Coyote diet and conflict in urban parks in Calgary, Alberta

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Abstract – *Urban parks are an attractive component of cities and may be essential for maintaining urban ecosystem function. However, when parks are inhabited by coyotes (*Canis latrans*), concerns for the safety of children and pets often arise. Recent attacks upon children in Calgary (2005) and Canmore (2007), Alberta emphasize the need to understand and mitigate this threat. It has been postulated that the availability of human food sources may increase the potential for human-coyote conflict. Our research is the first empirical field based study addressing this issue in Calgary; our focus is on developing a baseline understanding of dietary composition within parks. We hypothesized that the anthropogenic content in coyote diet may be greater in parks with more conflict. Scat was collected bi-weekly in seven sites within Calgary, from August 2006 – September 2007. Dietary analysis has yielded evidence of rodents, berries, vegetation, human garbage, and pets. Small mammals make up the majority of Calgary's coyote diet. Garbage found in scats includes tissue, plastic, rope, paper, foil and rubber. Results from dietary and conflict analysis (based upon City of Calgary data) will be discussed. It is our intent that these contributions will be used by park and wildlife managers to mitigate conflict.*

Keywords: *Coyote, diet, conflict, urban parks*

Introduction

The coyote (*Canis latrans*) is a very successful, highly adaptable Canid (Fox and Papouchis 2005; Morey, Gese, and Gehrt 2007). Unlike most species, it has benefited from the European settlement of North America, taking advantage of the removal of its primary predator, the wolf (*Canis lupus*), and the removal of forests and creation of increased edge habitat (Fox and Papouchis 2005). While the historic range of coyotes is thought to have been confined primarily to the grasslands and prairies of western and central North America, today coyotes are found from the east to west coast, from the tundra of the north to Panama in the south (Bekoff 1977; Fox and Papouchis 2005; Gompper 2002).

Along with this range expansion into a variety of natural habitats, coyotes have also learned how to behaviourally adapt to and even succeed in urban environments (Fox and Papouchis 2005; Morey, Gese, and Gehrt 2007). However, carnivores and humans living in close proximity to each other often leads to concern and even conflict (Atkinson and Shackleton 1991; Gompper 2002; Morey, Gese, and Gehrt 2007; Riley et al. 2003). Conflict is here defined as any human-wildlife interaction that physically harms the human, their property, or the wildlife species in question, or where there is clear threat to physical safety. The potential for conflict and even danger to human safety that exists when a wild predator moves into areas of high human density is a cause for concern (Timm et al. 2004). Aggressive encounters with children and pets in 2005 sparked fears amongst residents of Calgary, Alberta (Canadian Broadcasting Corporation 2005). Many other cities have had problems with coyotes. Some urban centers with established and studied coyote populations include but are not limited to Vancouver, Chicago, Tucson and Los Angeles (Ditchkoff, Saalfeld, and Gibson 2006; Grinder and Krausman 2001; Morey, Gese, and Gehrt 2007). The only known case of human death originating from a coyote attack happened in Los Angeles (Pool 2007). It has been both theorized and observed that coyotes will take advantage of pets as easy prey (Trout Jr. 2001). It is also thought that human sources of food-availability (*i.e.*: garbage, pets, bird seed) are a causal factor in these attacks and aggressive encounters (Bekoff and Gese 2003; Carbyn 1989).

The perceived and potential risks of coyotes to human safety leads some urban citizens to prefer to see coyotes exterminated from their city. However, lethal control is not generally accepted in our society (Gehrt 2004; Gibbs 2001), and in fact these methods are often ineffective at removing coyotes (Fox and Papouchis 2005; Gompper 2002). Coyotes will change their activity patterns, social structure and breeding behaviours when persecuted (Fox and Papouchis 2005; Kitchen, Gese, and Schauster 2000). In areas of high persecution by humans, coyotes often live in pairs, and not packs (Fox and Papouchis 2005). In this situation, all adult coyotes are available to mate and reproduce annually, as opposed to only the alpha pair breeding (Fox and Papouchis 2005), resulting in population growth. With the removal of some coyotes, the remaining coyotes have reduced intraspecific competition over resources, resulting in a higher pup survival rate (Fox and Papouchis 2005). Even if a city were able to eliminate all its resident coyotes, transients and young coyotes dispersing from the rural or natural areas near the city will find these available areas and move in to fill them. Thus, coyote persecution within an urban area often results in an eventual increase in the coyote population (Fox and Papouchis 2005). Furthermore, extermination is unfavourable from an ecological perspective (Bekoff and Gese 2003; McKinney 2002) as coyotes can provide a valuable role in keeping prey populations in check, such as rodents and geese (Chew 2005; Fox and Papouchis 2005).

