Badger Ecology in the Cariboo Region of British Columbia, Canada

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Extended Abstract: The Cariboo region of British Columbia (B.C.) is the northern extent for many grassland-dwelling species at risk. The North American badger (*Taxidea taxus jeffersonii*) is one endangered species that occurs in the grasslands of the Cariboo (Fig. 1). Badgers were previously thought to be at low densities in the Cariboo region because it is the limit of their distribution; however, the recent number of badger sightings suggests that there may be more badgers in the Cariboo than previously thought. In 2003, research began south of the community of 100 Mile House to (1) determine local distribution and relative abundance of badgers in the region, (2) locate and describe suitable burrowing habitat, and 3) identify key prey species. Herein, we report our preliminary findings within the study area (4337 km^2).

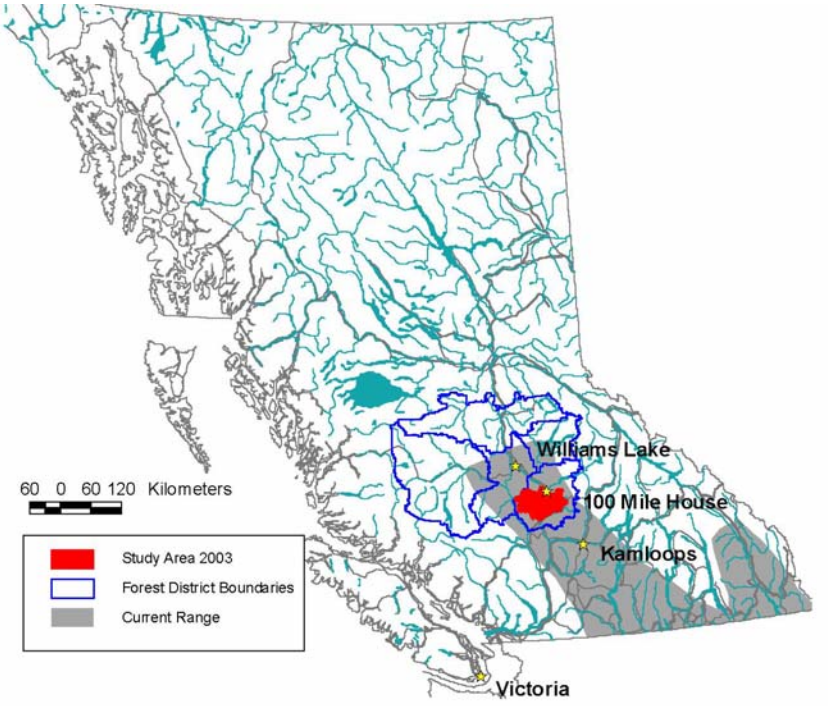

Figure 1. The study area (2003) in relation to the estimated range of badgers in British Columbia (Rahme et al. 1995) and Forest District boundaries in the Cariboo region.

[1]NatureServe Explorer (version 4.0, July 2004) lists *Taxidea taxus* and *T. t. jeffersonii* as the American badger. The BC Species and Ecosystems Explorer (September 2004) lists the common name for *T. taxus* as 'badger'.

Local Distribution and Abundance

Badger sightings reported by the public as well as aerial surveys and ground searches for burrows (n = 368) indicated that badgers are widely distributed across the Cariboo region. We used DNA fingerprinting (D. Paetkau, Wildlife Genetics International, Nelson, B.C.) from badger hair that was either naturally shed or snared using barbed wire snag-sets to identify individual badgers. We collected 105 samples from 65 burrows; 36% of the samples were used to identify individuals and determine sex ratio and minimum home range size.

The extreme variability of the markers used to identify individuals suggested that the study population was large enough to maintain high levels of genetic variability (Table 1, D. Paetkau, pers. comm.). We identified 13 badgers (10 males, 3 females) from 38 samples at 29 burrows. The minimum density of badgers in the area that we surveyed was 1/269 km^2. We calculated 100% minimum convex polygon (MCP) areas for four badgers with ≥ 3 burrow locations (Table 2, Fig. 2). The average MCP area was 77.2 km^2 (SD = 73.5), and average maximum distance traveled was 17.3 km (SD = 15.1). There were four burrows where more than one badger was detected, with detections ranging from 2 to 26 days apart.

