
Site Fidelity in Forest-Dwelling Woodland Caribou (*Rangifer tarandus caribou*) Nursery Habitat in Wabakimi Provincial Park and Woodland Caribou Signature Site

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Abstract

Forest-dwelling woodland caribou (Rangifer tarandus) in Ontario have been designated as “threatened” by both the Committee on the Status of Species at Risk in Ontario (COSSARO) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). A four-year standardized, systematic inventory and monitoring Species at Risk (SAR) project of woodland caribou nursery areas was completed in both Wabakimi Provincial Park (WPP) and Woodland Caribou Signature Site (WCSS). Over 150 nursery sites were identified in these protected areas over four years. Caribou research has indicated a relative degree of site fidelity to calving and nursery grounds (Brown and Theberge, 1985; Ferguson and Elkie, 2004). DNA collections took place in both protected areas over the last four years to examine site fidelity and to contribute to a caribou metapopulation model for Ontario. Lakes, both heavily and minimally impacted by recreation, were surveyed in the first three years of study. Previous research suggests that peatland complexes (fen and bog) provide caribou calving and nursery habitat (Bergerud et al., 1990; Stuart-Smith et al., 1997). In the fourth year of this study, peatland complexes were examined for mother/calf pair use. Remote peatland complex results indicate a fairly high nursery use in WPP which stresses the importance of monitoring and protecting these types of habitats or ecosystems. DNA results were not able to confirm site fidelity to the individual level because of low DNA extraction success collected from summer samples. However, preliminary

results suggest site fidelity within each park was due to the fact that there were very few haplotypes shared among the Wabakimi population and the Woodland Caribou population. These results suggest that very different maternal lines utilize these areas. This study highlights some of the key findings from the four-year site fidelity study, including management recommendations, lessons learned from DNA collections, extractions, and the current direction for successful DNA sample collection and extraction techniques which will build upon the Ontario wide metapopulation model for woodland caribou.

Keywords: Woodland caribou, nursery habitat, site fidelity, Wabakimi Provincial Park

Introduction

The Forest-dwelling woodland caribou (*Rangifer tarandus caribou*) has been designated as “Threatened” by both COSSARO and COSEWIC. Over the last 100 years, caribou range has receded further north in Ontario (Schaefer, 2004). This study focuses on two protected areas, Wabakimi Provincial Park (WPP) and Woodland Caribou Signature Site (WCSS), located above the current southern limit of the continuous range of caribou occupancy.

Due to the status of caribou populations across Canada, new non-invasive sampling techniques are necessary to reduce human handling. With the advent of population genetics, new tools are available to study caribou population dynamics and habitat use through DNA analyses.

Previous studies have supported the theory that female caribou have site fidelity to calving and nursery grounds (Brown and Theberge, 1985; Paré and Huot, 1984). Research results also support the theory that peatland complexes (e.g., fen and bog) provide important caribou calving/nursery habitat (Stuart-Smith *et al.*, 1997; Hillis *et al.*, 1996; Bergerud *et al.*, 1990).

Research Objectives

Our main objective was to establish permanent reference sites within WPP and WCSS to monitor caribou nursery areas and evaluate use over time. Our second objective was to determine whether these calving/nursery areas are in fact of “traditional use” (i.e., if the same mother uses similar areas yearly through DNA analysis).

Methods

Previous studies suggest that caribou calves are born between the last week of May and first week of June (Bergerud, 1975; Ferguson and Elkie, 2004).

To limit the amount of human disturbance while sampling nursery sites, we started the surveys in the middle of June each year and continued until late July. In 2001 we surveyed the southern halves of WPP and WCSS being surveyed. In 2002 the northern halves of WPP and WCSS were surveyed. A selected group of nursery sites were re-surveyed in 2003. In 2004, fen and bog areas of WPP and WCSS were surveyed.

The methodology for this survey followed the “Identification of Woodland Caribou Calving and Nursery Sites” from MNR’s *Selected Wildlife and Habitat Features: Inventory Manual* (Timmerman, 1997). Most islands and every 1-2 km of shoreline were surveyed by walking a 100 m transect (perpendicular to the shoreline) or across an entire island if the island was less than 500 m in width (Timmerman, 1997). If the island was larger than 500 m in width, 100 m transects were sampled approximately every 1 km (Timmerman, 1997). All data (including absence data) were recorded at each site. Caribou sightings included adult/calf tracks, adult/calf beds, hair, pellets (faecal droppings), shed antlers, and tree rubs. Any mother and calf pellets and/or mother and calf beds were classed as nursery habitat (i.e., areas being occupied by cow/calf pairs during the summer months). Most sand beaches were surveyed due to the ease of track and freshness identification. All sighting locations were recorded using a Global Positioning System (GPS). Absence sites were defined as 100 m transects with no caribou sightings. Pellets were collected and kept frozen for shipping to Trent University Wildlife Forensic DNA Laboratory for analysis.

