Carnivore Monitoring Project

Banff, Kootenay and Yoho National Parks,

Winter 2008 – 2009

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INTRODUCTION

Over the past decade Parks Canada has developed an ecological integrity (EI) monitoring framework to track both indicators and measures of ecosystem health over the long term. These ecological integrity monitoring programs provide a standardized method of determining specific aspects of quantifiable change across a bioregion (McLennan and Ponomarenko, 2007). One measure identified within the framework in the Mountain National Parks was to monitor large carnivore populations. However, as of the EI monitoring program launch in March of 2008 no one methodology had been proposed to monitor large carnivores.

The original intent of this project was to explore innovations in technology that may be useful in tracking large carnivore populations over time. The project's broadest goal was to add information to existing wildlife data bases on difficult to monitor carnivore species that are at low density, elusive and costly to monitor with other methods. Although all three parks presently support some method of tracking carnivores, it is mostly done in a manner limited by season (e.g. winter only), location (e.g. proximal to the town of Banff) and by personnel (one person conducting transects for an entire national park). We note that many methods of inventory are not correlated between parks to the most optimum extent, as is data management. Additionally, existing inventories although comprehensive may be very out-dated (Achuff et.al., 1984).

The National Park's mandate to conserve biological integrity requires an ecological inventory that by necessity, must be coarse filtered (Hunter, 1991). Our argument is that to a large extent, should the "keystone" carnivores of an ecological system be present in desired composition and abundance, then the multitude of species umbrelled by them should also be preserved. Our approach may also contribute greatly to a fine-filtered approach of studying particular high profile species (Species At Risk Act, 2002), as well as species targeted for involved management (e.g. Mountain Caribou). As the method is inexpensive and effective, it may serve well when applied both to models of dynamic ecosystem succession and when considering ecosystem-based management principles. Small scale benefits of this project also become apparent when considering critical wildlife habitats such as denning sites, or when prescribed burns are planned.

Our objectives therefore were to: 1) further refine and broaden the monitoring techniques developed in our 2007/2008 trial field season, 2) engage both interested public and Parks Canada personnel by soliciting their assistance, 3) determine presence/absence and movement patterns including general spatial distribution and abundance of selected carnivores, 4) unobtrusively derive predation data when reasonable, and 5) provide community and individual education regarding carnivores whenever possible.

From late October 2008 until May 1, 2009, we (author and many co-workers) monitored 24 digital remote cameras over 4320 camera/days, cumulatively drove in excess of 60,000 km, and skied over 12,000 km in an effort to determine carnivore status in Banff, Kootenay and Yoho National Parks (BNP, KNP, YNP respectively). We used multiple methods to maximize data collection potential and found both tracking counts and camera-traps were equally effective at procuring data, at rates similar to Balme et al. (2009). He used parallel studies to estimate abundance and density of leopards (*Panthera pardus*) in South Africa, finding that camera-trap surveys were more accurate, rigorous and cost-effective than traditional track-count methods.

We believe that this remote camera surveillance project surpasses all other contemporary Park efforts to collect and synthesize data on large carnivore movement, status and distribution for three local national

parks. This monitoring project may help standardize collection of carnivore information (winter and summer) and we see it as very complimentary with methods of our neighbouring provincial managers. This inventory approach is intended to fit within the framework of ecological integrity monitoring programs (McLennan and Ponomarenko, 2007).

STUDY AREA

Our study area encompassed: 1) all of KNP and surrounding drainages including Simpson, Mitchell, Cross, Kootenay south of KNP to Palliser junction, and upper Beaverfoot; 2) all of YNP and lower Beaverfoot; and 3) the Bow River watershed of BNP and north to Saskatchewan Crossing. We also recorded data from areas peripheral to the fore-mentioned (e.g. Columbia Valley, Peter Lougheed Provincial Park) on an opportunistic basis. No bio-geo-climatic information is provided here as recipients of this report are very familiar with these regions.

METHODS

1) Remote Cameras

Remote wildlife monitoring with the use of cameras has been an effective tool for many years (Kucera and Barrett 1993, Mace et al. 1994, Cutler and Swann 1999, Rios-Uzeda et al. 2007, Matthews 2008). We positioned 4 cameras (*Reconyx Silent Image Professional Edition* digital cameras - various models, Wisconsin, USA) in YNP, 5-7 cameras in KNP, 5-7 in District West of BNP, and 9-11 in District East of BNP. Locations chosen (Figures 1, 2, 3 and 4) were based on prior field experience and in consultation with highly experienced Warden Service members and were selected to maximize carnivore events and limit travel time (which was dictated by restricted funds and person-power). Cameras were set on trails and roads used predominantly by both humans and wildlife. Most camera locations were highly productive, when compared to historical sightings and sign and our personal experience in tracking wildlife in Mountain National Parks for over 20 years. Cameras were uniquely programmed to maximize battery life, reduce false images, and yet obtain quality images adequate for our purposes. Our objective was not to concentrate on a particular species but to acquire data from the range of large mammalian carnivores. Similar to last years' pilot trials, we chose to limit monitoring of the Bow Valley Wolf Pack to reduce stressors to this already highly taxed pack. Cameras were retrofitted with "C-cell" battery adaptors that held rechargeable 1.2 volt NiMH 5000 mAh batteries, along with large capacity compact flash memory cards and were serviced on approximately one month intervals.

For the purposes of this report, we define a carnivore "event" as any appearance of wolf, fox, coyote, lynx, cougar, bobcat, grizzly bear, black bear, fisher, wolverine or marten that was captured by camera and separated by an arbitrarily chosen time interval of 10 minutes before another animal's appearance. For example, if a wolf was photographed and then photographed again within 10 minutes of its first

appearance, we considered this a single event. Camera images were reviewed, managed and tallied as described below (Database).

Figure 1. Locations of camera monitoring sites in KNP, Winter 2008-2009.

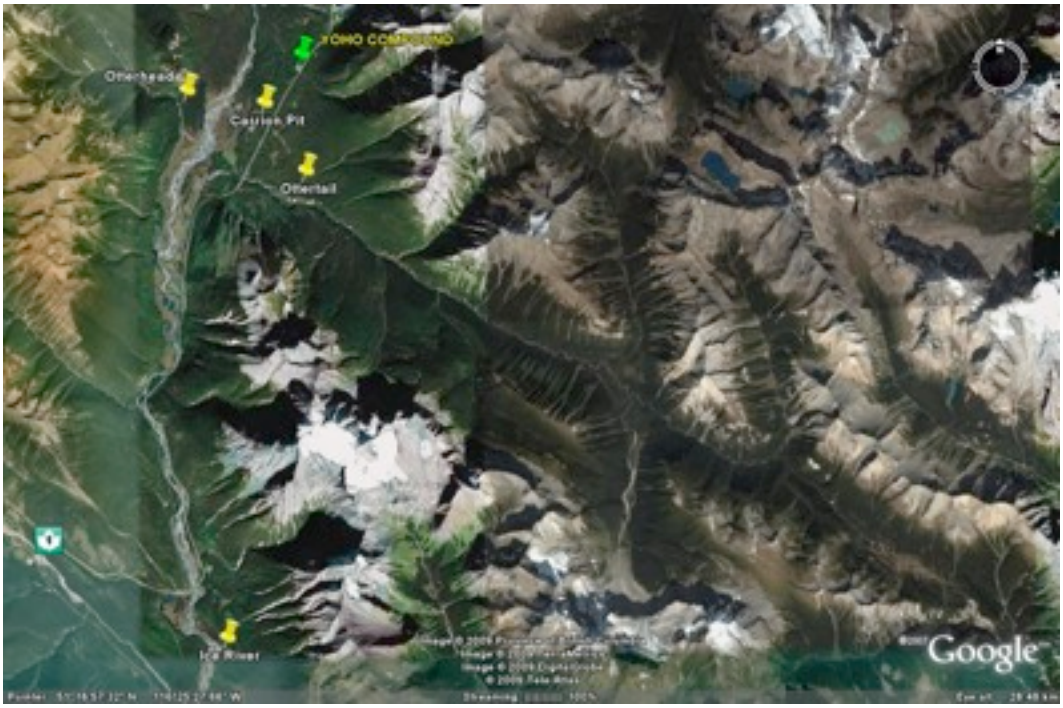

Figure 2. Locations of camera monitoring sites in YNP, Winter 2008-2009.

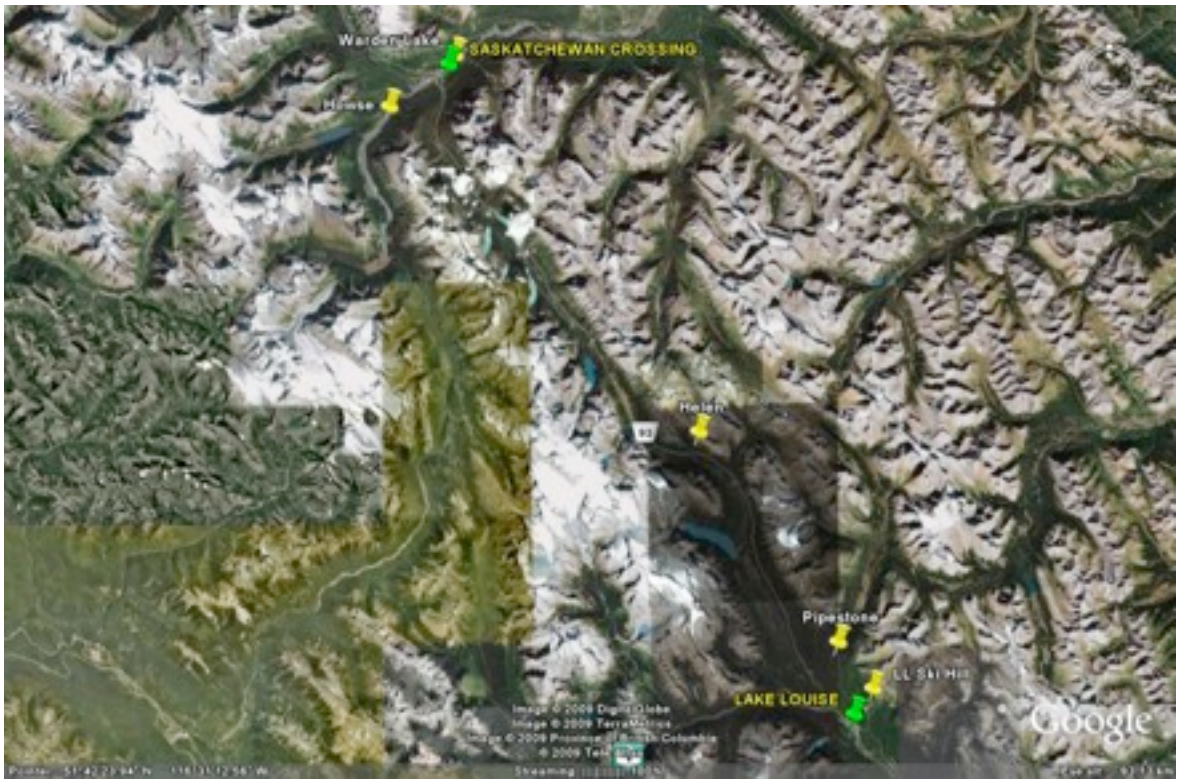

Figure 3. Locations of camera monitoring sites in north BNP, Winter 2008-2009.

