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# Insights into food web structure through knowing the helminth parasites

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## Introduction

- Wolves (*Canis lupus*) are final hosts for many helminth parasites that are transmitted through the food web.
- Studying the diversity of gastrointestinal (GI) parasites of wolves can provide insights into predator-prey interactions, and the circulation of indirectly transmitted parasites.
- This study marks the first attempt to determine the diversity of food web transmitted GI parasites present in wolves in the Sahtu Settlement Area, NWT.

## Questions

- What is the diversity of GI parasites in wolves in the Sahtu region?
- What can the parasites convey about wolf diet?
- Does parasite prevalence suggest variation in wolf diet between prey regions?

## Methods

- GI tracts received from carcasses of trapped wolves submitted to the Government of NWT.
- GI tracts were opened and examined for parasites following published protocols<sup>1</sup>.
- Only cestodes and trematodes were identified as they invariably involve intermediate hosts that wolves prey upon.
- Cestodes were identified to species based on overall morphology for *Echinococcus* sp., and based on hook morphology for *Taenia* spp. (Figure 1A, B).
- Trematodes were identified to genus based on morphology.
- Species ID of *Taenia* were confirmed by PCR and sequencing.



Figure 1A: Rostellar hooks of *T. hydatigena*. Red arrow indicates small hook



Figure 1B: Rostellar hooks of *T. krabbei*. Red arrow indicates small hook.

## Parasite diversity in Sahtu wolves

Table 1: Prevalence of adult gastrointestinal parasites in carcasses of wolves collected from April 2011-2013 in the Sahtu (white columns) compared to a historical study on wolves from boreal and tundra regions in Canada by Choquette et al., 1973 (green columns).

Parasite species	Boreal caribou & Moose (n=17)	Boreal Forest* (n=21)	Barren ground caribou (n=20)	Tundra* (n=61)	Mountain caribou (n=6)
<b>Cestodes</b>					
<i>Taenia hydatigena</i>	29%	63%	10%	50%	33%
<i>Taenia krabbei</i>	82%	25%	38%	80%	50%
<i>Echinococcus granulosus</i>	41%	24%	10%	0%	0%
<i>Diphyllobothrium</i> sp.	0%	0%	0%	2%	0%
<i>Taenia pisiformis</i>	0%	25%	0%	0%	0%
<i>Taenia serialis</i>	0%	13%	0%	20%	0%
<b>Trematodes</b>					
<i>Alaria</i> spp.	53%	5%	43%	0%	0%



Figure 2: Dissected scolex of *T. hydatigena* showing a complete set of rostellar hooks

- Morphology of large and small hooks was used to identify *Taenia* spp. (Figure 2).

- Echinococcus granulosus* (Figure 3) was identified based on morphology.



Figure 3: *Echinococcus granulosus*.



Figure 4: *Alaria* sp.

- Alaria* sp. (Figure 4) was identified based on external morphology.

- Parasites collected from wolf carcasses (Table 1) included *T. hydatigena*, *T. krabbei*, *E. granulosus* and *Alaria* spp.
- This is the first report of the diversity of GI parasites present in Sahtu wolves.

## Parasites and dietary habits of Sahtu wolves



Figure 5: Moose. (photo credit: Jeff Jemison)

- Taenia hydatigena*, *T. krabbei* and *E. granulosus* may use moose as intermediate hosts.

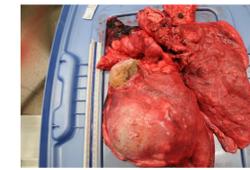


Figure 6: Caribou lungs with large hydatid cyst caused by *E. granulosus*

- Barrenground caribou and boreal caribou are also important intermediate hosts for *T. hydatigena*, *T. krabbei* and *E. granulosus*



Figure 7: Frog. Picture extracted from: images2.fanpop.com

- Life cycle of *Alaria* spp. requires tadpoles as intermediate hosts.
- Infected tadpoles will grow into frogs or toads harbouring *Alaria* spp.

- Rodents that prey on infected frogs or toads can become paratenic hosts to *Alaria* spp.
- Wolves eating infected frogs or rodents may get *Alaria* parasites in the intestines.



Figure 8: Red backed vole, a common rodent. Picture extracted from: redbuttecanyon.net

- The presence of these parasites (Table 1) suggests that caribou, moose, frogs, toads and possibly rodents are parts of the diet of Sahtu wolves.
- We did not detect *T. pisiformis*, *T. serialis*, transmitted through hares, nor *Diphyllobothrium* spp., transmitted through fish. This differs from previous studies<sup>3</sup>.
- Based on parasite fauna, we found no evidence that wolves in Sahtu are preying on hares, rabbits or fish.
- Taenia arctos*, a newly described tapeworm in moose and grizzly bears, was not found, suggesting that wolves are not involved in its life cycle.

## Diet variation between prey regions?

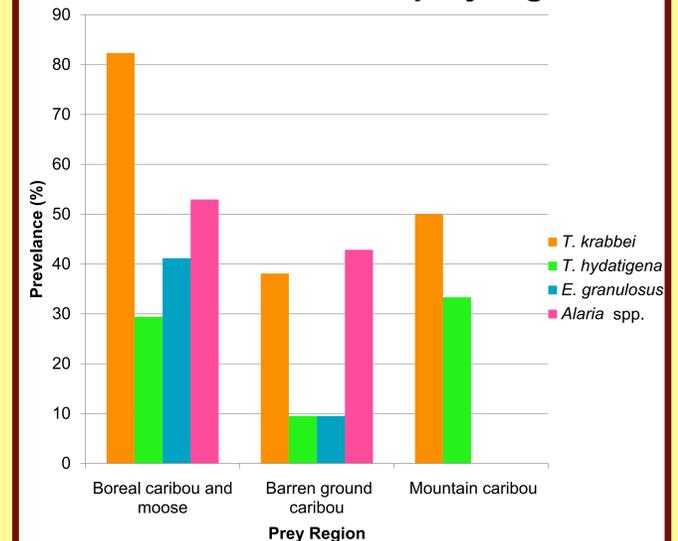


Figure 9: Prevalence of parasites with respect to different prey regions. Prey region group sizes are as follow: barren ground caribou (N=21), boreal caribou and moose (N=17), mountain caribou(N=6).

- Prevalence of *Taenia krabbei* and *Echinococcus granulosus* are significantly higher in the boreal caribou and moose prey region. (Pearson's chi-square test,  $\chi^2=7.6319$  and  $\chi^2= 7.5714$ , df=3,  $p < 0.05$  respectively)

- Echinococcus granulosus* is known to be more prevalent in moose compared to caribou, which may explain the significant difference in prevalence across prey regions.

- Lower *T. krabbei* prevalence in barrenground caribou prey region may be linked to low caribou densities.

- There was no significant difference in prevalence of *T. hydatigena* or *Alaria* between regions.

- The prevalence of wolves infected with *Alaria* spp. are much higher than previous studies<sup>2,3</sup>, suggesting that frogs may now be an important part of wolf diet.

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## References

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