In 2004, peatland complexes were examined for mother/calf use. Remote fens/bogs, which are defined as being at least 5 km from an outfitter, were accessed by helicopter. Fen/bogs adjacent to lakes were accessed by boat. Transects were set and sampled on islands in peatland complexes. All signs of caribou (i.e., tracks, pellets, beds) were recorded.

Results

Caribou Nursery Areas

A total of 46 and 98 nursery sites were identified in WPP and WCSS respectively. A total of 197 DNA samples were collected and analyzed at Trent University Wildlife Forensic DNA Laboratory.

Caribou re-use of nursery areas vary dramatically between the two protected areas (Table 1). In WPP there is a very high re-use of nursery sites (94.7%) in comparison with WCSS (33.0%). We speculate that this difference may be attributed to the possibility that nursery sites may be more available in

WCSS, thus mothers have many more options from year to year. Interestingly, adult-only use is substantially higher in WCSS than in WPP.

Table 1. Re-surveyed nursery sites in both protected areas in study years.

Re-use of Nursery Site	WPP n=38	WCSS n=85
Nursery Sign (%)	94.7	33
Adult Sign Only (%)	2.6	49
No Sign (%)	2.6	18

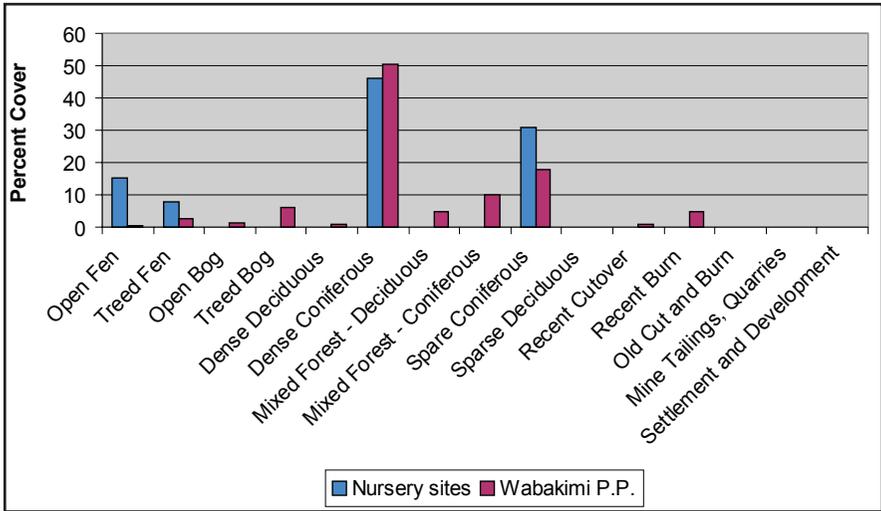
The remote fen/bog sites in WPP had a dramatically higher proportion of nursery sign (60%) than the adjacent fens/bogs (21%) (Table 2). Likewise, the adjacent fen/bog sites in WPP had a much higher proportion of no caribou evidence (58%) compared to the remote fen/bog sites (20%). Based on these patterns we suspect that caribou are preferentially selecting more remote wetlands for nursery sites. The cause of this pattern is difficult to isolate as the fens and bogs near outfitters may be perceived differently than the remote fens and bogs by woodland caribou. Due to lack of resources, remote fens and bogs were not examined in WCSS. Interestingly, the high proportion of wetlands with only adult sign in WCSS (64%) is consistent with re-surveyed nursery sites (i.e., islands, peninsulas, shoreline) in WCSS (see Table 1).

Table 2. Caribou sign in relation to transects walked in each protected area in the 2004 fen and bog study.

