Ya Ha Tinda Carnivore Diet Analysis: Project Update

Kara MacAulay, Eric Spilker, Jodi Berg and Evelyn Merrill,
Department of Biological Sciences - University of Alberta
Submitted to: The Wild Sheep Foundation of Alberta


Photo Credit: K. MacAulay.

SUMMARY

The following is a project update that describes field work completed the summer of 2016, and preliminary data analyses as part the M.Sc. project of Kara MacAulay at the University of Alberta. Scat analysis is continuing this summer and will be completed in Fall 2017.

BACKGROUND

Large predators play an important role in the trophic structure of an ecosystem, and this awareness has led to a greater emphasis on their conservation and management (Estes et al. 2011). Predation shapes prey communities and there is evidence that prey perceive the risk of predation, as they navigate a "landscape of fear" and alter their behaviour in response (Laundré et al. 2001). For example, effects of predation risk have been shown to affect habitat selection, migratory behaviour and reproductive fitness of female elk (*Cervus elaphus;* Hebblewhite et al. 2006; Creel et al. 2007).

Predation risk has previously been modeled using surrogates for risk such as distribution of predators or encounters between predator and prey (Kristan and Boarman 2003; Hebblewhite et al. 2005). Although commonly used, the above approaches of modeling spatial risk based on predator distribution may not reflect a successful attack. I address an alternative to these approaches for mapping large-scale predation risk based on mortality by relating features within a movement buffer to prey contents of predator scats.

Wolves and cougars are major predators of bighorn sheep in Alberta, although the impact of these predators on sheep varies regionally. Through an extensive analysis of wolf kill sites and scats in the montane and foothill region, there was no evidence of wolf killed sheep in west central Alberta near Nordegg (Webb et al. 2010, Knamiller 2011) while sheep made up 1.5% of ungulate biomass in wolf diets (estimated from scats) 100-km south in Banff National Park (Huggard 1993) in the more montane area. Knopff et al. (2010) found sheep comprised 1.67% of cougar diets over a ten-year period in the Clearwater County and Bow Valley regions of west central Alberta. Cougars tend to be generalist predators, but could potentially reduce populations in small, isolated sheep populations, due to individual specialists (Knopff and Boyce, 2007). In southwestern Alberta, Ross et al. (1997) found evidence of sheep specialists, where one female killed 9% of a sheep population in a single season. Coyotes and bears have been observed killing bighorn sheep in Alberta, although these observations are not common throughout the literature (Shank 1977; Festa-Bianchet 1988)

Figure 1. A cougar latrine located by a scat detection dog in Banff National Park. Cougar scats were often found at the base of a coniferous tree buried under duff or litter. *Photo credit: E. Spilker*

The goal of this project is to provide a spatial model of mortality risk for bighorn sheep in the Upper Red Deer River drainage encompassing Ya Ha Tinda, through measuring spatial distribution of prey contents in scats. We hypothesize that prey distribution will have a considerable impact on what prey contents are found in scats. We predict that scats found closer to sheep ranges will be more likely to contain sheep in scat relative to scats located farther from sheep ranges.

OBJECTIVES

The overall objective is to determine whether spatial differences in predator diets reflect predation risk for bighorn sheep relative to sheep ranges. Using scats from five large carnivores, specifically we will:

(1) determine which ungulate species comprise what proportions of the scats of wolves, coyotes, cougars, grizzly bears and black bears

(2) spatially model the mortality risk to bighorn sheep and other ungulates based on scat contents across the Ya Ha Tinda region and assess model predictions to known ungulate kill sites.

METHODOLOGY

Scat collection:

Using scat detection dogs and opportunistic collection, cougar, grizzly bear, black bear, coyote and wolf scats (n=700) were collected along ~1500-km of transects over a 1425-km^2 study area from 2013-2016 (Figure 2).