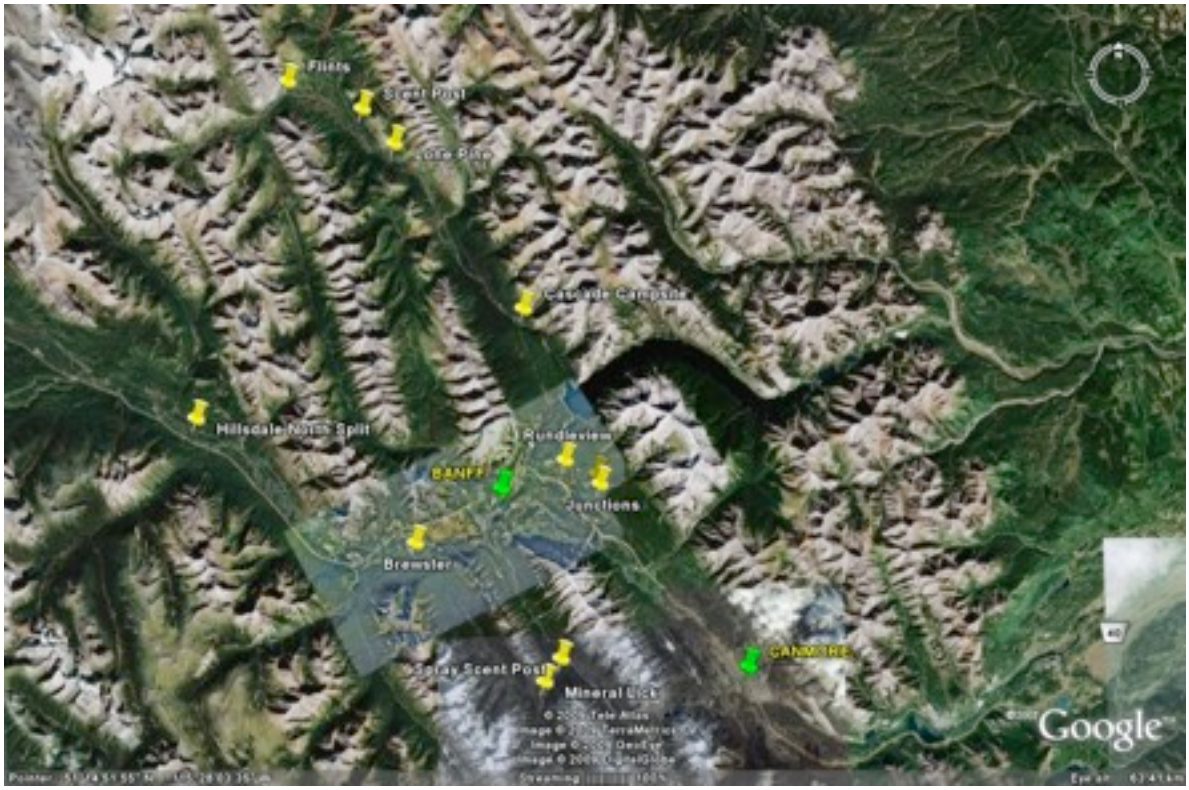

Figure 4. Locations of camera monitoring sites in south BNP, Winter 2008-2009.

2) Transects/Tracking

In all parks, the author and co-workers skied and hiked both established and random routes with efforts often made to synchronize to camera maintenance needs. Data from carnivore sign was recorded on tally sheets (see Appendix 4) and included: date of observation, location, age of sign, species and type (track, scat, scratch etc.) of sign, estimated number of animals, direction of travel and comments. Sheets were collected at season's end, tallied and entered in computer database spreadsheets (Excel). The number of volunteers dedicated to this project, exceeded 30 (see Acknowledgements) and we received additional assistance from over 80 back-country lodge/hut guests. When special sightings or signs (e.g. wolverine tracks) were brought to our attention, we made every effort to validate them by personal field investigation. When we were unsure of the skill level of our co-workers due to having no prior relationship with them, we confirmed abilities by spending at least several field days together. When no verification could be made of the quality of special data provided by volunteers that we did not know, we did not enter those data in our main database. Back-country huts and lodges had numerous guests that contributed to our project but their data was only entered on computer, if it was verifiable by knowledgeable additional sources or by photographic evidence. At the start of the field season, we met with all co-workers dedicated to the project, to ensure consistent data collection and recording techniques. Standardized tracking keys (Appendix 6) were kindly provided with permission, courtesy of Ben Gadd (1995).

Many of our co-workers on this project were Parks Canada staff. As a result, we asked all of these individuals, not to duplicate their recording efforts and to only record to Parks Wildlife Observation Database. This excluded countless entries from our dataset, but it eliminated wasted effort, simplified data sets and avoided confusion.

3) Trailhead Kiosks

At the trailheads of the Ice River (YNP), Pipestone River (BNP) and Simpson River (KNP) we erected fish creel survey collection boxes on loan from C. Pacas (Figure 5). On the outside top of the lockable boxes was posted a request (Appendix 3) for trail users to fill in a ballot style form (Appendix 5) if they had observed carnivore sighting or sign during their travels. The ballots were to be deposited in a slot, inaccessible to non-researchers, within the creel box. Animal track keys similar to those provided to co-workers were also attached to the outside of the box as was a colour map of the area (sample in Appendix 7) detailing trails most likely to be used during the winter. We cleared and monitored these on an opportunistic basis.

Figure 5. Data collection box at Ice River trailhead, YNP, 2008 – 2009. On the top surface we mounted our rationale and request, track identification keys (side opposite not shown) and topographic map of area. Pencils and response ballots were located within.

4) Data Base

Photographic data from carnivores were entered on Excel spreadsheets and included the following fields: location, camera id, UTM, date established, date of maintenance, carnivore species, number of events, date and time of event, image number, comments, and other species noted. Additional "human use" parameters simultaneously recorded were numbers of individuals and groups for: hikers, skiers (or snowshoers), snow machines, bicyclists, and dogs on and off leash. Data from field tracking/transect sheets, kiosk records and from field notes were entered and tallied similarly but with different relevant fields.

In December 2008, it quickly became apparent that our computer entry resources would be overwhelmed by the incoming data. Thus "normal" movements and numbers of carnivores were not tallied for the purposes of this study (e.g. canids moving on Cascade, West Kootenay, Dolly Varden, and East Kootenay fire roads). This decision was made both to expedite data management and because the value of these data to Parks Managers is moot. We chose therefore to enter only the most significant track events for all species. We report many hypothetical postulations based upon limited data and conjecture and appreciate the tenuous nature of this. Nevertheless, we proceed to offer these opinions on many issues that we believe are of concern and worth to managers.

5) Outreach and Education

We made every effort to communicate our findings with school groups, various audiences and individuals encountered during the course of our work. Engaging park visitors or interested individuals was seen as an integral part of our monitoring responsibilities. We were pleasantly surprised when these park users happily volunteered to communicate their findings to us on an opportunistic basis.

6) Analysis

To examine temporal use of trails by carnivores, we plotted the number of events per selected species per 24 hour period. Polynomial regression analysis was used to smooth graphs and highlight trends. Success per unit effort by camera site was calculated by dividing the number of carnivore events per station by total camera nights per site.

RESULTS

1) Outreach and Education

Ten presentations of our work were made to: a "Wild Voices" audience of approximately 60 people in Invermere, B. C.; a "Wildsight – Upper Columbia" audience of approximately 80 people in Golden, B.C.; The Friends of Yoho Annual General Meeting; the Lake Louise Ski Hill staff (60 staff in training); and to several public schools with classes of grades 4, 5 and 8 in Calgary, AB. (approximately 120 students).

We received unexpected support through email responses of skiers who noted our address from trailhead kiosks. These normally were from keen individuals who wanted to know more about the project and also wanted to supply additional information to the information ballot they had filled out prior and left within the kiosk. From this manner we obtained several potentially valuable contacts that would be willing to assist should this monitoring project occur again next winter. From a number of Warden Service members, we were also referred to people who had reported interesting sightings this winter to Parks Canada. We were then able to follow up with phone calls to obtain more information on the same. Upon sharing some of our study images, we found these contacts were more than willing to share many of theirs.

Lodge, hut and hostel response was somewhat disappointing. Our hope is that we can derive greater participation next season, if we are able to provide educational presentations there to both staff and guests. We believe that if the staffs of these facilities understand the project more, we could garner greater support. It is also likely that better compliance may be achieved next year, as the staffs perceive more credibility to a long-life study. It must be noted that we have been referring only to the returns from these specific facilities. The poor performance just discussed is in very stark contrast to the efforts of the individual volunteers that we selected and who were asked to participate.

In our initial proposal for this project, we showed a need to once or twice throughout the winter, publicly support the volunteers by publishing in local newspapers, their names and some mention of their accomplishments towards our monitoring goals. However it was suggested that this not be done for a variety of reasons. We continue to believe that if this can be accomplished, personal pride would aid volunteer efforts which may translate into a greater quantity of results thereafter.

A post-field season survey of all co-workers (approximately 34 agencies/huts/lodges/individuals) allowed that without an exception, all would participate in this project again - should Parks Canada see the value in funding it.

2) Data Synopsis

From the 110 camera collection sessions over 6 months, we documented all extant carnivore species with the exception of fisher and bobcat (although fisher were photographed in 2007 – 2008 field trials). Approximately 1,480,000 images were uploaded, filtered, categorized and tallied. An estimated 3,000 person/days were involved collecting data in the field and 70 days managing the database and report writing. Cameras versus other data collection methods, recorded the majority of the documented presence of these species (Figure 6). The greatest rate of data collection as defined by mean carnivore events per camera (mean = 43), came from KNP (Table 1). Our study revealed a wide range of success per unit effort of the remote cameras (r = 2.45 – 152.00 operational days per carnivore event) that functioned collectively over almost 4000 days (Table 2). We note that the sites at Dog Lake, Crooks Meadow and West Kootenay Fire Road, were exceptionally productive for KNP averaging 4.02 camera days to capture a carnivore event. The three best camera locations in Yoho National Park (Ice River, Carrion Pit and Ottertail) required on average, 11.57 camera days to capture a carnivore image, while Banff's three most productive cameras (Lone Pine, Brewster and Cascade Campsite) required only 3.88 days.

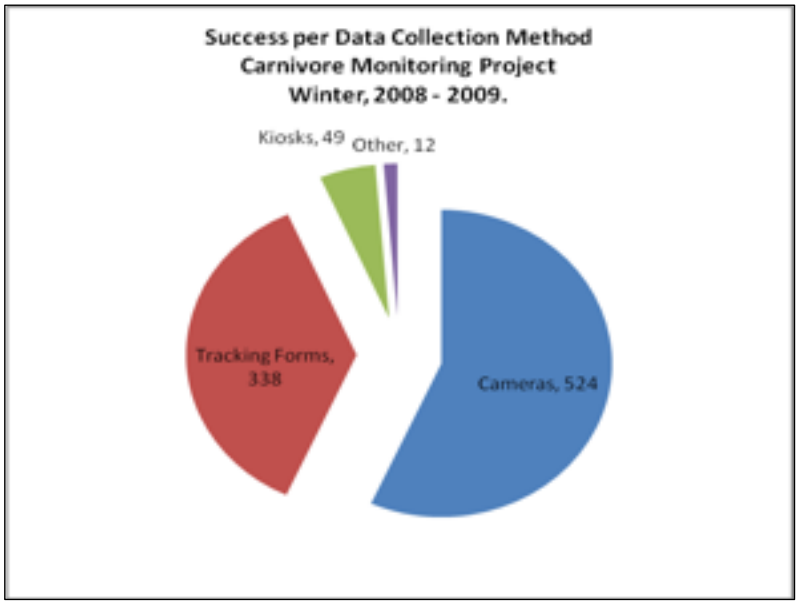

Figure 6. Data collection success per collection method for Carnivore Monitoring Project, Winter 2008 – 2009. Cameras were most successful recording 57% of all carnivores documented, followed by tracking forms (37%), kiosks (5%) and other (un-solicited)(1%).