Table 1. Observed heterozygosity (H_o) and success rates for the five markers that were selected to identify individual badgers.

Marker	H_o	*Success*
Ma-1	0.61	0.63
Tt-1	0.85	0.88
Tt-2	0.54	0.84
Tt-3	0.61	0.78
Tt-4	0.92	0.84
Mean	0.71	0.80

Table 2. Badgers that were identified with DNA analysis and the minimum number of burrows where their DNA was detected. The 100% minimum convex polygon (MCP) and maximum distance traveled were calculated from these burrow locations.

Badger ID	*No. of burrows detected*	*100% MCP (km^2)*	*Maximum distance traveled (km)*
M002	1	—	—
M004	2	—	20
M005	2	—	0.3
M008	7	178	43
M009	2	—	17
M031	2	—	2.5
M035	2	—	6
M036	6	2.2	8

Table 2. Badgers that were identified with DNA analysis and the minimum number of burrows where their DNA was detected. The 100% minimum convex polygon (MCP) and maximum distance traveled were calculated from these burrow locations (cont'd).

Badger ID	*No. of burrows detected*	*100% MCP (km^2)*	*Maximum distance traveled (km)*
F042	1	—	—
M049	3	57.8	21
F065	3	70.6	38
M097	1	—	—
F104	1	—	—

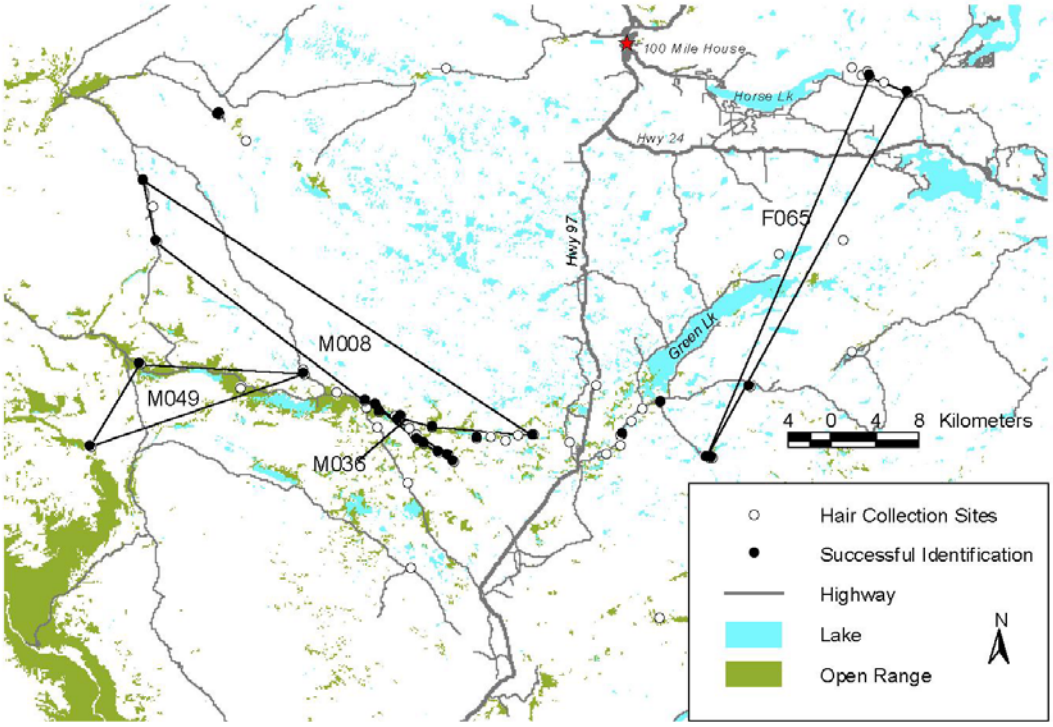

Figure 2. Hair collection sites (*n* = 68) and the locations (*n* = 29) where a badger was successfully assigned to a sample using DNA analysis. Thirteen badgers were identified, and minimum convex polygons were estimated for four badgers (M008, M049, M036, F065).

