# Endoparasite distribution in wild canids and felids in Subarctic regions of Québec, Canada

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## Introduction

- The Canadian North is undergoing unprecedented climate and landscape changes, which may affect the distribution and prevalence of many parasites that can be transmitted from animals to humans.
- Recently, tapeworm *Echinococcus multilocularis* has been detected in canids outside known endemic areas suggesting increasing risks of human echinococcosis.
- Foodborne parasite *Toxoplasma* is present in subarctic regions but intestinal infection in wildlife hosts has not been definitively demonstrated.
- Increased knowledge on the distribution and prevalence of parasites is needed to better understand the effects of climate change on disease dynamics and predict potential impacts on human health [1,2].
- Our objective is to report baselines information on zoonotic parasites in carnivores (wild canids and lynx) in subarctic regions in northern Canada, including tapeworms (e.g. *E. canadensis*), roundworms (e.g. *Toxocara spp.)*, and protozoans (e.g. *Toxoplasma, Giardia,* and *Cryptosporidium* spp.).

## Sample Distribution

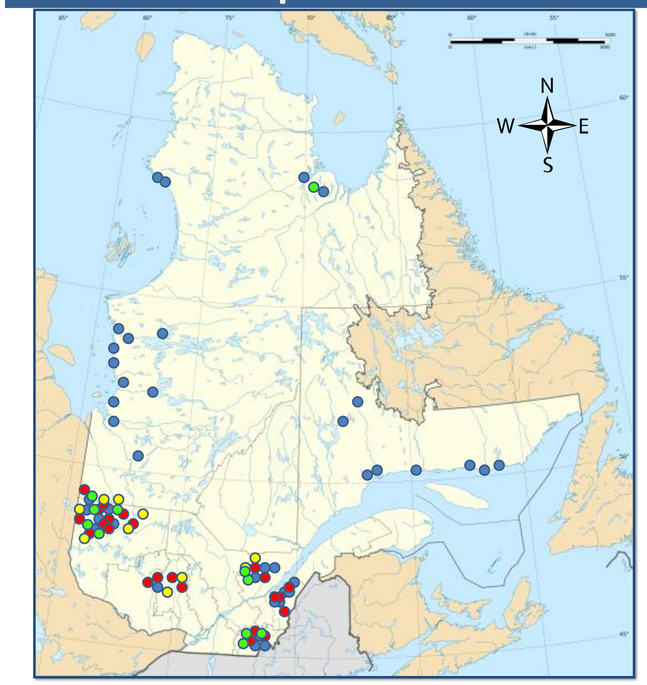


**Figure 1.** Sample distribution of fox (*Vulpes vulpes/lagopus*), coyote (*Canis latrans*), wolf (*Canis lupus*), and lynx (*Lynx canadensis*) in the province of Québec, Canada.

**Figure 2.** Arctic fox necropsy at the Nunavik Research Center, Kuujjuaq, QC.

**Figure 3.** Processing of Arctic fox intestine.

## Materials and Methods

Whole carcasses and intestines were collected by local trappers from wolves (23), coyotes (77), red and arctic foxes (184), and lynx (31) across Québec during the winter of 2016/2017 (Figure 1). We used morphological, molecular, and immunological methods to detect parasites in feces and/or intestines, which has increased sensitivity compared to basic fecal examination (Figures 2 to 4).

- All intestinal tracts were stored at -80˚C for at least 5 days to inactivate infectious *Echinococcus* eggs, and at -20˚C all other times between harvesting and inspection. Adult worms were collected from the small intestines by the scraping, counting, and filtration method[3] after thawing the tracts at room temperature.
- A magnetic capture technique on brain and heart from foxes and lynx was used to detect *Toxoplasma gondii*[4]. DNA was extracted from 25 to 100g of tissue. Real-time qPCR will be used to detect *Toxoplasma* DNA. Serological techniques (IFAT and MAT) will also be used for detection of antibodies.
- Fecal samples (3g) were analyzed by sugar flotation to detect parasite egg prevalence and intensity (Table 1).