Table 1. Distribution of carnivore camera events per national park with mean events per camera. Banff, Kootenay and Yoho National Parks, Winter 2008 – 2009.

Carnivore event success per park.
Winter 2008-2009

	Number of carnivore events	Mean events per camera
KNP	172	43.0

YNP	44	8.8
BNP	308	20.5

Table 2. Success per unit effort of 24 remote cameras in Carnivore Monitoring Project, Winter 2008 – 2009.

Camera Site	Total carnivore events	Camera days	Mean success per station per camera day	Mean camera days per carnivore event
WEST KOOTENAY FIRE ROAD	73	179	0.41	**2.45**
CROOKS	55	184	0.30	**3.35**
LONE PINE	51	176	0.29	**3.45**
BREWSTER BRIDGE	45	180	0.25	**4.00**
CASCADE CAMPSITE	37	155	0.24	**4.19**
SPRAY SCENT POST	39	188	0.21	**4.82**
HILLSDALE SPLIT	32	167	0.19	**5.22**
DOG LAKE	27	169	0.16	**6.26**
ICE RIVER	17	156	0.11	**9.18**
SASK CROSSING Warden Lake	20	184	0.11	**9.20**
DOLLY VARDEN	17	177	0.10	**10.41**
YOHO CARRION PIT	14	146	0.10	**10.43**
FLINTS	17	180	0.09	**10.59**
PIPESTONE	13	163	0.08	**12.54**
OTTERTAIL	10	151	0.07	**15.10**
SPRAY MINERAL LICK	9	157	0.06	**17.44**
SASK CROSSING Howse River	10	184	0.05	**18.40**
JUNIPER	9	178	0.05	**19.78**
RUNDLEVIEW RIDGE	10	199	0.05	**19.90**
JOHNSON JUNCTION	8	188	0.04	**23.50**
JOHNSON LAKE	7	188	0.04	**26.86**
OTTERHEAD	5	139	0.04	**27.80**
SHERBROOKE LAKE	3	151	0.02	**50.33**
HELEN	1	152	0.01	**152.00**
TOTAL and MEANS	**529**	**2712**	**0.13**	**19.47**

The contribution of each species to the total number of camera events for both field seasons are displayed in Figures 7 and 8. Significantly more wolves and fewer coyotes were documented this year when compared to last. Of consideration however, is the effect of a single camera site that documents a disproportionately large number of carnivores – such as occurred on the West Kootenay fire road (n = 73). Also of note is that data from the first field season came only from BNP.

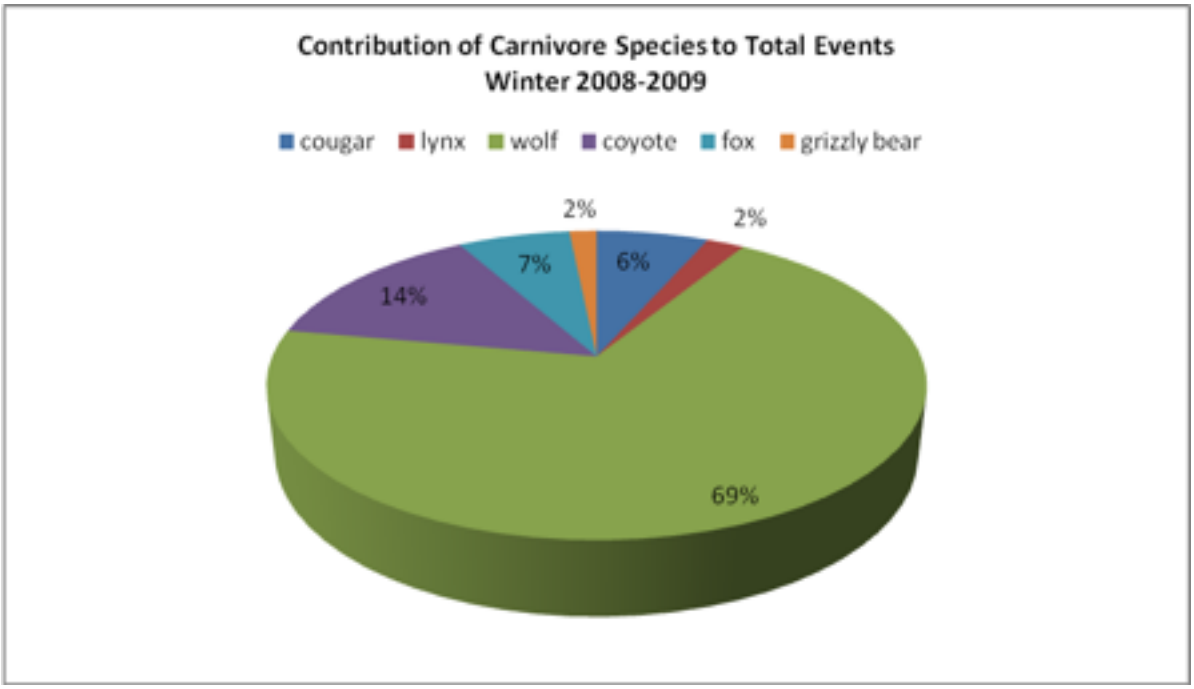

Figure 7. Distribution of carnivore species recorded by remote camera in all parks, winter 2008-2009.

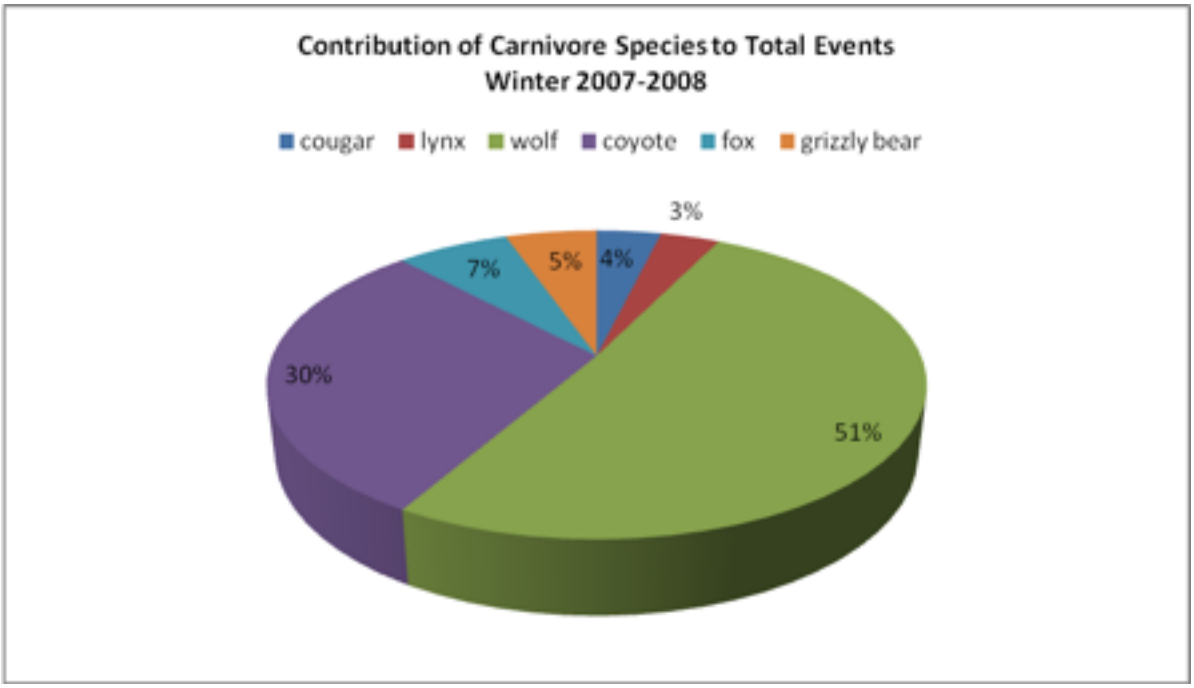

Figure 8. Distribution of carnivore species recorded by remote camera in BNP, winter 2007-2008.

3) Kiosks

The three kiosks at the trailheads for Ice River, Pipestone, and Simpson River, were productive in varying degrees. The Ice River camera recorded < 22 individuals including researchers, throughout the winter. Consequently, it received the least amount of response (n = 10 ballots). The Simpson River site received 18 ballots while the Pipestone kiosk collected 21. This low response rate may be seen to suggest that this data collection method should not be used in future, however data from all sites allowed the principal

researcher to investigate and verify, 3 sets of wolverine tracks, 4 sets of cougar tracks and 3 passes of a wolf pack – all of which we would not have been aware.

4) Tracking Forms

As data from all forms (some of which were still outstanding with huts/lodges at the time of this writing) were not entered (man-power issue) we do not present summary tables for this data collection method. We estimate however, that > 350 carnivore track sets were documented by this technique. Field investigation to verify the validity of this information was performed whenever possible, and most often for wolverine as this species is of special concern and is notorious to identify by tracks in the field.

5) Species Results

A complete table of total images per species of carnivores photographed at each station is provided in Appendix 1. Success rates per camera, as measured by numbers of carnivore events, ranged from 73 at the West Kootenay fire road site, to one at Helen Lake. Cameras each averaged 21.8 carnivore events. We tallied 529 carnivore images in addition to 5799 humans and many other birds and mammals – a ratio of approximately 1carnivore:10 humans. Additional to this are carnivore records from trail head kiosks and tracking forms. These number in excess of 400 records but have not been tallied to-date due to limited resources.

A) Wolf Packs

Because of our limited resources, wolf pack status reported here and in Appendix 1 is obviously incomplete. Nevertheless, we documented the existence of 40 to 61 wolves in 11 packs in and around our study area. Cameras documented wolf/wolves 65, 96, 127, and17 times for the Cascade, Bow Valley, Kootenay and Yoho Packs respectively. Regular and opportunistic howl surveys aided our field investigations in all Parks – the purpose of which was to locate packs so that later back-tracking might prove pack numbers. These surveys were ceased in early January to diminish the negative effects of this method on wolves during the breeding season. We noted estrual urinations from multiple wolves in the Bow Valley, Cascade and Palliser Packs in January. A single wolf from the YNP Pack also appeared in heat during the same month. In BNP we noted that wolves investigated den sites on the Fairholme Bench and near Cabin II of the Cascade Valley. A Peter Lougheed den was visited by a single wolf in December and we back-tracked wolves near two traditional denning areas of the Palliser Pack in early January. No effort was made to follow Bow Valley or KNP wolves for this purpose. At the time of this writing we feel confident that the following packs are at dens: Bow Valley, Cascade, Kootenay, Palliser, and Yoho.