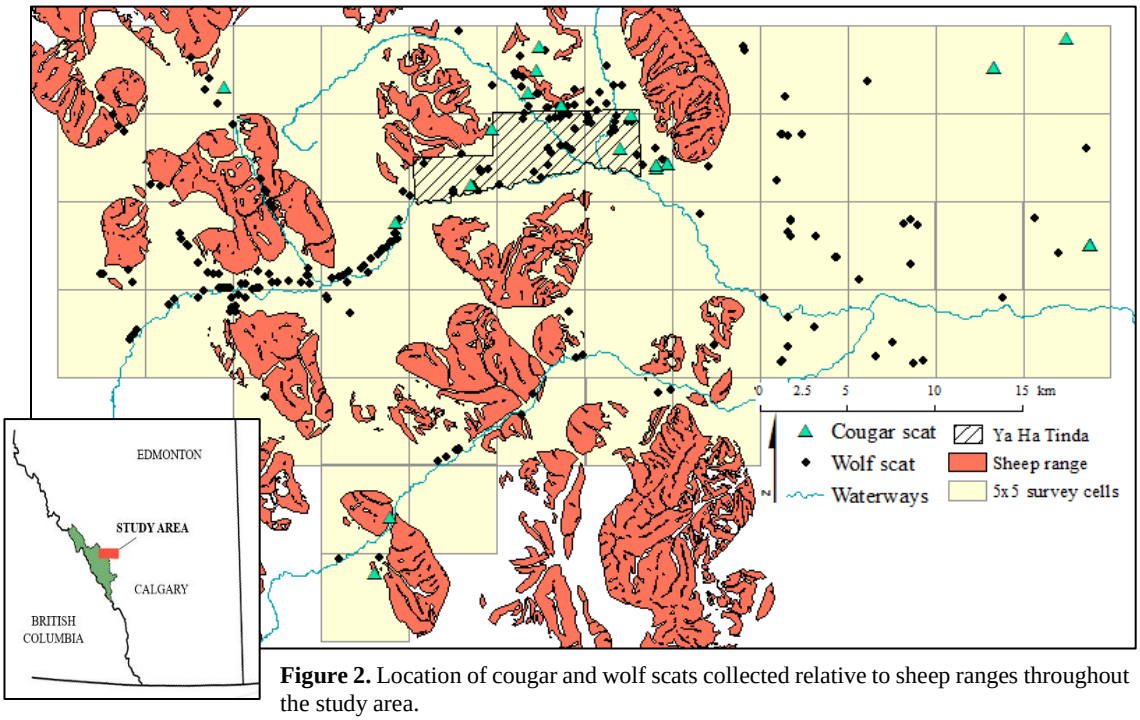

Figure 2. Location of cougar and wolf scats collected relative to sheep ranges throughout the study area.

When a scat was located, handlers recorded the suspected species based on physical characteristics such as scat diameter measurement ranges and physical descriptions of Elbroch (2003), Weaver and Fritts (1979) and Rezendes (1992). Scats were ranked visually based on colour, moisture level, presence of mold, and weathering of fecal material to estimate time of defecation.

Figure 3. A cougar scat with indigestible material (hair and bones) useful for prey identification. *Photo credit: E. Spilker*

To verify field identification of scats, we swabbed a subset of the scats for DNA using non-finished toothpicks following protocols recommended by Wildlife Genetics International.

Laboratory analyses

A subset of scats (n=300) were selected for macroscopic analysis. Scats were autoclaved and washed to remove dirt and debris and indigestible material (bones, hair and vegetation) was isolated. We randomly selected 20 hairs and identified each to species and age-class using reference keys that differentiate various microscopic characters for species. To date, we have analyzed wolf (n=40) and cougar (n=10) scats.

We also will analyze all scats (n=500) using a DNA analysis technique that extracts DNA from hair present in scat (Wildlife Genetics Int'l, Nelson, B.C.) The DNA approach is time-effective but indicates only the primary prey species present. To date, 75 samples have been sent for analysis and we expect results summer 2017.

Sheep ranges

As part of his MSc. thesis, Eric Spilker derived bighorn sheep resource selection values for the Ya Ha Tinda region (Figure 2) using a resource selection function (RSF) developed for sheep in Montana (DeCesare and Pletscher 2006). Data used to build the RSF came from aerial surveys conducted by Parks Canada from 1988 to 2012. We will use the RSF values to determine whether bighorn sheep occurrences in scats are best explained by proximity to sheep ranges.