	WPP		WCSS	
	Remote Fen/Bog (n=5)	Adjacent Fen/Bog (n=19)	Remote Fen/Bog (n=0)	Adjacent Fen/Bog (n=33)
Nursery Sign (%)	60	21.1	0	3
Adult Sign Only (%)	20	21.1	0	63.7
No Sign (%)	20	57.9	0	33.3

Open and treed fens have a much higher nursery site use than the availability in WPP (Figure 1). Treed bogs were sampled in the field but no nursery use was found. Both dense and sparse conifer categories are abundant in WPP and are frequently used as nursery sites. No other land-cover classes had nursery use.

Figure 1: Distribution of land-cover types (Land-cover 28 satellite imagery) in relation to used nursery sites in WPP.



DNA Analysis

Over 200 samples were collected during the summer months of 2001 to 2004. DNA extraction results were poor for pellets collected in the summer months. This is likely due to environmental factors such as sun and rain, which probably degraded the DNA contained in the epithelial cells (i.e., cells lining of stomach contained in the mucosal coating) on the outside of the faecal pellets (Ball and Wilson, 2004). However, preliminary results suggest some site fidelity within each park due to the fact that there were very few haplotypes shared among the Wabakimi population and the Woodland Caribou population. This suggests that very different maternal lines utilize these areas. There was also a 95% re-use rate of mother/calf pair sites in WPP, and 33% re-use of mother/calf pair sites in WCSS in the summer of 2003 (see Table 1).

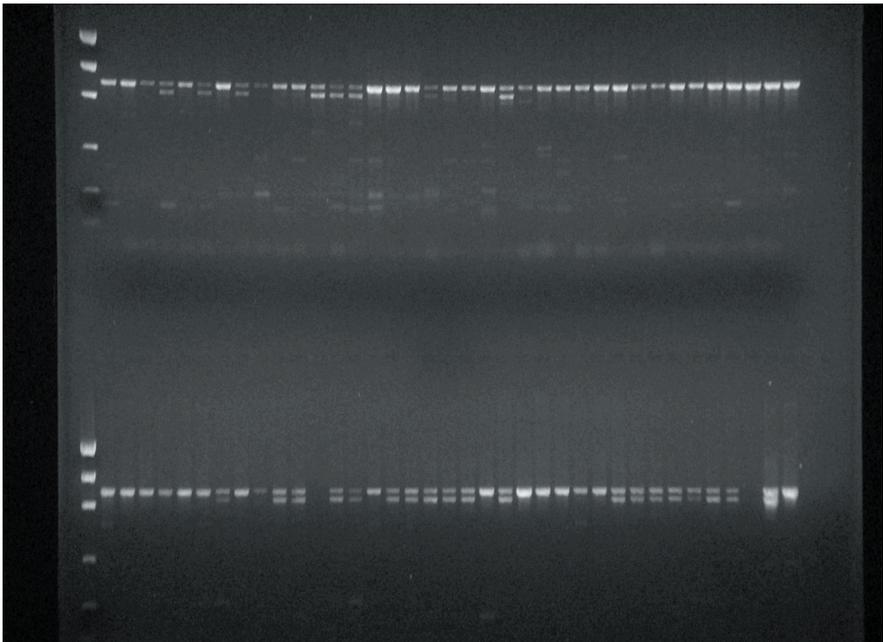
Summer Sampling and DNA Analysis (Ontario)

DNA extraction involved washing faecal pellets to remove the mucus layer on the outer epithelial surface cells. Fifty-two % of samples successfully amplified both mitochondrial and small nuclear DNA microsatellites; however, we had no success in the amplification of large high molecular weight gender markers (approximately 900 base pairs) and microsatellite markers larger than 250 base pairs. This suggests that the DNA extracted from faeces collected in summer was degraded.

Winter Sampling and DNA Analysis (Manitoba)

Over 200 samples were collected in Manitoba in late January and early February 2004. We successfully sexed all samples using high molecular weight Zfx-Zfy sex chromosome intron markers (920 bp) (Figure 2). We extracted DNA using faecal wash for summer samples collected in Ontario. This analysis raised the possibility of obtaining additional multiplexes and additional microsatellites for analyses.

Figure 2. Amplification of high molecular weight gender markers (Zfx-Zfy), approximately 900 base pairs. One band represents amplification of a homozygous (XX) female and two bands represent amplification of a heterozygous male (XY).



There was a high contrast between the faeces collected in the winter and summer. Winter collected samples were highly successful in the extraction of high quantities of quality DNA which was evident in the amplification of high molecular weight gender markers and all microsatellites utilized. Our results here show that winter collected samples provide the best opportunity to obtain quality faecal DNA which will produce minimal analytical error.

