THE DEVIL'S IN THE DIVERSITY: DIVERGENT PARASITE FAUNAS AND THEIR IMPACTS ON BODY CONDITION IN TWO GREENLAND CARIBOU POPULATIONS

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Introduction

Body condition and fecundity in *Rangifer tarandus* sspp. can be negatively impacted by gastrointestinal nematode parasites [1-2], but these relationships may be specific to the parasite species present. Our previous work suggested a divergent parasite fauna in two west Greenland caribou (*R. t. groenlandicus*) populations [3]. Herein, we report on a more detailed study of parasite diversity in these animals and discuss the processes which may have structured parasite faunas. Further, we investigate if these parasite faunas impact west Greenland caribou.

Objectives

1) Characterise gastrointestinal parasite diversity in Akia-Maniitsoq (AM) and Kangerlussuaq-Sisimiut (KS) (Fig. 1) caribou

2) Determine if abomasal nematodes are significant predictors of caribou body condition and fecundity in these populations

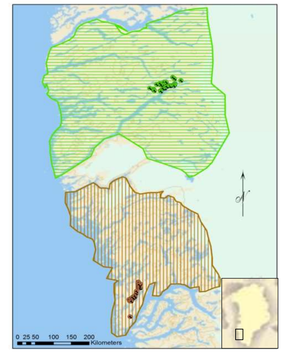

Fig. 1. West Greenland with the caribou ranges of Kangerlussuaq-Sisimiut (green) & Akia-Maniitsoq (brown). Collection sites of caribou are indicated. Insert ©Uwe Dedering 2012. Created with ArcGIS 9.3 and the DeLorme World Basemap (©2012 DeLorme).

Methods

Female caribou and their calves-at-heel were collected opportunistically as part of CARMA's surveys [4]. 47 Caribou were collected from AM in March / April 2008 and 49 from KS in March 2009. Post-mortem examinations recorded animal age (Adult ≥ 3 years, subadult 1-2 years, calf < 1 year), reproductive status and indices of body condition (i.e. carcass weight, body protein mass, back fat, kidney fat and marrow fat). Abomasa and small intestines of adults and subadults were examined for gastrointestinal parasites. Adult nematodes of both sexes were identified to species.

Nematode diversity

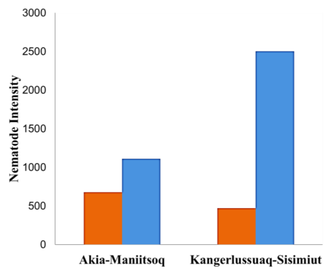

Fig. 2. Median abomasal nematode intensity; adults (orange) and larvae (blue).

Larval and adult nematodes were found in all abomasa (Fig. 2); no parasites were recovered from small intestines. Significant differences between populations were found; in AM, only *Ostertagia gruehneri* was recovered, but in KS, both *Marshallagia marshalli* and *Teladorsagia boreoarcticus* were found (Table 2).

Table 2. Prevalence [P, % positive samples], Intensity [Median (Min. – Max.)] and Species Proportion† [S/P, Mean (SD)] of abomasal nematodes collected from Akia-Maniitsoq (AM) and Kangerlussuaq-Sisimiut (KS) female caribou.

		Ostertagia gruehneri		*Marshallagia marshalli*			*Teladorsagia boreoarcticus*		
	n	P	Intensity	P	Intensity	S/P (SD)	P	Intensity	S/P (SD)
AM									
Subadult	7	100	910 (460-1,370)						
Adult	34	100	572 (80-2,290)						
Total	41	100	675 (80-2,290)						
KS									
Subadult	4			100	340 (115-435)	88.3 (6.6)	100	30 (10-110)	11.2 (6.5)
Adult	30			100	468 (50-1,690)	90.0 (6.5)	93.3	45 (5-250)	9.7 (6.5)
Total	34			100	420 (50-1,690)	89.8 (6.4)	94.1	45 (5-250)	9.9 (6.4)

† Species Proportions calculated using only those animals with multispecies infections

Associations with Body Condition & Fecundity

In both populations the dominant species of nematode was negatively associated with body condition, although estimates were consistently small (β = -0.24 to -0.61). Intensity of larvae was not a significant predictor.

