In the four decades since Maurice Hornocker undertook the first intensive radio-collar study of cougars, a substantial literature on the behaviour, genetics, ecology, conservation, and management of *Puma concolor* has developed. Rarely a month goes by
without some new finding relating to one or more of these topics being published in the peer reviewed literature. Indeed, we probably know more about cougars than almost any other wild felid in the world. Despite this relative abundance of information, however, there is still much to be learned about these fascinating predators. This is especially true in Canada, where, with a few important exceptions (e.g. the excellent 10-year Southern Alberta study conducted by Orval Pall, Ian Ross, and Martin Jalkotzy in the 1980s and early 1990s), a comparatively small portion of all the cougar research in North America has been undertaken.

A review of population estimates and harvest information presented by various provincial and state agencies at the 8th and 9th Mountain Lion Workshops suggests that Canada is probably home to approximately one quarter of North America’s total cougar population. Moreover, Canada maintains abundant populations of ungulate prey species, much lower human population densities than occur in most US states, and a wealth of forested habitats which maintain a high potential to be occupied by cougars if additional range expansion and numerical increase were to take place. All of this makes Canada a potential future stronghold for healthy cougar populations in North America.

This possible future is far from certain, however, and our foresight regarding cougars in Canada is clouded by unanswered questions about cougar ecology, conservation, and management. For instance, the Canadian landscape is increasingly fragmented by resource extraction and residential development, and we need to know what behavioral and population level consequences these large-scale habitat changes will have for cougars. It is equally important to understand how rural Canadians perceive cougars. How do rural residents want cougars managed? Are the perceptions and
management preferences voiced by this important constituent compatible with biological reality and do they allow for cougar populations to be maintained as human populations grow? Indeed, the conservation prospects for cougars in Canada may well depend on the willingness of a growing rural and exurban human population to tolerate these top predators.

![Cougar in Tree](image)

Photo Courtesy Kyle Knopff: Central East Slopes Cougar Study (CESCS) Cougar in Tree

Other critical questions relate to the influence cougars have on populations of their prey. Are cougar populations increasing and expanding their geographic distribution in Canada, and if so what are the ecological and management implications? Several caribou
herds and certain wild sheep and elk populations in Alberta and British Columbia are below target levels, in some cases approaching local extinction. Predation has been identified as the primary proximate cause of decline in many of these cases and predator control has become a hot topic. Wolves were initially viewed as the primary culprit, but recent attention has focused more on the entire guild of top predators, including cougars. Under what circumstances do cougars cause declines in vulnerable populations of prey? What factors drive prey selection, prey switching, and the rate at which prey are killed by cougars? Is it possible to maintain healthy predator populations while still allowing populations of at-risk-prey (e.g. caribou) to recover? If so, what management strategies would be most likely to achieve this result?

Many of these questions parallel similar questions being asked by researchers wherever cougars occur, others are unique to Canada, but each is an important component for an improved understanding of the possible future for cougars north of the 49th parallel. In an attempt to provide answers to some of the questions outlined above, we are currently conducting two intensive radiotelemetry studies of cougars in Alberta, Canada (see map below for the geographic locations of each study area).
Both studies are based out of the University of Alberta, which is located in the city of Edmonton. The first is the Central East Slopes Cougar Study (run by Kyle and Aliah Knopff and supervised by Dr. Mark Boyce and Dr. Colleen Cassady St. Clair), which was initiated in 2004 and for which fieldwork is now complete. The second is the Cypress Hills Cougar Study (run by Michelle Bacon and supervised by Dr. Mark Boyce), which was initiated in 2007 and for which fieldwork is ongoing. Because data collection and
analyses are in progress, full results are not yet available from either study, but preliminary data from both studies have already yielded interesting findings.

At the Central East Slopes Cougar Study site we have collared and monitored 44 different cougars between December 2005 and fall 2008. Most of these animals were outfitted with Global Positioning System (GPS) collars. A fundamental component of this study was to better understand the interactions between cougars and their prey in multi-prey systems. To this end, we selected a study area representing a true multi-prey system and containing 8 types of potential wild ungulate prey (white-tailed deer, mule deer, elk, moose, feral horses, mountain goats, bighorn sheep, and caribou). We have refined and
advanced GPS telemetry techniques for locating cougar killed prey. Our methods of identifying and visiting clusters of GPS locations have allowed us to achieve nearly complete predation histories (prey > 8kg) for each GPS collared cougar for as long as the collar remained active. Through our efforts, we located 1,372 predation events and 83 incidents of cougar scavenging.

Photo Courtesy Kyle Knopff: A colt killed by 9827R, an adult male who specialized on feral horses at our West Central Alberta site.
Preliminary results demonstrate that while the cougar population as a whole subsists primarily on deer, diets are remarkably diverse and individual preference for prey types appears to play an important role in this diversity. Some individuals, for instance, consume primarily deer, others bighorn sheep, and still others focus on feral horses (which are common in west central Alberta). Distinct differences between the predatory behavior of males and females have also been noted and males tend to kill more large prey (elk, moose, and feral horses) than do females.

Photo courtesy Kyle Knopff:
Kyle Knopff with a bighorn sheep killed by CESCS subject 1011R. Cougars in West Central Alberta tended to show strong preferences for certain prey types. Cougar 1011R killed mostly bighorn sheep.
Yet another exciting avenue of research that we have been able to pursue at our west-central Alberta site is to examine the interactions among sympatric large carnivores (specifically cougars and wolves). This is made possible thanks to a simultaneous large-scale study of wolves that Nate Webb and Dr. Evelyn Merrill have been conducting in the same study area. Most studies of wolf/cougar interactions that have taken place to date occurred where wolves are re-colonizing (e.g. Yellowstone).