Again this winter, we noted many small wolf numbers of 1 to 3 that were not commonly travelling with the main pack. We suspect that this behaviour is a response to maximize predation efficiency. This places large hypothetical confidence intervals around pack sizes as many more observations of small groups are made, as compared to observations when the pack is all together. As no wolves were radioed in the study area with the exception of one at Saskatchewan Crossing, no definitive polygons of home range could be constructed. We therefore present hypothetical territories for the Bow Valley, Cascade, Kootenay and Yoho Wolf Packs. Territories are based on our interpretation of track sequences and sightings derived from this study in addition to historical data and prior experience. Territory boundaries are incomplete which reflect limited study data and other empirical evidence.

1) Cascade Wolf Pack

On almost a monthly routine, the Cascade Pack made what appears to be a circuit (both clockwise and counter-clockwise) up Stoney Creek, over Dormer Pass to Barrier, up the Panther and then back into the Cascade via Wigmore Summit. As we never contiguously tracked sections from Dormer Cabin to Windy

Cabin, this movement is un-verified. Sensitive Species Surveyors (Tom Hurd) did follow tracks from Barrier back into the Cascade via Wigmore, at a time when we knew the pack to be found north of Dormer Cabin. We have no evidence of a separate wolf pack formerly called the "Panther Pack" at this time and we believe the two packs (Cascade and Panther) have now merged. Anecdotal evidence suggests that 31 wolves east of BNP have been killed by trappers this winter, with one trapper collecting 8 wolves near the Panther River.

The Cascade Pack regularly used the Fairholme Bench again this season to a location at least as far east as Carrot Creek (Figure 9). Our cameras recorded many passes of the pack on the bench, as well as a lone gray-coloured wolf. We also noted with interest that these wolves have occasionally moved very close to the former Buffalo Paddocks this winter, with one wolf entering the TCH at this point, and exiting near the Cascade Power Plant. Should Parks' personnel have the will and resources to continue to gate Banff town elk to the north side of the TCH in this area, we believe it inevitable that the pack will begin to predate in this area. Our only concern is that the narrow strip between the TCH and Cascade waterfall, receives a considerable amount of human intrusion due to dog walkers, ice-climbers and casual visitors.

2) Bow Valley Wolf Pack

Much information is available from various sources on the movements and status of the Bow Valley Pack which may have suffered at least 3 mortalities this winter. Our report on this pack is consequently brief. The most recent sighting we have (21 April 2009) indicates that at least 3 black and 1 gray coloured wolves remain, although additional wolves from this pack may have been in the Spray Valley on the date of this sighting. It appears that the pack is pushing out its northern boundaries somewhat and is spending more time than in other years between Castle Junction and Lake Louise (Figure 9). This observation is similar to that documented for the Cascade Pack (above). Although wolves occasionally were noted in the upper regions of KNP this winter, our tracking showed that the Bow Valley Pack never ventured over the Alberta/British Columbia boundary. Of interest is the frequency with which a small group of the Bow Valley Pack patrolled the lower and middle Spray. We skied this region many times this winter and always found wolf sign less than one week old from multiple wolves (n = 2 – 5) that could always be traced back to their entry in the Spray, via Sundance Pass. The pack made one notable journey from the Bow, over Sundance, up the Spray to Fortune Flats, and then progressed into the Palliser (Upper Spray) for a distance of at least 6 km. At this time, we also found small groups wandering up Bryant drainage for an 8 km distance. The opportunity for this pack to travel within its normal home range and not be disturbed by human presence (highways, railways, wildlife photographers, visitors, etc.) is exceptional. The only region within their territory where these wolves could experience seclusion is in the Spray Valley. We applaud Parks Canada for the far-sighted decision to continue to restrict human presence in the Spray and allow this harried pack the opportunity to travel and hunt in a natural fashion.

Figure 9. Home ranges (hypothetical) of Bow Valley and Cascade Wolf Packs, as determined by Carnivore Monitoring Project, Winter 2008-2009 and historical data. Ranges are unbounded in places due to limited data.

Noted again this winter was the intense efforts made by hobby and professional photographers to image this pack. Occurrences we reported to the Warden Service include: a photographer running to his car and pursuing in a vehicle, a wolf that had just appeared on the 1A; multiple sets of snowshoe tracks at a wolf kill near Hillsdale; numerous sets of snowshoe tracks fore-tracking fresh wolf tracks; photographers working in concert with each other by two-way radios and cell phones; unknown individual(s) clearing fresh scat from the 1A thereby providing an accurate age of any scat found since the clearing; and consistent patrols of the 1A especially immediately after fresh snowfall.

An interesting comparison of the presently suggested change of home ranges for the above two packs may be made by study of what we believed to be the BNP pack distribution in 2006 – 2007 (Figure 10). The comparison highlights the year-over-year potential of this project to show changes in species distribution.

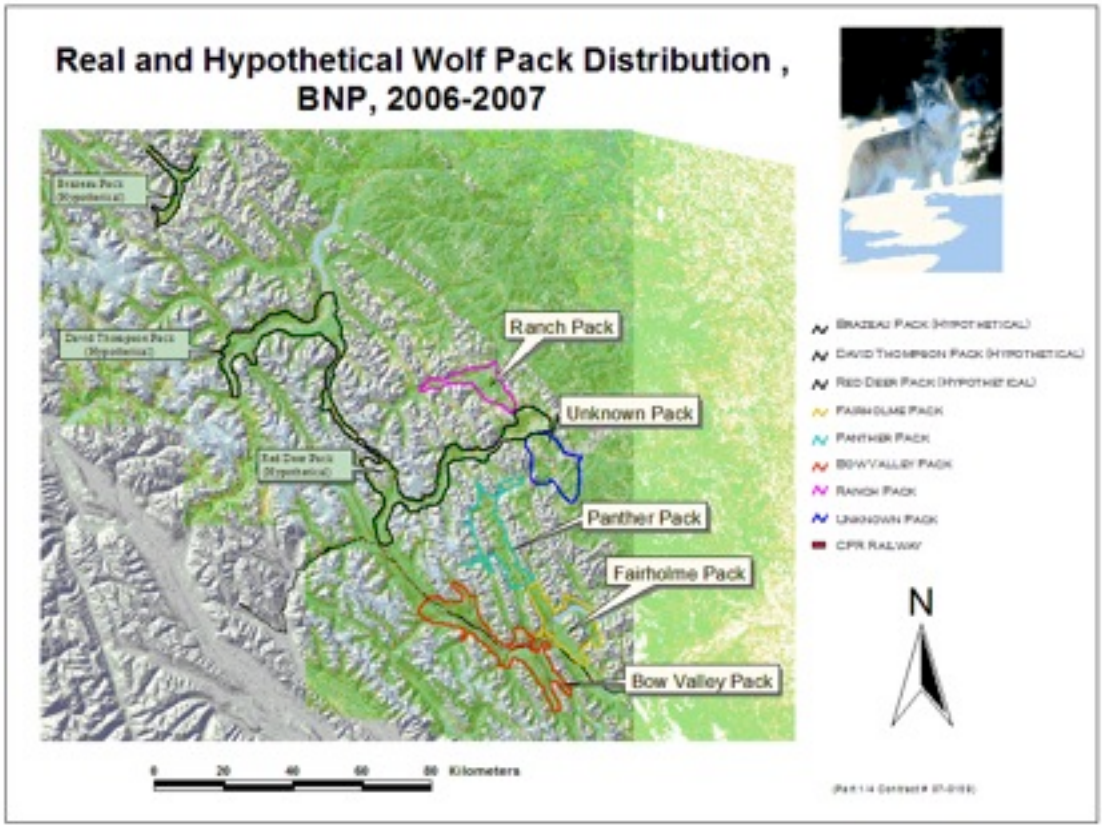

Figure 10. Conjectured and observed BNP wolf pack home range for 2006 – 2007. Note that there is no evidence for the present existence of the Panther Pack. What was termed the "Fairholme Pack" (a.k.a. Cascade Pack) appears to have expanded north into that range. A northward movement of the territory boundary of the Bow Valley Pack is also evident when compared to Figure 9 above.

3) Yoho Wolf Pack

This pack of 6 was the most tightly affiliated of the four discussed in detail within this report. Rarely would the pack break up into smaller hunting groups. Their movements into the Beaverfoot drainage this winter was not closely studied, however we noted that all available evidence seems to suggest no major changes to pack territory (Figure 11) when compared to older wolf studies for the1990's. Of interest was the discovery that both our cameras and Ivan Phillips' noted that one gray-coloured wolf in the pack is blind in its right eye. Cursory evidence suggests that this disability is not significantly hindering this animal (good body condition). Although we made no effort to investigate any known den sites for this pack, we did discover that 2 rendezvous sites (1 each in Kicking Horse and Beaverfoot drainages) had been used last year, and one also in the Kicking Horse had not.

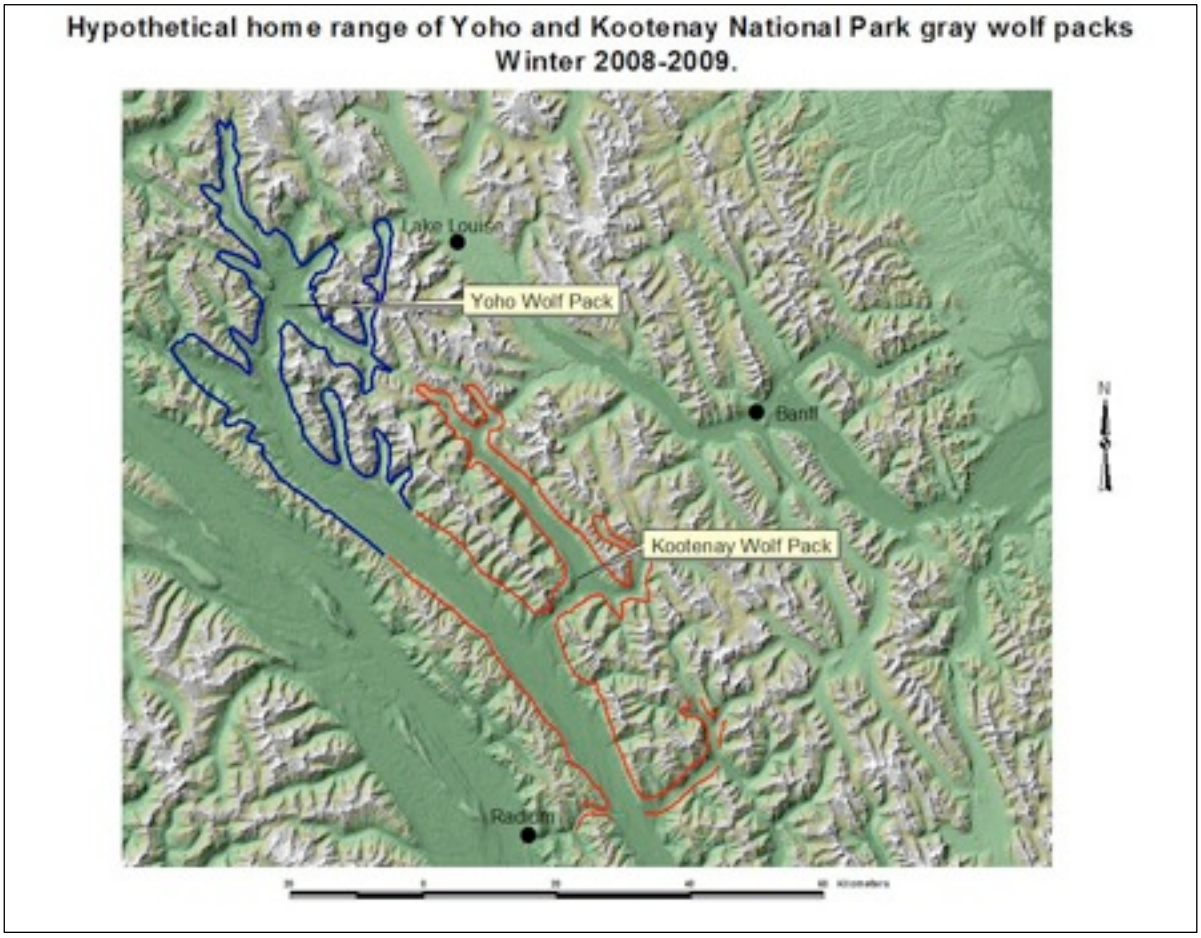

Figure 11. Territory (hypothetical) of Yoho and Kootenay National Park Wolf Packs, as determined by Carnivore Monitoring Project, Winter 2008-2009 and historical data. Ranges are unbounded in places due to limited data.