Results from our pilot study suggested that DNA fingerprinting for individual badgers is a viable option for monitoring the population. Snagged hair samples cost approximately $186 each for field collection and lab analysis, and 53% (27 of 51) of samples were successfully assigned to 12 different badgers. In contrast, field costs for collecting shed hair were very low because it could be combined with other activities, but costs for lab analysis were approximately $157 per sample. The quality of these samples was not as good as snagged hair, and only 20% (11 of 54

samples) of the shed hair samples were assigned to 7 badgers. Despite the lower success rate, we found that using shed hair for DNA fingerprinting is a viable option for censusing the badger population because the hair can be collected opportunistically and analyzed later as funding is available.

Suitable Burrowing Habitat

Badgers in British Columbia require suitable soils for burrowing and sufficient prey to eat (Rahme et al. 1995). In October 2003, we collected vegetation, soils, and prey data at 50 badger burrows that we identified in the study area. We found badger burrows predominantly on grassland slopes adjacent to wetland areas in aeolian soil deposits. Badgers typically inhabited grasslands with little or no (≤ 7%) canopy cover; occasionally, these were small openings in the forest, particularly on hilltops with suitable soils.

Burrows were found mainly in eutric brunisols from (glacio)fluvial or morainal parent material (Valentine and Schori 1980). Burrows were often located in aeolian or lacustrine deposits along esker ridges or in undulating or gently sloping terrain. Soil textures at these sites were mainly coarse silts (0.02–0.05 mm), medium silts (0.006–0.02 mm), and some fine sands (0.05–0.25 mm) (B. Chapman, pers. comm.). All have similar properties, are well drained and easily excavated, and provide stability for the burrow. Most soils dug from burrows had less than 20% coarse fragment content. On occasion, burrows were dug where two soil types met, for example, between aeolian silt deposited over gravel.

Den openings and aboveground runs of potential prey species (ground squirrels [*Spermophilus* sp.], mice and voles, marmots [*Marmota* sp.], and muskrats [*Ondatra zibethicus*]) were counted at all badger burrows surveyed (Fig. 3). On average, there was more prey sign detected at 8 burrows within pine/spruce (*Pinus contorta/Picea glauca*) ecosystems ($\bar{x}$ 13, SD = 11.2) than at 42 burrows within dry Douglas-fir (*Pseudotsuga menziesii*) ecosystems ($\bar{x}$ 4, SD = 3.3) ($t_{0.05}$ = 2.3, DF = 7.2, P = 0.05). More ground squirrel burrows were counted in the pine/spruce ecosystems ($t_{0.05}$ = 2.7, DF = 7, P = 0.03), and this may have been related to the number of hay fields and pastures present, which ground squirrels favor compared to the open rangeland within the dry Douglas-fir ecosystems. Colonies of ground squirrels and marmots may be sparse across the Cariboo, and ground squirrels do not occur west of the Fraser River (Nagorsen 1990). In the absence of these species, badgers may rely more on microtine rodents or species that they can find in riparian habitats.