The risks discussed above coupled with the rapid urban expansion of the city of Calgary emphasize the need to understand the role humans and wildlife play in these conflicts. It is hoped that such an understanding will facilitate the design of an urban ecosystem that allows coexistence by minimizing conflict between humans and coyotes. Therefore, the purpose of our research is to examine the relationships between coyote diet, biogeographical features of the landscape, and human-coyote conflict. Through our research, we hope to provide an understanding of how human sources of food affect the potential for coyote conflict, and make recommendations for park design and garbage management to promote long-term coexistence of people and coyotes in Calgary. This paper will focus on the preliminary results of dietary analysis and how this relates to management.

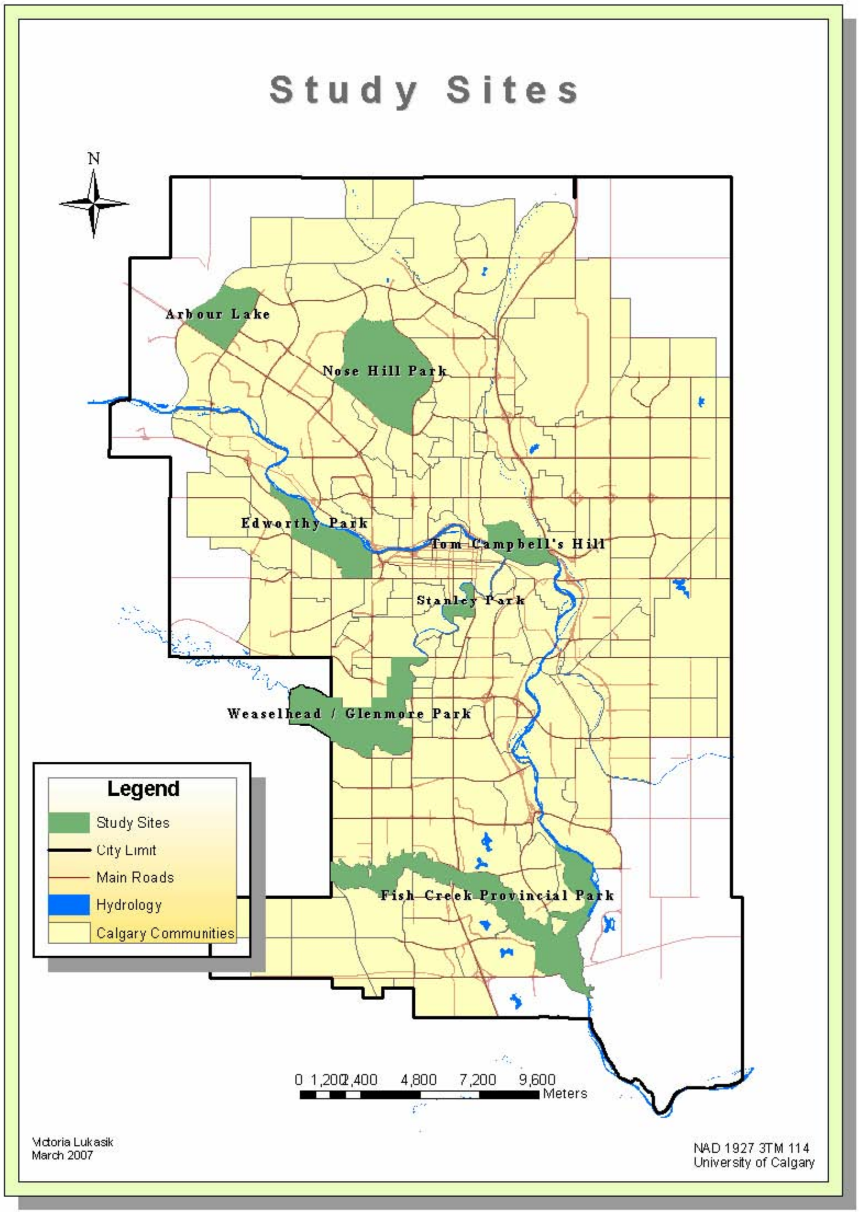
STUDY AREA

This study takes place in seven sites throughout the city of Calgary (see Fig. 1), located in southwestern Alberta, in the foothills of the Canadian Rocky Mountains. Calgary has a population of just over one million in an area of 5083 km^2 (Calgary Herald 2006). It is composed of an inner city surrounded by sprawling suburbs, all still considered part of the city proper. Population density is greatest at the core, and decreases as one moves outward.

Calgary has a relatively hilly topography, as the prairies meet the foothills of the Rocky Mountains (Foley 2006). The elevation within the city ranges from 1060 meters above sea level in the river valleys to 1240 meters above sea level in the surrounding hills (Foley 2006). In some areas the elevation change is very abrupt. This causes Calgary's many microclimates, which result in an increased biological diversity within the city (Foley 2006).

Two major rivers run through the city; the Bow River and the Elbow River. There are also several creeks within the city, Fish Creek, Nose Creek and West Nose Creek, as well a large, though not natural, lake, the Glenmore Reservoir (Foley 2006). These numerous water bodies result in hundreds of kilometers of riparian habitat within the city (Foley 2006). There are a variety of habitats within the city. This is particularly due to the fact that the boundary between the Aspen Parkland and Fescue Grassland Natural Region runs directly through the city (Foley 2006). However, while Calgary has a rich variety of natural habitats, much of the city is also manicured and exotic invasive vegetation – especially those popular in private landscaping – is a constant challenge (Foley 2006).