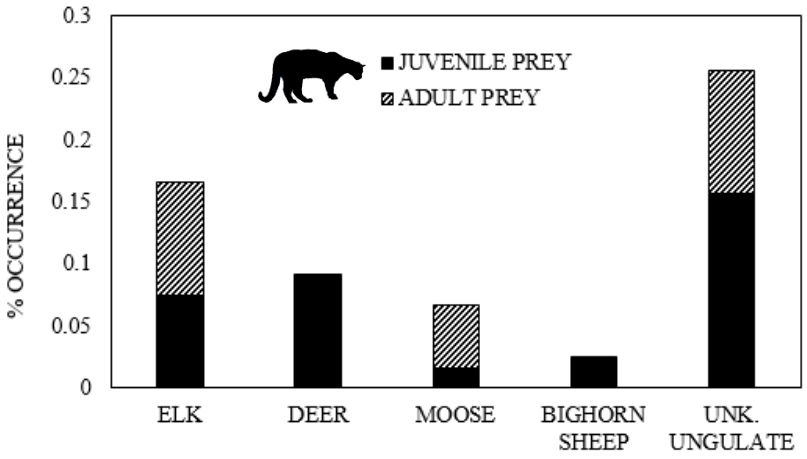

Figure 4. Percent occurrence of prey hairs in cougar scats (n=10).

PRELIMINARY RESULTS

Ungulates make up a large portion of wolf (77%) and cougar (66%) diet, where juvenile ungulates occur more frequently than adult ungulates across all species (Figure 4 and 5). There is high diet overlap between wolves and cougars, with the exception of two species; bighorn sheep was significantly more frequent in cougar scat relative to wolf scat (Mann-Whitney U-test, $P<0.001$). One feral horse occurrence was found in wolf scat, where no occurrences were found in cougar scat.

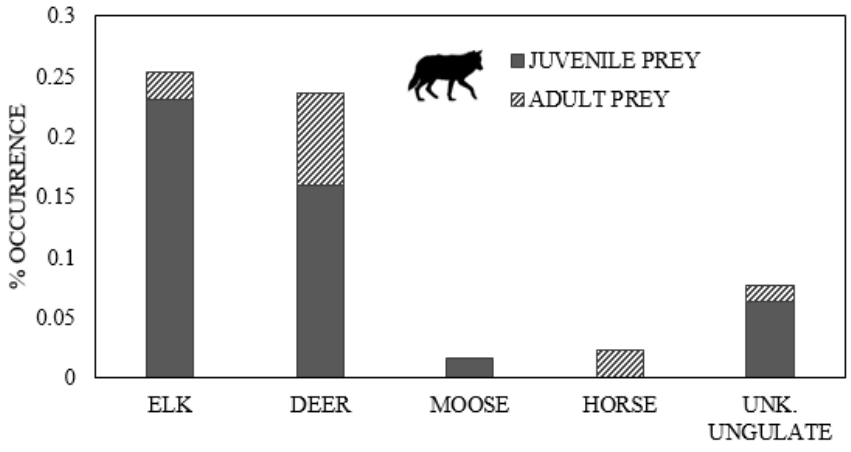

Figure 5. Percent occurrence of prey hairs in wolf scats (n=40).

We found 3 occurrences of juvenile bighorn sheep in 2 cougar scats: (1) adjacent to the border of Banff National Park along the Red Deer River (~2-km from sheep range, and (2) in the northeastern portion of the study area along the James River (~15-km from sheep range). We have found no

occurrences of bighorn sheep in wolf scat to date, where the scats are located on average 3.2 +/- 5.1 km from sheep ranges

Scat analyses will be completed in fall 2017 at which time I will model bighorn sheep predation risk based on scat contents.

ON-GOING ANALYSES

- Continue to analyze wolf and cougar scats, as well as coyote and bear.
- Determine what variables (prey distribution/sheep ranges and landscape) best predict the amount and presence/absence of bighorn sheep in scats of the four carnivores across the study area
- Use known ungulate kill sites (2002-2017) and to validate predictions of mortality risk.

Figure 6. Eric Spilker and Rounder taking a break from surveying for carnivore scat in Banff National Park. *Photo credit: K.MacAulay*

SIGNIFICANCE

This study extends work done by a current MSc. Student using scats to study spatial interactions among predators based on distribution of scats to better understand the pressure of summer predation on bighorn sheep and other ungulates. This study will be an important next step for improving the assessment of spatial risk to bighorn sheep and other ungulates and addresses the question in a novel way.