AM: *O. gruehneri* was associated with: back fat, protein mass & kidney fat (Fig. 3A)

KS: *M. marshalli* was associated with carcass weight, protein mass & kidney fat (Fig. 3B)

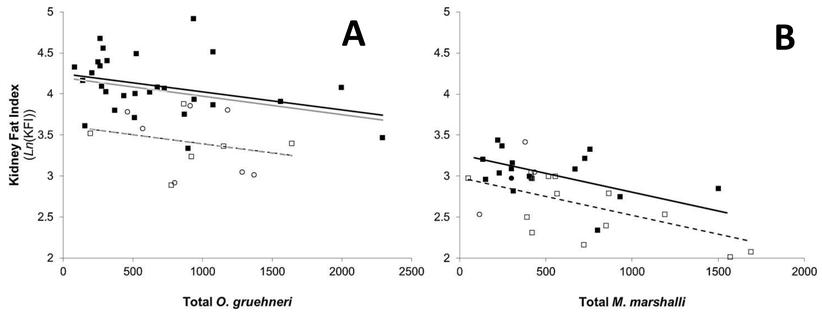

Fig. 3. Association between kidney fat index (KFI) and intensity of adult nematodes in AM (A) and KS (B) adult (squares) and subadult (circles) female caribou. Solid lines are predictive for pregnant animals (solid); dashed lines for non-pregnant animals (empty). Black lines are predictive for the full dataset; grey for sensitivity testing.

Only *O. gruehneri* was associated with fecundity (Fig. 4). Intensity (and presumed impact) of *O. gruehneri* is highest pre-rut, whereas *M. marshalli* is most abundant overwinter and this may suggest that nematode species with seasonal peaks pre-rut have a greater impact on caribou fecundity than those with seasonal peaks overwinter.

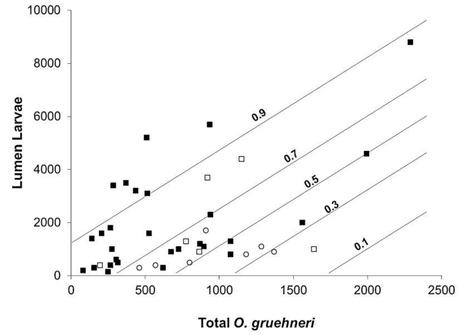

Fig. 4. Association of pregnancy status (pregnant: solid; non-pregnant: empty) to intensity of lumen larvae and adult nematodes in subadult (circle) and adult (square) AM caribou. Lines are the probability of an animal being pregnant.

Discussion

AM and KS caribou originate from Canadian barren-ground (*R. t. groenlandicus*) [3], but their abomasal nematodes are very different. Current faunas may be a result of parasite loss during colonisation of Greenland by caribou and subsequent parasite spill-over from Norwegian reindeer (*R. t. tarandus*) and Greenlandic muskoxen (*Ovibos moschatus*) imported to AM and KS, respectively [5-6]. Abomasal nematodes were significant predictors of body condition in both populations suggesting that nematode parasites, regardless of species and at low intensities, may impact caribou health. These closely related caribou populations with their unique and divergent faunas provide a natural system for investigating parasite ecology and impacts.

References

[1] Stein 2002, *J Anim Eco* **71**: 937. [2] Albon 2002, *P Roy Soc B - Biol Sci* **269**: 1625. [3] Steele in press, *Rangifer.* [4] Kutz in press, *Rangifer*. [5] Cuyler 1999, *Rangifer* **19**: 81. [6] Boertmann 1992, *Rangifer* **12**: 5.

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