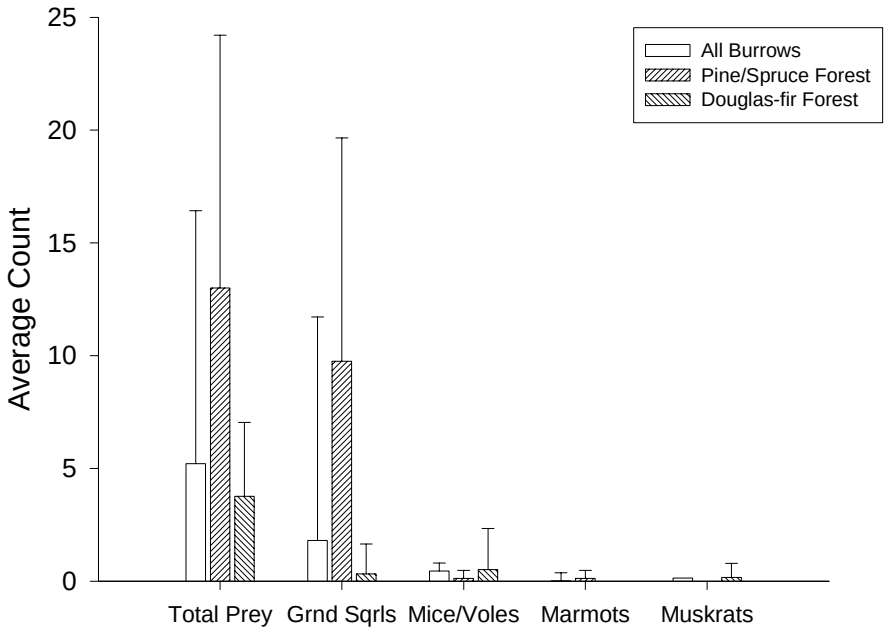

Figure 3. Average number of den openings (+ SD) of prey species counted at all badger burrows (*n* = 50), and separated into burrows occurring in Douglas-fir ecosystems (*n* = 42) and pine/spruce ecosystems (*n* = 8) in the Cariboo region.

In the Cariboo region, there was evidence of badgers excavating muskrat burrows along the shores of wetlands and small lakes. This has not been reported elsewhere in British Columbia but was observed in Nebraska where meadow vole (*Microtus pennsylvanicus*) populations were declining (Errington 1963). Of all badger burrows and sightings recorded in the Cariboo, 23% were within 50 m and 12% were within 15 m of a wetland or lake.

Key Prey Species

Badgers are specialized for hunting fossorial prey, but will supplement their diets with a number of other mammals, birds, eggs, reptiles, amphibians and invertebrates, and some berries (Messick 1987). Prey remains (bones, feathers, etc.) were collected at burrow locations, and 42 samples were sent to experts for identification (S. Crockford, Pacific IDentifications, Victoria, B.C.; University College of the Cariboo, Kamloops, B.C.). A broad range of taxa were identified in the samples. The most common species were rabbit/hare (Leporidae), marmot, and muskrat, which each occurred in 12% of the samples, and at least 6 individuals of each species were identified. Rodents, such as Columbian ground squirrels (*Spermophilus columbianus*), red squirrels (*Tamiasciurus hudsonicus*), and murids were also commonly found in the samples. There was evidence that badgers had likely scavenged mule deer (*Odocoileus hemionus*), and had

also consumed ducks, geese, grouse, starlings, frogs or toads, and at least one longnose sucker (*Catostomus catostomus*).

Conclusions

Our preliminary results suggest that there are more badgers in the Cariboo region than may have been previously expected, and that these badgers may be an important source of genetic variability for the B.C. population. Badger habitat associations are unique in the Cariboo region compared to the rest of the province because badgers in the Cariboo move through predominantly forested habitat, have a stronger association with wetland complexes, and may rely on these areas as a major source of food. Measures to prevent loss of badger habitat in the Cariboo should protect and restore burrowing and foraging habitat, and should ultimately increase public awareness and appreciation of badgers and their prey.

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References

Errington, P. 1963. Muskrat populations. Iowa State University Press. Ames, Iowa.

Messick, J. P. 1987. North American badger. Pages 586–597 in M. Novak, J.A. Baker, M.E. Obbard, and B. Mallock, editors. Wild furbearer management and conservation in North America. Ontario Trappers Association, North Bay, Ontario.

Nagorsen, D.W. 1990. The mammals of British Columbia: a taxonomic catalogue. Royal British Columbia Museum, Victoria, British Columbia.

Rahme, A.H., A.S. Harestad, and F. L. Bunnell. 1995. Status of the badger in British Columbia. Wildlife working report WR-72. Wildlife Branch, British Columbia Ministry of Environment, Lands and Parks, Victoria, British Columbia.

Valentine, K.W.G., and A. Schori. 1980. Soils of the Lac La Hache-Clinton area, British Columbia. Research Branch, Agriculture Canada, Vancouver, British Columbia.

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