs were analyzed from eight wolves aged six years or older (Figure 2). Whether or not this age distribution is representative of the wolf population in the Dehcho and/or biased toward a sample of younger animals is unknown. Human garbage was the item with highest frequency occurrence in stomachs; no human garbage was found in scats. This implies that harvested wolves may be more closely associated with human habitation i.e. harvested near communities or trap lines and cabins. The stomachs containing marten and lynx remains were submitted by trappers who had just had their trap lines robbed by wolves. No marten or lynx remains were

found in scats. The absence of human garbage from scat samples could support the assumption that scat samples collected in the field provide a more accurate picture of wolf diet than the collection of stomachs from harvested wolves. However, all wolves will scavenge when times are tough, which would mean opportunistic use of trapped animals and material from community dump sites.

More wolf carcasses were provided to ENR during 2010/11 to 2012/13 when a substantial monetary incentive was implemented, but in only one year did we receive more than ten carcasses. Wolf trapping is generally uncommon in the Dehcho. There is a diversity of spiritual beliefs about wolves amongst the different Dehcho communities. Substantial monetary incentives, up to $650 more/sample, did not provide a substantial increase in the number of carcasses provided to ENR. The cost to marginally increase sample size is difficult to justify because few wolves are ever harvested in this region.

There continue to be advances made in the design of experiments that use the prey contents found in scat to determine predator diet and potential changes in diet over time, however sample sizes in the hundreds are required and scat analyses is a labour intensive and time consuming method (Williams et al. 2012). There have been advances in molecular ecology leading to new methods for determining diet (Deagle et al. 2005). Some methods use stable isotope signatures (Lecomte et al. 2011), or genetic barcoding (Blaxter et al. 2005). More recently, next generation sequencing (NGS) techniques have been touted as a more powerful approach (Shehzad et al. 2012, Pompanon et al. 2012). Regardless of the methodology used to determine dietary components of stomach or scat contents, the interpretation of any results has to consider how the sample of scats or stomachs collected relates to the predator and the

questions to be answered. In order to assess wolf diet in the Dehcho, regardless of methodology, sample size will remain a huge constraint. The additional monetary incentive for local hunters and trappers to provide wolf carcasses had little impact on increasing sample size. Alternate ways to increase sample size need to be explored. The macroscopic analysis of the wolf scats and stomachs collected over an 11 year period did document the wide range of food items ingested by wolves in this region, but it provided little insight into the relative importance of the different prey items.

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PERSONAL COMMUNICATIONS

Brad Culling, Diversified Environmental Services, Fort St. John, BC.

Victor Jumbo, hunter/trapper, Trout Lake, NWT.

Conrad Thiessen, Regional Biologist, BC Provincial Government, Ft. St. John, BC.

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