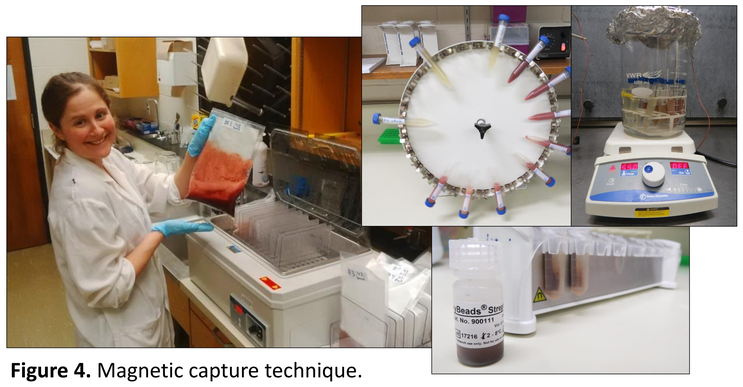

**Figure 4.** Magnetic capture technique.

**Figure 5.** Worms collected from small intestines by the scraping, counting, and filtration method.

## Results

- *E. canadensis* G8 and G10 was detected in wolf and coyote in west-central Québec, but not in any foxes in Nunavik or elsewhere within the province (Table 2).
- No *E. multilocularis* or *E. granulosus* G1-G3 was detected. *Alaria* was identified by examination of intestinal contents under microscope in 89 sample (31%). Of these, a subset were identified as *A. canis / marciniae* using PCR at the CO1 locus[5].
- Based on morphology, 81 of 203 (39.9%) samples were positive for *Taenia* spp. tapeworms. DNA sequencing identified the following species: *T. pisiformis*-like, *T. hydatigena*, *T. twichelli*, *T. crassiceps*, *T. polyacantha*, and *T. krabbei*.
- Only one lynx was tested serologically so far, and was positive for *Toxoplasma*.

**Table 1.** Prevalence of parasites based on fecal flotation in wild canids from Québec, Canada.

| | Wolves (N=23) | | Coyotes (N=77) | | Foxes (N=184) | | Overall (N=284) | |
|---|---|---|---|---|---|---|---|---|
| | **N** | % | **N** | % | **N** | % | **N** | % |
| *Taenia spp.* | **4** | 17.4 | **11** | 14.3 | **2** | 1.1 | **17** | 6 |
| *Toxascaris leonina* | **1** | 4.3 | **3** | 3.9 | **57** | 31 | **61** | 21.5 |
| *Toxocara canis* | **0** | 0 | **2** | 2.6 | **17** | 9.2 | **19** | 6.7 |
| *Trichuris* | **2** | 8.7 | **6** | 7.8 | **49** | 26.6 | **57** | 20 |
| *Uncinaria* | **1** | 4.3 | **3** | 3.9 | **12** | 6.5 | **16** | 5.6 |
| *Capillaria* | **0** | 0 | **0** | 0 | **1** | 0.5 | **1** | 0.4 |
| *Diphyllobothrium* | **0** | 0 | **1** | 1.3 | **4** | 2.2 | **5** | 1.8 |
| *Metorchis* | **0** | 0 | **0** | 0 | **1** | 0.5 | **1** | 0.4 |

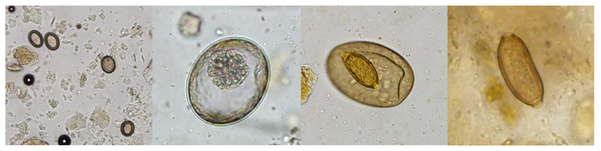

**Figure 6.** From left to right: *Taenia*, *T. leonine, Trichuris/Alaria*, and *Capillaria*

**Table 2.** Prevalence of *Echinococcus* species and genotypes in wild canids from west-central Québec, Canada.

| | Wolves (N=23) | | Coyotes (N=77) | | Foxes (N=184) | | Overall (N=284) | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| *E. canadensis* | | | | | | | | |
| G8 only | **5** | 22 | **3** | 3.9 | **0** | 0 | **8** | 2.8 |
| G10 only | **1** | 4.3 | **2** | 2.6 | **0** | 0 | **3** | 1.1 |
| G8/G10 | **2** | 8.7 | **4** | 5.2 | **0** | 0 | **6** | 2.1 |
| *E. multilocularis* | **0** | 0 | **0** | 0 | **0** | 0 | **0** | 0 |
| ***Echinococcus* (total)** | **8** | 35 | **9** | 12 | **0** | 0 | **17** | 6 |

## Future work

- Provide baseline information useful to communities, public health personnel, wildlife managers, and policy makers.
- Help to develop culturally appropriate control and surveillance strategies for diseases affecting the health of both wildlife and people in the Canadian Eastern Subarctic, and the basis for future predictive models.
- Understand better the wildlife and human health significance of parasites in arctic, subarctic, and temperate ecosystems, as well as the trophic relationships of wild carnivores and their prey species.

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## References

1. Bradley M. J., *et al.* (2005) Int J Circumpolar Health., 64(5), 468-477
2. Polley L., *et al.* (2010) Acta Veterinaria Scandinavica., 52
3. Gesy K, *et al.* (2013) Parasitol Res., 112, 1–4
4. Opsteegh M, *et al.* (2010) Int J Food Microbiol., 139(3), 193-201
5. Bowles J, *et al* (1992) Mol Biochem Parasitol., 54(2), 165-173

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