ACKNOWLEDGMENTS

We would like to thank the project collaborators and funding partners: Alberta Conservation Association, Colleges and Institutes Canada, NSERC Discovery Grant # RGPIN-2016-04733, Parks Canada, Safari Club International- Northern Alberta Chapter, TD-Friends of the Environment Foundation, University of Alberta, University of Montana and the Wild Sheep Foundation of Alberta. We would also like to thank Rick and Jean Smith and other Parks Canada staff for their continued support of our research and for logistical help with use of the ranch facilities and backcountry cabins. We would especially like to thank Eric Spilker, Jodi Berg and their detection dogs Rounder and Shrek. Your knowledge of the study area and willingness to always keep on surveying allowed us to be very successful each field season. Without all of your support, this project would not be possible!

Funding provided by the Wild Sheep Foundation of Alberta allowed us to hire a technician to assist in scat analysis and contract the services for DNA analysis of scat prey contents. We thank you for your past and continued support of our research.

OUTREACH

The Wild Sheep Foundation of Alberta was acknowledged in a poster presented at the R.E Peter Student Symposium at the University of Alberta in January 2017, and at the Canadian Parks Conference in Banff, AB in March 2017, and in an oral presentation at the Alberta Chapter of The Wildlife Society where Kara MacAulay received a Best Student Presentation Award.

LITERATURE CITED

Berg, J.E., E. Spilker, J. Killeen, M. Hebblewhite, and E. Merrill. 2016. Ya Ha Tinda Elk and Predator Studies: 2015-2016 Update. Department of Biological Sciences, University of Alberta, Edmonton, AB, Canada. 58 pp.

Creel S., D. Christianson, S. Liley, J.A. Winnie 2007. Predation risk affects reproductive physiology and demography of elk. Science 315:960.

Estes J., J. Terborgh, J.S. Brashares, et al. 2011. Trophic downgrading of planet Earth. Science 333:301–306.

Elbroch, M. 2003. Mammal tracks & sign: a guide to North American species. Stackpole books.

Festa-Bianchet, M. 1988. Seasonal range selection in bighorn sheep: conflicts between forage quality, forage quantity, and predator avoidance. PhD thesis. University of Calgary, Alberta, Canada.

Hebblewhite M., E.H. Merrill L.E. Morgantini. 2006. Is the migratory behavior of montane elk herds in peril? The case of Alberta's Ya Ha Tinda elk herd. Wildl Soc Bull 34:1280–1294.

Hebblewhite M., C.A. White, C.G. Nietvelt CG, et al. 2005. Human activity mediates a trophic cascade caused by wolve. Ecology, 86:2135–2144.

Huggard, J. 1993. Prey selectivity of wolves in Banff National Park. I. Prey species. Can J Zool. 71:130-139

Knamiller, P.T. 2011. Seasonal Wolf Predation in a Multi-Prey System in West-Central Alberta. MSc. thesis, University of Alberta, Edmonton, Alberta Canada.

Knopff, K.H. A.A Knopff, A. Kortello, M.S. Boyce. 2010. Cougar kill rate and prey composition in a multiprey system. J Wildl Manage 74:1435–1447.

Kristan, W.B. and W.I. Boarman. 2003. Spatial pattern of risk of common raven predation. Ecology 84:2432–2443.

Laundré, J.W., L. Hernández, K.B. Altendorf. 2001. Wolves, elk, and bison: reestablishing the "landscape of fear" in Yellowstone National Park, U.S.A. Can J Zool 79:1401–1409.

Ross, P.I. M.G. Jalkotzy, M. Festa-Bianchet. 1997. Cougar predation on bighorn sheep in southwestern Alberta during winter. Can J Zool 775:771–775.

Shank, C. 1977 Cooperative defense by bighorn sheep. J Mammal 243–244.

Wasser, S.K., B. Davenport, E.R. Ramage, K.E. Hunt, M. Parker, C. Clarke, and G. Stenhouse. 2004. Scat detection dogs in wildlife research and management: Application to grizzly and black bears in the Yellowhead Ecosystem, Alberta, Canada. Canadian Journal of Zoology 82: 475-492.

Weaver, J.L., and S.H. Fritt. 1979. Comparison of coyote and wolf scat diameters. Journal of Wildlife Management 43: 786-788.

Webb, N. 2010. Density, demography and functional response of a harvested wolf population in west-central Alberta, Canada. PhD thesis, University of Alberta, Edmonton, Canada.