Calgary has a highland continental climate, which includes a long variable winter and short warm summers (Foley 2006). Warm, dry Chinook winds from the west raise winter temperatures drastically for several days at a time (Foley 2006). These winds cause regular thawing and freezing of snow and water bodies. It also leads to great temperature extremes, but a climate where no cold or warm spell lasts very long.



<u>Figure 1</u> - Study sites and surrounding communities

The study sites for this project include Arbour Lake (AL), Nose Hill Natural Environment Park (NH; the largest urban park in Canada), Edworthy Park (ED), Tom Campbell's Hill (TCH), Stanley Park and Erlton/Roxboro Natural Area (SPR), Weaselhead Natural Wildlife Area and North Glenmore Park (NGW), and Fish Creek Provincial Park (FC; the largest provincial park found within a Canadian city; Foley 2006). Sites were chosen based upon verified reliable coyote presence, variation in size, habitat type, and location. Table 1 below summarizes some main characteristics of the study sites.

<u>Table 1</u>: Study Sites (Foley 2006)

Site	Total Park Size	Major Habitat Types	Degree of Human Interface	Park Established
Nose Hill Natural Environment Park	1128 ha	GL, CL, QU	Low	1980
Tom Campbell's Hill Natural Area	18 ha	GL, PS	Medium	1991
Edworthy Park	169 ha	DG, FP, RH	Medium	1962
Stanley Park / Erlton/Roxboro Natural Area	60 ha	DF, GL, PS	High	1984
Arbour Lake	0 ha	GL, PS	High	N/A
Fish Creek Provincial Park	1348 ha	CF, DF, GL, RH	Low	1973
North Glenmore Park and Weaselhead Natural Wildlife Area	237 ha	CF, DL, DF, GL, PS, RH	Low	1971

CF: Coniferous Forest FP: Foothills Parkland (transition: GL to aspen forest)
CL: Coulees (dominated by trembling aspen, shrubs, vines) GL: Grasslands DF: Deciduous Forest PS: Poplars and Shrubs DL: Delta QU: Quarry (being naturally recolonised by flora & fauna) DG: Douglas Fir Forest RH: Riparian Habitat

METHODS

Scat Collection

Scat analysis is a recognized method used to determine diet composition (Kennedy and Carbyn 1981; Novack et al. 2005; Prugh 2005), and has been found to provide a reliable measure of coyote diet patterns (Prugh 2005). The fieldwork consisted of one complete year of scat collection (Aug 2006 - Sept 2007).