We suggest a need for diligent monitoring of the TCH where the pack crosses the highway at Leanchoil Marsh and near Finn Creek. These locations are obvious topographic "pinch-points" where many animals move between the Beaverfoot and Kicking Horse drainages and through the geographically constrained point near Finn Creek. On six occasions this winter, we obtained pack tracks crossings the TCH as shown

in Figure 12. We were not surprised to note the close proximity of these crossings to the points of previous wolf mortalities as documented in Parks' records. These data may prove valuable when proposed highway expansion projects through YNP begin.

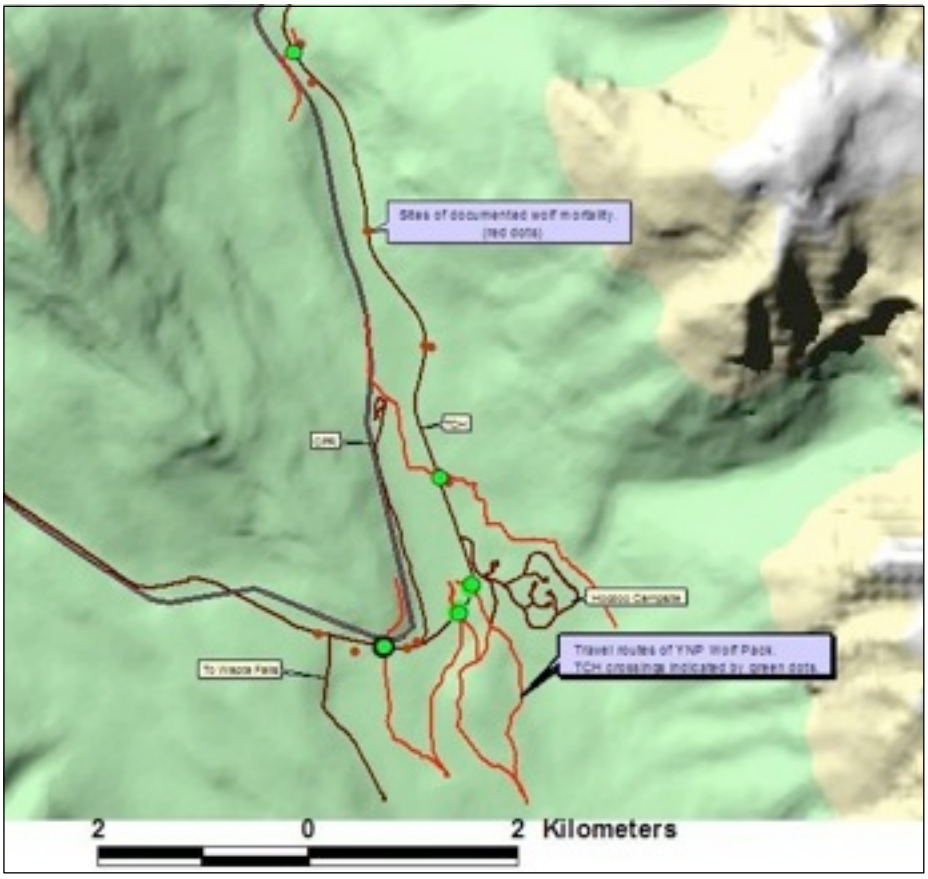

Figure 12. Trans-Canada Highway crossing locations of the YNP Wolf Pack in winter 2008 – 2009. Six tracking sessions in the Chancellor Campground region show that the YNP Wolf Pack continues to cross the TCH in areas where 11 wolf mortalities have been documented.

4) Kootenay Wolf Pack

Consistently 5 to 8 gray wolves comprise the KNP pack (Appendix 2) and the territory (Figure 11) also appears similar to older studies. Back-tracking confirmed that the pack still uses the upper Beaverfoot to a limited extent. We applaud Parks Canada for restricting snow machine use on the West Kootenay fire road as snow conditions and depths typically curtail wolf movement in this area. Should an easily travelled platform be presented to this pack, we have no doubt that significant access to more remote areas would occur – with the ultimate demise of the considerable moose population that is presently "inaccessible". It is our belief that these isolated groups of moose may constitute the seed population for large areas in the Beaverfoot to Kootenay Crossing.

Glen Kubian on 27 December 2008, documented what appeared to be an incursion of the Palliser Wolf Pack into the KNP pack territory near 16 Mile Pit. What likely are these same Palliser wolves were photographed by cameras as far north as Dolly Varden fire road in KNP. Our first assumption was that this group might have come from the Beaverfoot (i.e. Yoho Wolf Pack) but a tracking transect across the valley near the Beaverfoot/KNP boundary confirmed that this did not happen. Indeed, several similar transects showed no wolves coming into KNP from either this valley or from BNP this winter. The colours and numbers of this intruding pack (3 black, 2 gray), were confirmed independently by two rock truck drivers from the local magnesite mine – thus we conclude (albeit with limited data) that this pack was likely the Palliser Pack. A lone black wolf continues to appear on cameras near Kootenay Crossing at the time of this writing.

5)Other Wolf Packs

Cameras provided images of adequate quantity and quality to conclude that the Pipestone (Red Deer) Pack (5 black and 1 gray in early winter) are distinct from the Saskatchewan Crossing Pack (1 black and 3 gray). Confusion was caused when both packs spent time near Bow Summit in November and December of 2008.

We are also aware of a small pack (2 or 3 wolves – no sightings) that may be found in the Smith Dorrien and Kananaskis Lakes region. These wolves may also be accessing the Upper Spray River valley via passes near Mount Burstall and Smuts. The Palliser Pack (3-4 black, 2 gray) have been seen and tracked a number of times. We believe that on occasion, this group will also enter the Upper Spray River valley, meaning that at least 3 different wolf packs utilize that portion of BNP – mostly in summer. Over the 5 winter months, we note that the Pipestone (Red Deer) pack has been reduced in numbers from 5 black and 1 gray wolves, to 3 black and 1 gray. Several sightings and camera data suggest that these wolves heavily utilized the western edge of their habitual territory this winter. We can provide no data on the Clearwater Pack and cannot surmise whether or not this pack is distinct from the Saskatchewan Crossing Pack. Based on our past experience, however, we believe that it is a separate pack whose territory also encompasses part of Harrison Flats. In the Columbia Valley, we are also aware of the Cartwright Lake Pack that is composed of 6 black and 1 gray wolves and the Canal Flats Pack which contains 3 black and 3 gray wolves.

a) Wolf Prey Selection

When compared to the period of last re-colonization of wolves in this region (1980 – 1995), average individual prey size has diminished. Our data (Appendix 8 - Table 3), indicates that the preponderance of wolf kills recorded this winter by our study are mostly deer (76.2%) versus the larger bodied elk and moose. This apparent shift in prey species as compared to older wolf studies in the area (Huggard, 1993) is probably correlated to the obvious decline in many elk populations over that period. Park's data from 2002 to 2008 shows a marked decline in Cascade elk from 41 to 6 respectively, with similar results over the same years for the Ya-ha-tinda Ranch elk (993 to 408). We documented 21 wolf kills (Figure 13), all of which were deer (2 mule deer, 10 white-tailed deer, 4 deer sps.) excepting 2 elk and 3 moose. Of all predation noted by this study this winter, 84% was wolf-caused. Locations of predation are displayed in Figure 14. We noted the preponderance of wolf kills near Kootenay Crossing which assisted our comments provided to Alan Dibb on the potentially deleterious impact of a proposed forest and facility modification at this site.

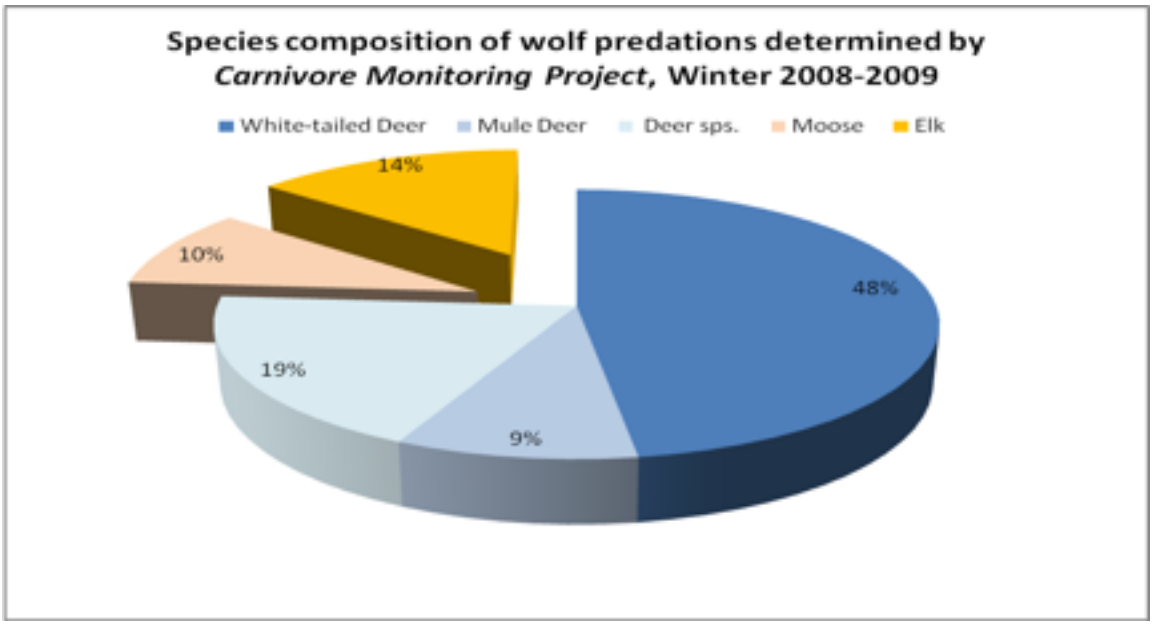

Figure 13. Graph showing percentage and species composition of wolf predations in study area of Carnivore Monitoring Project, Winter 2008-2009.