Photo courtesy Kyle Knopff:
An adult feral horse killed by cougar 9827R and usurped by wolves
By contrast, our study area in west-central Alberta has maintained viable populations of both wolves and cougars as far back as records have been kept. Indeed, the first group of wolves that were translocated into Yellowstone in 1995 came from this part of Alberta. We have observed high densities of both cougars and wolves overlapping completely at large spatial scales. Interactions between the two predators are not uncommon, and we have recorded a number of instances of wolves usurping cougar kills. Despite indirect and occasional direct conflicts over resources, both predators appear to have maintained a solid foothold on the landscape over substantial periods of time. We are currently conducting fine scale analyses to identify at what levels niche separation occurs and ascertain how this has facilitated the long-term simultaneous persistence of two competing top predators.

Photo courtesy Kyle Knopff:
A feral horse killed by 9827R. The horse was killed only hours before this photo was taken and was buried by the cougar.
Interestingly, we also have discovered that the presence of wolves on the landscape can have important implications for cougar populations that go beyond direct competition with the big canids. In many jurisdictions in Canada, setting snares around ungulate carcass bait is used as a technique to harvest wolves. We found that cougars also are highly susceptible to this practice. Indeed, 4 out of 12 collared cougar mortalities which occurred during our study resulted from snaring. Most places where cougars occur in Canada and many regions that they might reasonably be expected to repopulate have wolf populations and permit snaring. Consequently, this source of mortality will be an important consideration in future management and conservation planning for cougars in Canada.

A final research focus of the Central East Slopes Cougar Study is the study of human-cougar interactions. Industrial activity and rural-residential development is common within the study area and we are assessing the impact this is having on cougar population dynamics, predatory behavior, and habitat use. In addition, 13 of our collared cougars had home ranges that overlapped substantially with human agricultural and high-density rural-residential areas, allowing us to directly assess human-cougar conflict. Although ranching and hobby farms were common within the study area, we recorded very few instances of cougar predation on domestic livestock or pets (< 1% of all kills located). When depredation did occur, llamas and domestic dogs were the most frequent targets. Cougar sightings and cougar kills of wild ungulates (e.g. elk and deer) near residences also are often considered conflict situations, however, and were not uncommon. Indeed, to assuage public response to these types of conflict situations, recent legal changes in Alberta permit the killing of cougar on-sight provided the animal is on
your private property. Because of this conflict and because understanding the drivers of human tolerance for cougars factors heavily into effective management, we conducted a survey in the summer of 2008 to better understand rural residents’ perceptions of these predators. Combining the results of this survey with cougar GPS-location and predation data will allow us to compare public perception with biological reality and better identify possible avenues for future cougar-human coexistence.

Photo courtesy Kyle Knopff: Aliah Knopff (left) and Michelle Bacon (right) monitor the first cougar captured and radio-collared in the Cypress Hills, Alberta
On the other side of the province, at our Cypress Hills Study site, we have the opportunity to study cougars at the eastern frontier of their Canadian range expansion. Cypress Hills Interprovincial Park is an island of forested habitat within a sea of prairie. Rumors of cougar movements eastward into the Cypress Hills had been circulating since the late 1990s. Clear evidence of cougars using the area began to accumulate between 2001 and 2006. However, it remained unclear whether a breeding population existed. In 2007 two photographs of family groups were obtained (one by park officials and one by our research team), confirming the presence of a breeding population. In spring 2008, we captured and GPS collared the first cougars in the Cypress Hills, a mature male and an adult female. The female gave birth to 4 healthy kittens on July 16th, 2008. This work has identified the most easterly breeding population of cougars known in Canada to date.

Photo courtesy Kyle Knopff:
Michelle Bacon with a new member of the Cypress Hills Cougar Population
Further expansion of cougars into Saskatchewan appears to be ongoing and the Cypress Hills Interprovincial Park is likely an important staging area for this eastward movement. Current work at the Cypress Hills study site aims to determine the distribution and prey selection of cougars within this small island habitat. Because of the increase of both humans and cattle in the park during the peak summer season, we will also evaluate the seasonal effects on cougar movement and predation. Our objective is to provide information which can assist in conflict reduction between cougars and people, thereby increasing local tolerance for the newly arrived predator which is protected within the park system and is likely to become a permanent feature of the Cypress Hills landscape.

Photo courtesy Kyle Knopff:
Camera trap photo of a cougar in the Cypress Hills
As has been the case in many parts of North America, Canadian cougars have undergone a dramatic recovery since the period of intense predator persecution which lasted from the time of first European settlement through the middle of the 20th century. Post-persecution era populations have rebounded in Alberta and British Columbia and are beginning to expand eastward. This represents an important large carnivore conservation success story. Cougars remain difficult to manage, however, and their future remains uncertain. Whether or not cougars are able to maintain their strong foothold in Canada...
and even to expand it further will depend on a variety of factors, some of which we have highlighted in this article. We hope that the research we are conducting in these areas can be used to help guide management and conservation of this resilient carnivore into the future.

Photo courtesy Kyle Knopff:
Left to right – Lome Hindbo (houndsman), Laiah Knopff, Kyle Knopff with 44th Cougar collared for the Central East Slope Cougar Study