Study sites (see Fig. 1) were selected based upon presence, incident reports (Calgary Animal Services 2007), den sites and habitat characteristics (see Table 1). Each study site covers a circular area of approximately 3.14 km^2 (1 km radius), centered on the den site when available. This is equal in size to many urban coyote home ranges (Fox and Papouchis 2005; Grinder and Krausman 2001).

Fixed trails within this search area were surveyed for scat every two weeks. Macdonald (1980) noted that coyotes define their territories not only with urination but also by depositing their faeces at strategic and often conspicuous locations, including trail junctions and boarders. Any coyote scats found were bagged and marked for later dissection. Scat analysis was then conducted to determine diet composition at each site during the corresponding times of year.

Coyote scats found were distinguished from dog scat with the following criteria (Halfpenny and Biesiot 1986):

Size: 12-30mm in diameter (varied in dogs)
Colour: dark, gray or reddish colour (not yellowish as for dogs)
Shape: thick or folded cords, often tapered (smooth, tubular for dogs)
Texture: firm to hard, except when primarily consisting of berries (soft and grainy for dogs)
Location: usually on paths and trails, or edge of paths and trails (dogs tend to

defecate in grassy areas off trails and paths) In addition, any scat with a diameter less than 18mm was also discarded to avoid misidentifying the common and very similar red fox (*Vulpes vulpes*) scat for coyote scat.

Dietary Analysis

Scats collected were stored in a standard freezer (-18 ºC). Before analysis, scat samples were placed in a deep freezer (-80ºC) for a minimum of 72 hours, to eliminate the danger of parasite transmission, particularly that of the granular tapeworm (*Echinococcus* spp.; Kennedy and Carbyn 1981).

Samples were then dissected by hand and components were categorized by food items. All components in each scat were identified, including bones, hairs, seeds, feathers and other materials. Hairs were identified by comparing the scale patterns as seen through a compound microscope to guidebooks and keys for identification (Adorjan and Kolenosky 1969; Halfpenny and Biesiot 1986; Kennedy and Carbyn 1981).

Once all the components were identified, the percent by volume composition was estimated with the help of a grid with 1 inch squares; the number of squares each item covered was recorded and divided by the total to obtain a percent of the total volume of the sample (Paczkowski, J. 2007. pers. comm. 21 Feb 2007). These volumes were recorded for each component. Components that made up less than 2% were considered trace amounts (Prugh 2005) and were recorded but not used in the analysis in order avoid giving a biased weight to these items.

RESULTS

Calgary's urban coyotes consumed a variety of foods, although primarily small mammals. Preliminary results show rodents as the most common component in scats across all sites. Small mammals were present in 251 samples of the 301 analysed. These were identified as primarily mice (*Peromyscus* spp.) and voles (*Microtus* spp.), as well as Richardson's ground squirrel (*Spermophilus richardsonii*). Plant matter was also common, found in 210 samples. Plant matter consisted mostly of fruit, particularly crabapples (*Malus* spp.), and also various grasses.