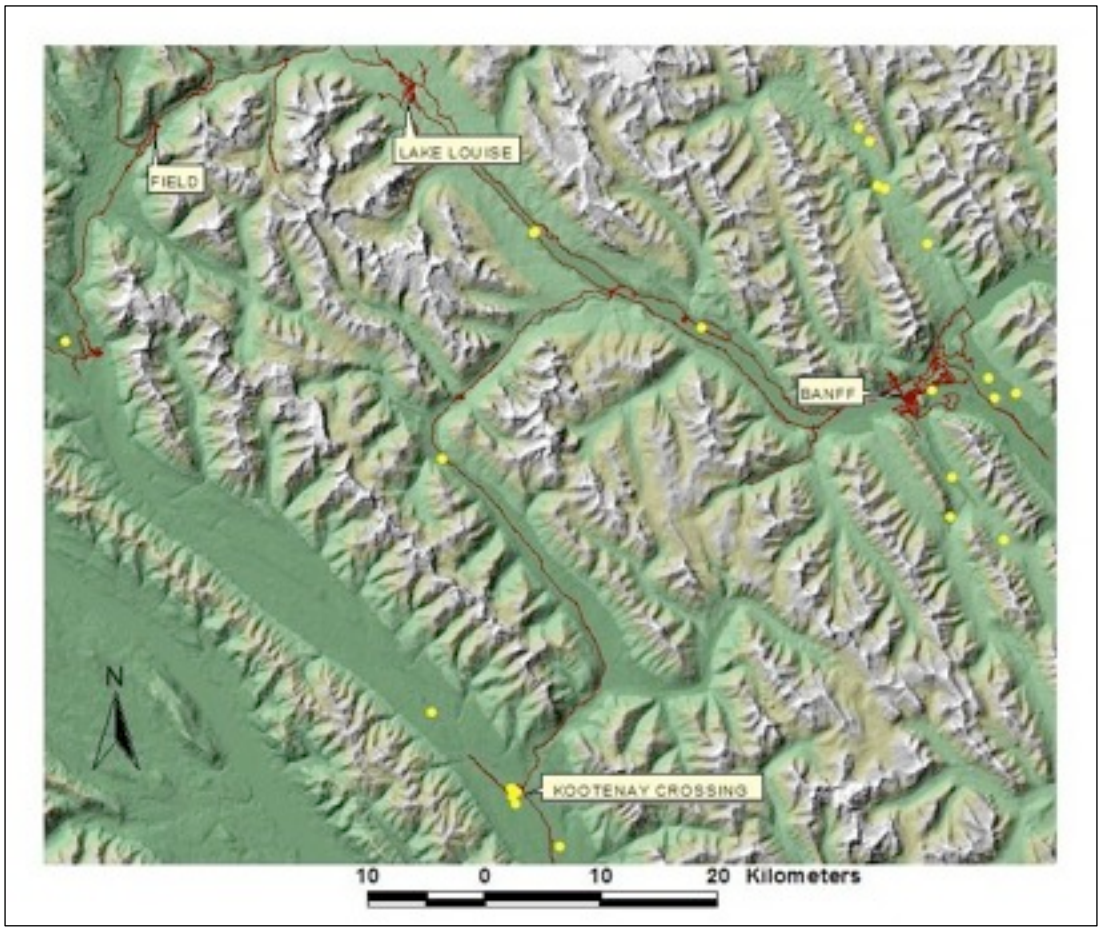

Figure 14. All predation (yellow dots) documented by Carnivore Monitoring Project, Winter, 2008 – 2009.

b) Other wolf events

We noted with interest again this year, a topographic funnel on the Healy Creek trail BNP, where wolves chase white-tail deer. A prominent cliff band (near the first bridge at the Sunshine Road parking lot) has been used a number of times to force deer to the creek. Tracking has documented this activity on at least 6 occasions, however this winter the cameras photographed a fast moving deer followed closely by 3 members of the BV Pack. Although this predation attempt was unsuccessful to our knowledge, our previous research has shown 3 wolf kills at this point. Also at this location, our camera documented a number of cougar and grizzly bear appearances.

An interesting movement was likely made by two wolves of the Cascade pack this winter. On several Cascade cameras we photographed a robust gray and a thinner, smaller, black wolf, moving north up the fire road on 21 March, 2009 (Figure 15). Fortuitously, we also were heading up the Cascade to maintain cameras and could verify that these wolves headed north to approximately Wigmore Summit and then reversed direction heading south to Stoney Creek. On 22 March, the pair had moved up to the Elk Summit area and appeared to be heading to Banff.

Figure 15. Larger gray and smaller black wolf nosing animal communication tree near Cuthead, BNP, 21 March, 2009.

On 23 March 2009, a larger gray and smaller black wolf appeared on the Vermillion Lakes where Banff resident Sally Plunkett, observed and photographed their presence (Figure 16). Sally was shown our images and she shared hers with us. We both speculated that these two wolves were likely the same ones photographed by both our cameras and hers, and that they had almost completed a circuit of Cascade Mountain. We find this movement unusual in that it is rare that Cascade Pack members would cross the TCH. It is very conceivable however that a different pair of similar appearance may have been involved as on 26 February, D. Hunter observed a single black wolf on the south side of the TCH and east of the compound. Wolves of both colours are common to both the Bow Valley and Cascade Packs.

Figure 16. Possibly two members of the Cascade Wolf Pack on Vermillion Lakes, BNP, 23 March, 2009. Compare to Figure 15 above.

In Mid-February 2009, we documented the Bow Valley Pack on a long foray into the Fortune Flats and lower Palliser region of BNP. Further investigation revealed that the pack had scavenged the horse that died in Bryant Creek this winter. The carcass had been removed from the creek and skidded via snow machine to a location near Turbulent Creek waterfall. It was there that the wolves fed upon horse - possibly for the first time in their lives.

Cameras allowed us to determine that the 3 gray and 1 black wolves of the Saskatchewan Crossing Pack, were different and distinct from the 1 gray and 5 black wolves of the Red Deer/Pipestone Pack. Several multi-day surveys at Saskatchewan Crossing revealed a disturbing trend. Early summer 2008 work suggested the pack consisted of 3 gray and 2 black wolves. One each of black and gray-coloured wolves wore radio collars. Fall investigations allowed us to conclude successful denning with at least two pups produced. (Our remote cameras documented a wolf adult moving 2 pups.) By late November 2008, the number of images of wolves from cameras had diminished severely to the point where by February, no wolves were photographed. Warden Terry Damm concurred that he had seen the least amount of wolf sign since he had been posted at the crossing. Early spring surveys in 2009 showed no fresh (< 1 month) wolf scat or tracks within a 700 radius of their traditional den site. Twenty kilometre transects of the Howse and South Saskatchewan also revealed no recent wolf sign. We presently are awaiting the results of a meeting with Parks and Provincial staff to find additional details such as trapper success and telemetry relocations of collared wolves using BNP.

Upon solid documentation of a distinct startle response in wolves when “head-first” images are taken at night by older model remote cameras, Mike Gibeau and this author prepared a paper for *Wildlife Professional* (Gibeau and McTavish 2009, in press) that outlines the issue and potential methods to alleviate. We highly recommend that other wildlife and human use researchers who utilize remote cameras, carefully review this article. To our knowledge no species other than wolf has shown a negative response to camera flash at night. Our paper reports on the positive results that the newer model (PC90) Reconyx© has made in fully eliminating this issue.

B) Coyotes

As coyotes appear to be ubiquitous throughout the study area, usually with the exception of soft deep snow regions (e.g. Kootenay north off highway), we made no attempts to monitor their predations or distribution. This may prove to be an error in hindsight however, as they are a very important and effective carnivore throughout the region. Several select points of interest are offered however. We noted in early January that coyote (and fox) sign could not be found in the upper Cascade after our first significant snowfall of 30+ cm. When this snow crusted and several researcher and snow machine forays had been completed, both species appeared once more. Indeed, we tracked almost continuously, 3-day old coyote sign from the Minnewanka trailhead, to Wigmore Summit and were impressed by the large movement of this animal. Over the 6-month study period, cameras documented the presence of 70 coyotes. Tracks from coyote were found without fail on all our transects into: Middle and Lower Spray, Redearth, Johnston, Cascade, Lower Pipestone, Saskatchewan and Kootenay Crossing, and all fire roads in KNP and YNP. Cameras documented coyote presence 49, 20, and 1 time(s) in Banff, Kootenay and Yoho respectively. We documented no coyote predations but noted scat containing deer sps. hair on numerous occasions. Coyote were present at approximately 78% of all wolf and cougar kills noted. A coyote pair (only one of which is shown in Figure 17) appears to be denning within 600 m of the last used den site for the Cascade Wolf Pack.

Figure 17. This coyote may have chosen to den near the Cascade Wolf Pack den site.

C) Fox

We were pleasantly surprised again this winter, by the abundance of fox as documented by our sightings, tracks and cameras. Fox were documented 35 times with cameras, 27, 6 and 2 times(s) in BNP, KNP and YNP respectively. We are aware of 3 dens in BNP, at least one of which is active this spring. It is perhaps unfortunate that the site of another is located within a back-country campground (CR6) as the human caused potential for disturbance here is considerable. We recently extracted logs that were placed within two entrance holes of this den. Visitors regularly camp within 40 m of the den and a commonly used bank

where day-hikers rest as a “lunch-stop” is within 10 m of the den. An un-used horse hitching rail (within 6 m of the den) is a visual magnet for visitors and we recommend that BNP considers its removal for this reason. An adult fox that traditionally utilized the den was photographed by our camera (Figure 18).

Figure 18. This fox near CR6 (Cascade Campsite, BNP) shows its distaste for our research by defecating 3 m in front of the camera.

D) Cougar

In our opinion, cougar abundance appears relatively stable in the study area, similar to several years past. On both the Fairholme Bench and lower Spray River valley of BNP, cougar sign is frequently noted. In fact, on the bench this winter, we never travelled farther than 3 km without contacting cougar sign. The author was followed at close range (< 30 m) for approximately 60 m this winter, by what appeared to be an adult cougar on the lower Spray. Tracks were often recorded on Mt. Hunter YNP and around the Leanchoil Marsh. Additional tracks were noted near the Black Bridge and surprisingly, a camera mid-winter photographed a cougar near Sherbrooke Lake. We feel that the location with the highest sign, especially documented by camera was near Dog Lake KNP (n = 8 events) where we always noted fresh tracks on every trip through the area. Careful examination of those tracks indicated at least 3 different animals frequenting the area. Cameras recorded the presence of cougar on 33 occasions (23 in BNP, 9 in KNP and 1 in YNP). Cougars killed a white-tailed deer each on Goat Creek and Fairholme Bench BNP, a mule deer in the Beaverfoot near the KNP boundary, and a family likely killed a sheep off the Spray Fire Road near the mineral lick (Figure 19). What appears to be the same family was photographed on Healy Creek Trail earlier in the winter (Figure 20). Cougar kills comprised 16% (n = 4) of the 25 predations documented this winter.

Of interest was the recovery of an emaciated cougar body which necropsy suggests may have been injured or killed by wolves on the 1A highway. This young animal may have also been observed a short time earlier, walking undeterred down the center of the road. Our field investigation at the site questions whether or not the Bow Valley Pack contacted the cat before or shortly after death.

Figure 19. This cougar family (7 March, 2009) in the Middle Spray, BNP were tracked over Sundance Pass to the Spray fire road which they followed to within 550 m of the Banff Springs Hotel. This family is likely responsible for the mortality of a sheep at the location shown.

Figure 20. These cougars photographed on Healy Creek Trail, BNP on 12 January 2009, may be the same individuals also recorded above (although the kittens appear smaller).