Management Implications

A number of forest management planning implications have arisen from these results.

- Peatland complexes are important areas to inventory and monitor for caribou calving/nursery areas. These areas require adequate monitoring and protection in forest management planning in order to protect corridors and minimize fragmentation.
- Nursery areas should be considered as critical as calving areas especially in forest management planning because nursing is a critical component of woodland caribou life cycle and sites are frequently re-used.

We recommend the following to minimize recreation impacts on caribou within protected areas.

- Protection of high-use areas including ample buffered zones to ensure connectivity for movement patterns throughout the seasons.
- Exclude recreational use or have assigned camping and shore lunch areas during the sensitive calving/nursery period from May to August.
- When boats are permitted in a protected area, the number of boats and horsepower size should be limited.
- Outfitters should be required to report number of guests to the park superintendent to monitor use near calving/nursery areas.
- Education of park users on the importance of calving/nursery activity. Park users should be able to identify caribou calving/nursery sign so that they do not disturb these calving/nursery areas.

Conclusions

With respect to site fidelity, there was a 95% and 33% re-use of sites by caribou mother/calf pairs in 2003 in WPP and WCSS, respectively (Table 1). Although we currently cannot be positive that maternal lines are using the same island/area from year to year, there is clearly re-use of sites. This suggests that these areas are providing suitable habitat to caribou cow/calf pairs during the nursery phase.

Bogs and fens were clearly important nursery areas for woodland caribou in WPP, especially those found in remote areas (Table 2 and Figure 1). Future studies are required in order to establish the level of site fidelity, as well as use by caribou in fen/bog sites during the calving/nursery season. These areas, which could potentially be critical to the life cycle of caribou, are often overlooked.

Mitochondrial DNA analysis did suggest that there was haplotype structuring within the areas of Woodland Caribou and Wabikimi Provincial Parks. However, as we could not determine the gender of these individuals, we could not provide information as to female phylopatry in these areas. As such, it is imperative that similar analysis be performed on Faecal DNA

collected in winter, which are not limited by degradation, and can provide additional information such as the gender critical for accurate analysis. Furthermore, DNA from winter collected faeces can also provide the opportunity to utilize microsatellite analysis and determine the fine-scale structure and dispersal dynamics of caribou within these areas.

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References

- Ball, M. and P. Wilson. 2004. *DNA-based Population Structure Analysis using Fecal Material of Woodland Caribou (Rangifer tarandus) from Within and Surrounding Ontario Parks*. Research Project Report: Natural Resources DNA Profiling and Forensic Centre: Peterborough, Ontario.
- Bergerud, A.T., R. Ferguson, and H. E. Butler. 1990. Spring Migration and Dispersion of Woodland Caribou at Calving. *Animal Behaviour*. 39: 360-368.
- Bergerud, A.T. 1975. The Reproductive Season of Newfoundland Caribou. *Canadian Journal of Zoology*. 53: 1213-1221.
- Brown, W.K. and J.B. Theberge. 1985. *The Calving Distribution and Calving-area Fidelity of the Woodland Caribou in Central Labrador*. Department of Biology, University of Waterloo, Paper 5.
- Ferguson, S.H. and P.C. Elkie. 2004. Seasonal Movement Patterns of Woodland Caribou *Rangifer tarandus caribou*. *Journal of Zoology*. 262: 125-134.
- Hillis, T.L., F.F. Mallory, W.J. Dalton, and A.J. Smiegielski. 1996. Preliminary Analysis of Habitat Utilization by Woodland Caribou in Northwestern Ontario using Satellite Telemetry. *Rangifer*. 10: 195-201
- Pare, M. and J. Hout. 1984. *Seasonal Movements of Female Caribou of the Caniapiscou Region, Quebec*. McGill University-Caribou Management. Paper 4
- Schaefer, J.A. 2004. Long-term Range Recession and the Persistence of Caribou in the Taiga. *Conservation Biology*. 17: 1435-1439.
- Stuart-Smith, K. A., C.J. Bradshaw, S. Boutin, D. M. Hebert, and A.B. Rippin. 1997. Woodland Caribou Relative to Landscape Patterns in Northeastern Alberta. *Journal of Wildlife Management*. 61: 622-63
- Timmerman, T. 1997. *Selected Wildlife and Habitat Features: Inventory Manual: Identification and Delineation of Woodland Caribou Winter Habitat*. Ontario Ministry of Natural Resources, ON.