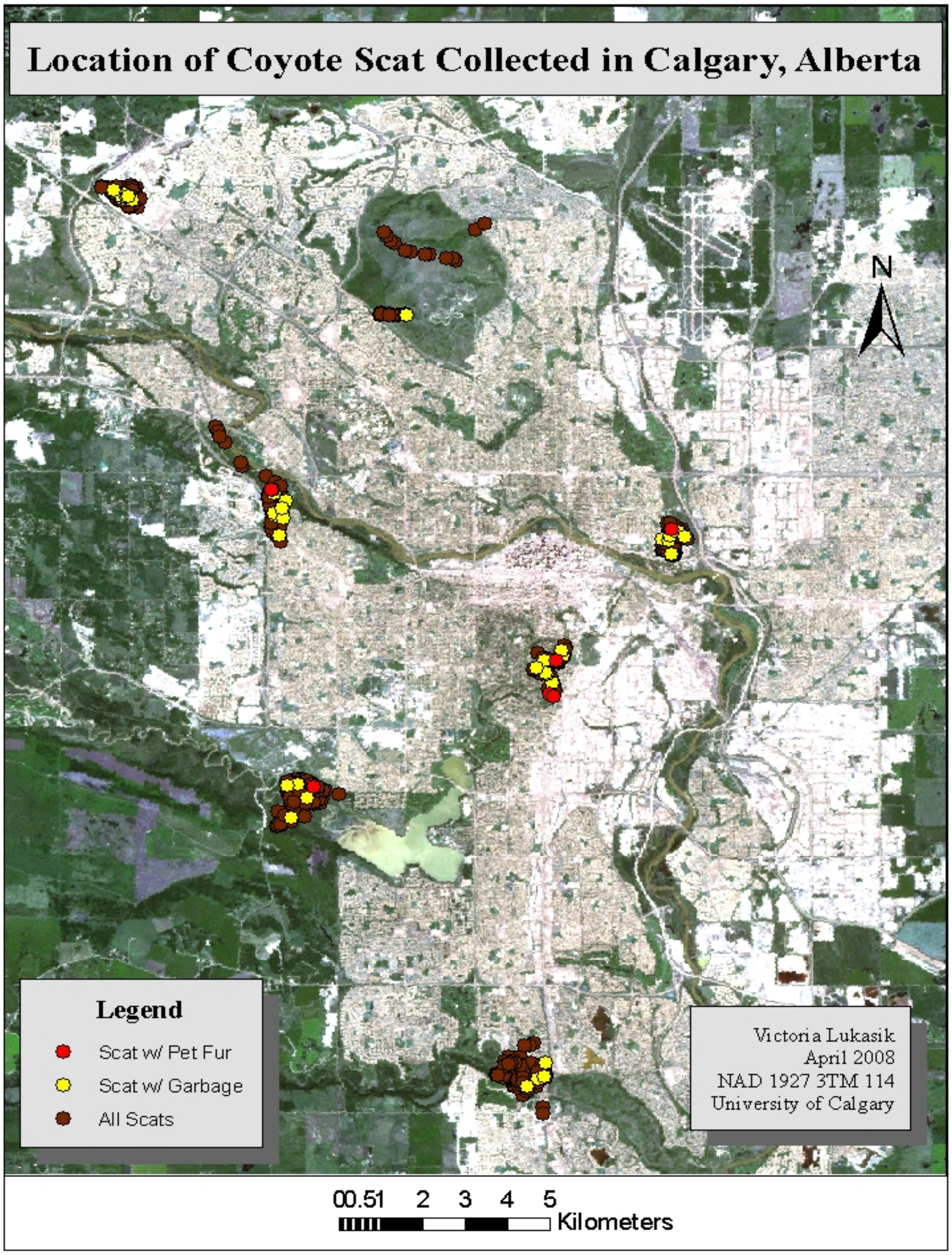
Human associated foods (mostly garbage) were the next most common item found in scats: importantly, this was found in only 15% of scat samples (see Fig. 2). Furthermore, this tended to compose only 5-20% of the volume of any scat that it was found in. Specific items found included fragments of plastic bags, paper towel, aluminum foil, hard plastic, rubber, synthetic fibers, peanuts, bird seeds and even gum.

Birds were preyed upon in most sites. Though not identified to species, several samples were identified as Anseriformes; likely Canada geese (*Branta canadensis*) or ducks. Many others were identified as Galliformes, most likely sharp-tailed grouse (*Tympanuchus phasianellus*).

Deer (*Odocoileus* spp.) were found in scats in 4 of the study sites, with highest presence in Fish Creek. Whether they were hunted or just carcasses that were fed upon opportunistically is unknown.