An additional value of our monitoring became apparent when we studied the time and dates of the two photographs shown below (Figure 21) taken at Dog Lake in KNP. The cougar appears at the same location as the human within 5 minutes of the passing of the human. On the graph below the images, we plotted the hourly activity of all cougar documented by both years of this work, and then added a

polynomial regression line to the second order of magnitude. We noted that single cougars are mostly nocturnal and females with kittens more active during the day. The graph shows that it is relatively unlikely to have a single cougar active in early afternoon.

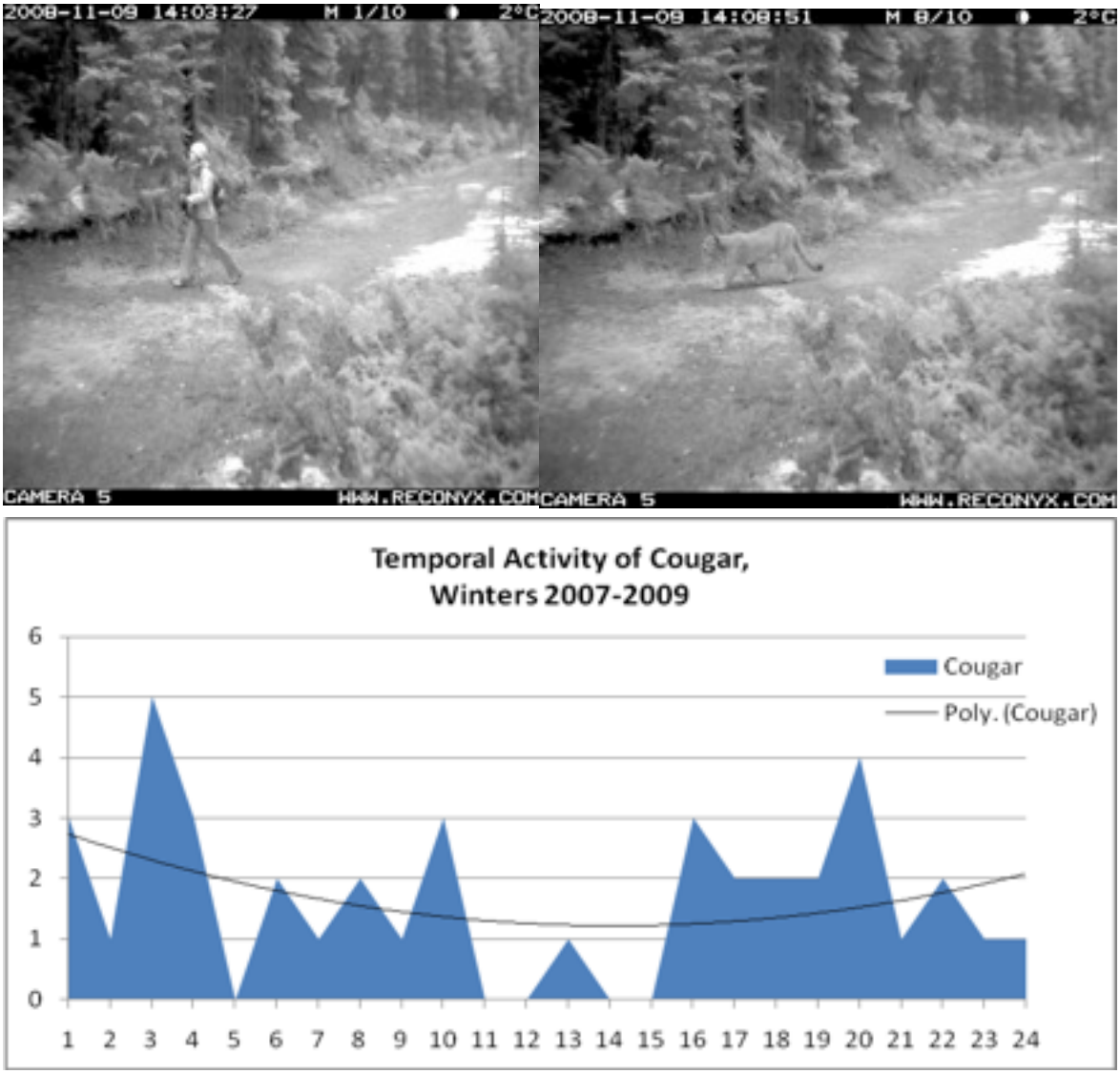

Figure 21. Carnivore monitoring also provided several interesting insights into predator behaviour. The two top images were photographed 5 minutes apart near Dog Lake, KNP. Parks Canada was able to provide hikers with timely warnings thereafter. The graph shows the diurnal activity patterns of cougar in all parks and hints at the low probability of the photographed event for that time of day.

E) Lynx

It is our belief that hare and squirrel populations remain strong, although we noted a possible drop in hare sign at the start of this year. Concurrent to this is the high number of lynx (n = > 55 events for tracks, n = 11 for cameras) that our study recorded. However our most current data from the spring of 2009, suggests that lynx abundance may now be waning.

Wonderful participation from co-workers in the Lake Louise area, allowed us to conclude that at least 4 lynx regularly utilized the ski hill. One female with 2 kittens and a single adult were observed, photographed and tracked (Figure 22) on many occasions. In the Cascade near the Elk Trap, we candidly observed a healthy looking female with two kittens for 20 minutes this winter. An untested but interesting observation noted this winter, was that as snow packs remained low until late January, hare were forced to leave their typical high density closed canopy stands with abundant pine regeneration, as over-browsing had occurred. Track counts per transect for lynx concurrently appeared to drop as lynx moved with the hare. Further investigation off transects allowed us to conclude that both lynx and hare were probably still in abundance at that time. When heavy snows finally came to most of our study area, hare returned to their original haunts, as did the lynx. A higher platform allowed continuous browsing for hare.

Figure 22. Our camera at the Lake Louise Ski Hill captured images of at least 4 different individuals this winter including a mother and 2 kittens.

F) Bobcat

No Bobcat sighting or sign were documented by this study this winter. This is likely a function of: 1) the poor proximity of our cameras in relation to bobcats' typical range – especially in KNP, 2) their low densities and 3) their secretive nature.

G) Wolverine

Wolverine were imaged 6 times by our cameras. However on several occasions, they passed by the Helen Lake camera site and were not photographed. A swale that formed in the snow in front of the camera allowed this fast moving mammal to pass the camera and not trigger it. Several track sequences were confirmed by Barb Bertch however. She hypothesized a potential denning area in the vicinity as determined by multiple track sets.

In the Ottertail of YNP our cameras recorded the passage of a wolverine on March 4 at 19:53. This was followed 46 minutes later by a different individual. (Figure 23). A large wolverine frequented the Pipestone cross-country ski trail in March 2009 (Figure 24). Remote cameras also documented wolverine presence at Sherbrooke Lake and in the Otterhead area of YNP. Five of six wolverine events as determined by remote photography occurred in YNP, with the other occurring in BNP (Pipestone).

This winter, > 30 valid track sets confirmed wolverine presence in the following regions: Sunshine/ Simpson, Cascade, Panther, Lower Spray, Helen/Dolomite/Mosquito Creek/Pipestone/Bow Summit, Wapta Lake/O'Hara, Ottertail Flats, and near Marble Canyon. At least two individuals were tracked in the lower and upper Cascade this spring, but the total number of individuals noted in the three parks could not be confidently estimated.

Figure 23. This wolverine was photographed several times this winter near Sherbrooke Lake in YNP.

Figure 24. Pipestone BNP wolverine heading north on 22 March, 2009.

H) Fisher

We have only had cameras image fisher twice in the last 5 year's work in the Mountain National Parks, and no images were taken over the course of this survey this winter. However, we regularly obtained track sequences (n = 5) in the Cascade Valley within a radius of approximately 4 km of the Elk Trap. In January 2009, we followed a set for 4 km up Stoney Creek starting approximately 3 km up from Stoney Bridge. It is our opinion that tracks suspected of being fisher, must be followed for a significant distance (minimum 500 m?) for proper verification. A smaller wolverine was back-tracked in the same region for 1.5 km before we were certain they were not made by fisher. Similarly, we are aware of field workers that mistakenly identified fisher tracks that they did not followed for any significant distance. Closer investigation, proved them to be slightly melted out snowshoe hare tracks! We believe it likely that fisher exist in very low densities, at least in the Cascade, Palliser and Pipestone valleys and near the headwaters of Baker Creek, BNP.

I) Marten

Similar to coyote, marten appear to be profuse in many regions of all 3 parks. Cameras noted their presence only 11 times, however we believe them to be more abundant than these data suggest. On the West Kootenay, Cascade, Redearth and Amiskwi fire roads, it was not uncommon to record numerous clusters of marten tracks at 500 m intervals throughout the length of our surveys (15^{+} km). Hare and squirrel populations appear very high in our opinion so the prey base for marten is abundant. On one transect near Flint's Park BNP, we recorded means of 138 squirrel, 82 marten and 56 hare sets per kilometre over the 3 km survey distance.

J) Grizzly Bear

Grizzly bears were observed infrequently on cameras (n = 0 in BNP, 5 in KNP and 3 in YNP). As our field season overlapped > 90% of the typical grizzly bear denning period, the low return from cameras for this species, comes as no surprise.

The fortuitous observation of a very dark coloured grizzly on Grassy II of the Cascade was made on 4 March, 2008. The bear was observed testing sheep on the bluff for 40 minutes. On 21 March of this year, at the same location, we observed what appeared to be the same animal. No sheep were in the immediate vicinity at the time, but the bear appears to have a somewhat consistent hunting pattern developed for early spring. A potentially similar short denning period was noted this winter from a grizzly in KNP (Figures 25 and 26).

Figure 25. Carnivore Monitoring Project also provided data on late season grizzly bear activity. This grizzly was active in the area of Crooks Meadow (KNP) for at least 10 days after this image was taken on December 6, 2008.

Figure 26. Possibly the same grizzly photographed above (Figure 25), was imaged again on April 6, 2009 on the West Kootenay fire road. Tracks likely from this same animal were recorded in the area on 26 March, 2009. If this grizzly is the same individual imaged above, we can conclude that it only denned for approximately 3 months this winter.

KNP and YNP managers have apparently made a decision similar to BNP to reduce clearance of deadfall on selected fire roads. This ecologically minded policy allows infilling of roadside shrubs and is returning many fire roads to a more natural state resulting in higher values for both wildlife and park users. We've observed that the shrub infill is often comprised of the highly important *Shepherdia canadensis.* Buffalo berry remains one of the primary berry crops for both bear species in late summer and fall. Parks Canada's wise decision has also greatly increased visitor experience in that these roads (e.g. Dolly Varden,West Kootenay, Spray) are fast becoming easily travelled trails with diminished (but safe) sight lines. It is our opinion that few visitors to these areas, desire to hike or ski on wide, open, humanized roads.

K) Black Bear

For likely the same reason as grizzly bears discussed above, black bear were poorly represented in camera data (n = 5). Of interest is that active bears were documented into the second week of December, 2008 in KNP (Figure 27). Cameras were much less affective at documenting black bear presence this winter than were tracking sequences.

Figure 27. Large black bear in early winter snow on the Dolly Varden fire road in KNP, December 8, 2008.