Several species of invertebrates were found, mostly beetles (Colleoptera). Though never more than 10% of any scat, invertebrates occurred in 4.7% of the scats analysed. Also found in a small number of scats were hare (*Lepus townsendii*) and skunk (*Mephitis mephitis*).

Seven samples were found to contain some portion of domestic cat (*Felis domesticus*) or dog (*Canis familiaris*) fur (see Fig. 2), ranging anywhere from 10-94% of the volume of the sample. While it is not unreasonable to assume that coyotes would have killed these animals, from scat analysis alone it is impossible to determine whether coyotes made these kills or



<u>Figure 2</u> – Spatial distribution of scats collected in Calgary, Alberta indicating location of scats containing garbage or domestic cat or dog remains.

Conflict identified between humans and coyotes in the city of Calgary were based upon reports called in by citizens. The vast majority of reports are simply sightings. Occasionally reports include accounts of coyotes scavenging in garbage, and more alarmingly, attacks on pets or aggressive behaviour such as swarming a pet or growling at a human. Only 8 of these encounters were reported between January and June 2007. Reports came from many areas of the city, with these more serious reports being located near Fish Creek (1), Nose Hill (1), Stanley Park/Rideau (1) and Tom Campbell's Hill (2). Other reports were several kilometers away from any of the study sites.

DISCUSSION

Our results indicate that small mammals and plant matter form the majority of coyote diet, which are consistent with results found in other studies (Cepek 2004; Morey, Gese, and Gehrt 2007). It was surprising that hare were not a larger part of the diet. Perhaps small rodents are more abundant or require less energy expenditure to hunt.

Arbour Lake had the highest occurrence of garbage and human-associated food in the coyote scats collected. This was expected as the site was primarily residential and garbage was often seen while conducting field work. Rodent remains formed the largest portion of these scats. Many ground squirrels and smaller rodents were regularly observed at this site. Perhaps this large natural prey base, supplemented with garbage was sufficient and thus it was not beneficial for coyotes in the area to prey upon pets. In addition, there are no off-leash areas at this site, thus decreasing the potential for dog-coyote interaction.

Stanley Park/Rideau had the highest occurrence of pet fur in scat and a high occurrence of garbage as well. While only one serious conflict was reported near this site, from speaking with residents of the area it seemed that this may be an under-representation. Furthermore an elementary school is located on the edge of this study area, and garbage and snack remains were often observed in that playground early in the field season. Since that time educational programs have begun and a major decrease in garbage was observed. Thus, it is possible that what began as a high-risk for conflict area may have been reduced to a lower-risk area simply through education and proper garbage disposal.

This research represents the preliminary, qualitative results of our ongoing study. Further scat analysis will be conducted using the remaining samples collected, such that we will have a large enough sample sizes to analyze seasonal differences in diet across the city and between sites. Site comparisons will be tested using Chi-square analysis to determine the significance of the relationship discussed qualitatively above. Additional conflict reports will be examined in order to provide a more rigorous analysis of the relationship between diet and conflict. A Geographic Information Systems (GIS) will also be employed to examine spatial relationships, using techniques such as cluster analysis.

Some preliminary recommendations based upon these results and observations have been made. Because fruit is a large component of their diet, fruits from fruiting trees and shrubs – particularly crabapples – should be collected in areas where coyote presence is not welcomed, such as people's back yards and dog runs. However, removing this resource completely might have a reverse effect as it would likely force coyotes to find an alternate food source, potentially turning to garbage or other human-related foods. Thus, fruiting trees and shrubs should be planted in strategic locations with low human and pet traffic, but good coyote habitat. An effort should be made to ensure garbage in parks is well disposed of and that garbage receptacles are not easy for coyotes – or other wildlife – to get into. An approach similar to that taken in areas with bear risks should perhaps be taken.

Furthermore, because conflict is mostly due to coyotes either taking advantage of an energy-efficient meal, or defending themselves, off-leash parks should be evaluated with coyotes in mind. Areas that are found to have high coyote populations, particularly with dens nearby, should probably not have an off-leash area, or at least this area should be closed during from late winter to early summer during denning and pup-rearing. Further information on coyote movement and dispersal would be particularly useful in these park zoning decisions.

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