L) River Otter

During the Christmas season of 2008, we were informed by Cyndi Smith (Wildlife Specialist, Waterton National Park) that she had noted slide tracks of river otter near the Bryant Creek bridge adjacent the Trailcenter Warden Cabin. After several attempts were made, we verified the activity of otter on the lower reaches of the Spray River, above the junction to the Palliser Cabin trail. Our best estimate was that only one animal was in this area. Additional sign was noted in February, near the open plunge pool at the Trubulent Creek waterfall. This exciting observation begs many questions about this fascinating animal (eg. overland travel in winter).

M) Unusual Sightings

Below are some selected images not commonly observed in the normal course of our carnivore monitoring duties (Figures 28 – 35).

Figure 28. Fortuitous image of the novelty hat worn by a little girl (unseen below hat in this image) examining the remote camera near Healy Creek, 2009.

Figure 29. Mountain goat following author's ski track at a low elevation near Sherbrooke Lake, YNP in December 2008.

Figure 30. A skunk wanders down the West Kootenay fire road KNP in January 2009.

Figure 31. This wolf appeared numerous times at the Yoho Carrion Pit camera YNP, often accompanied by 4 additional wolves. Note that this animal is blind in its right eye – as evidenced by lack of eye shine in that eye.

Figure 32. Bighorn sheep moving on the Healy Creek trail BNP, in mid-afternoon at a low elevation approximately equal to the Bow River.

Figure 33. Dramatic images of white-tailed deer leaping a log near Johnson Lake, BNP. Besides carnivores, cameras at this location recorded 98 white-tailed deer and 8 elk. Of interest was the paucity of mule deer documented here.

Figure 34. Emaciated fox on the West Kootenay fire road, KNP.

Figure 35. Ghostly figures of night skiers on the Cascade Fire Road, BNP.

6) Human Use

We tallied human use and present these data in Table 4. Some sites (e.g. Cascade and Brewster) received inordinate use upon occasion (Christmas holidays and date of Lake Louise-Banff Ski Loppett). Other data (Off-leash Dogs, below) provides that domestic dogs on average, accompany 1 in12 people. The effect is greatest for the monitoring sites at Dog Lake (KNP), and Cascade and Healy Creek Trail (BNP).

Table 4. Numbers of hikers and skiers using areas with remote cameras in Carnivore Monitoring Project, Winter 2008 – 2009. Users per each of the 25 camera sites averaged 232. Each camera site averaged 46 users per month, however the range was exceptionally large (r = 4 to 724/month).

Human Use of Camera Sites, Carnivore Monitoring Project, Winter 2008 - 2009.			
	# Hikers	# Hiker Groups	Mean Hikers/ Group
	409	231	1.77
	# Skiers	# Skier Groups	Mean Skiers/ Group
	5390	2567	2.10
Total Users	5799	2798	2.07

Off-leash Dogs

Our cameras documented 480 dogs this winter of which 372 (77.5%) were not on leash. In all parks, the area with the most observations of dogs off leash, was the Healy Creek Trail from the Sunshine Road parking lot, to the Sundance Pass Trail, BNP. Dogs off leash continue to be a concern for a number of reasons. In our opinion, the disturbance effect to wildlife is much greater for an off-leash dog, than from either a dog on a leash, or from the dog's owner. The radius around the owner through which many dogs travel (we estimate an average of 40 m) is significant. Wildlife displacement is obviously much greater than this, depending on wildlife species. To estimate the area of influence and potential wildlife displacement of an off-leash dog that roams within a 40 m radius of its owner that hikes or skis the Healy Creek Trail from the Sunshine Road parking lot, to its junction with Sundance Pass Trail, we placed a 100 m (arbitrarily determined) buffer round this section of the trail, and then calculated the area using Arcview 3.3 (Figure 36). We found that large mammals in an area of 78.7 hectares would be potentially displaced by an off-leash dog. The potential cumulative displacement becomes much more significant, when all regions where dogs are commonly walked in all parks are considered.

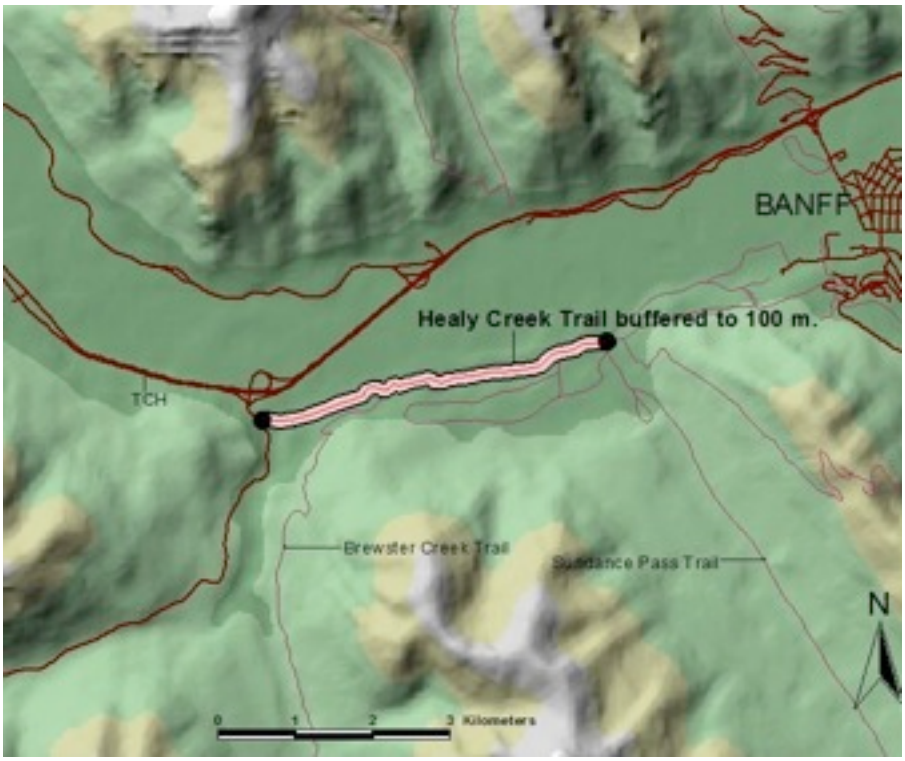

Figure 36. The area of influence (shaded pink) and potential large mammal displacement of an off-leash domestic dog travelling the Healy Creek Trail, BNP was calculated to be 78.7 hectares.

Additionally, we question what effects to the social hierarchy of wild canids, do domestic dog urinations on naturally occurring scent posts have. Over-marking by domestic dogs on wolf and/or coyote/fox scent posts is common. A small portion of dog activity at an animal communication tree on Healy Creek Trail this winter is displayed in the image composite Figure 37. We've noted similar results on the Goat and Spray fire roads, and the Norquay Trail to 40-Mile Creek. It is our belief that most urinations by wild canids are functional other than just to void the bladder and when a domestic dog marks the post of another canine, a message is sent. Of course the meaning of that message will likely remain a mystery, but it is likely contradictory and disturbing to highly territorial, social and reclusive animals such as wolves.

An additional concern is provided by Doug Whiteside, Staff Veterinarian at the Calgary Zoo (personal communication). He states that if vaccinations of domestic dogs are incomplete, transmission of viral diseases such as Parvovirus, Canine Distemper, Coronavirus and Infectious Canine Hepatitis can be transmitted to wild populations through urine and scat. There is also the potential for parasite transmission such as hookworms and roundworms.

Figure 37. This composite shows many domestic dogs off-leash on the Healy Creek Trail BNP, urinating and defecating on an animal communication tree used by bears, coyotes, fox and wolves in the winter of 2008-2009. At this site, dogs were recorded by camera on 269 occasions. Dogs were off leash 74.7% of the time (n = 201). The last image shown is of two wolves from the Bow Valley Pack at this same scent post.

MANAGEMENT IMPLICATIONS

Opportunistic collection of carnivore hair for the purposes of DNA analysis was beyond the scope of this study. However, should future budgets allow for the analysis, we believe significant numbers of hair samples would easily be obtained during the normal course of tracking and camera maintenance. Remote

wildlife cameras provide an easy way to quantify success by unit effort when compared to tracking transects which may offer notoriously variable results from year to year. We believe that coarse population trends may be quantitatively calculated from these photographic data. Indeed, many species throughout the world have been studied with this technology for this purpose, including fox, (Glen and Dickman 2003), black bear (Bridges et al. 2004), white-tailed deer (Koerth and Kroll, 2000), wood mice (Diaz et al. 2005), and cougar (Pierce et al. 1998). In a single study (DeVault et al. 2004), remote cameras were employed to monitor 17 different species. As both population abundance and trend are perhaps the most salient figures that managers desire, it follows that simple, cost–effective strategies to determine or estimate these values, must be employed. This study which was conducted by one staff and many volunteers, highlights basic biological inventory, presence and absence and relative abundance of 8 large carnivores. With additional resources, a power analysis would indicate how large a sample would be needed to derive accurate and reliable statistical judgements. We continue to believe that our methods present the most efficient and cost-effective means of monitoring large carnivores over these three national parks.

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APPENDIX 1

Synopsis of Carnivores Photographed per Camera Station.
Carnivore Monitoring Project Winter, 2008 - 2009

	wolf	coyote	fox	cougar	lynx	marten	wolverine	grizzly bear	black bear	TOTAL
RUNDLEVIEW RIDGE		1	6	2		1				**10**
JOHNSON JUNCTION				8						**8**
DOG LAKE	13	2	1	8				3		**27**
YOHO CARRION PIT	13							1		**14**
CROOKS	39	12	2			2				**55**
HILLSDALE SPLIT	19	12			1					**32**
OTTERTAIL	2				5		2	1		**10**
SHERBROOKE LAKE				1			2			**3**
BREWSTER BRIDGE	34	2	5	4						**45**
SPRAY SCENT POST	38	1								**39**
JUNIPER		1			4	4				**9**
WEST KOOTENAY FIRE ROAD	65	2	2	1		1		2		**73**
ICE RIVER	13	1	2					1		**17**
HELEN						1				**1**
LONE PINE	32	19								**51**
CASCADE CAMPSITE	19	2	16							**37**
DOLLY VARDEN	10	4	1			1			1	**17**
PIPESTONE	10				1	1	1			**13**
SASK CROSSING Warden Lake	12			4					4	**20**
SPRAY MINERAL LICK	5			4						**9**
FLINTS	8	9								**17**
OTTERHEAD	4						1			**5**
JOHNSON LAKE	6			1						**7**
SASK CROSSING Howse River	8	2								**10**
TOTAL	**350**	**70**	**35**	**33**	**11**	**11**	**6**	**8**	**5**	**529**

APPENDIX 2

STATUS OF WOLF PACKS IN AND AROUND BANFF, KOOTENAY AND YOHO NATIONAL PARKS. 2008 - 2009

PACK	PARK	GENERAL RANGE	RANGE OF PACK NUMBERS [1]	COLOURS CONFIRMED BY (T/C/S[2])
Bow Valley	BNP	Lower and Mid-Bow, Lower and Mid-Spray, Redearth, Sundance, Johnston	3 to 8[3]	3 gray, 4 black TCS
Peter Lougheed	Peter Lougheed	Mid-Spray, Smith Dorrien, Kananaskis, ?	3 to unk.	1 gray TS
Cascade	BNP	Fairholme, Cascade, Stoney, Dormer, Panther, 40 Mile	3 to 7	3 gray, 3 black TCS
Red Deer	BNP	Red Deer, Cyclone, Pipestone	3 -5	1 gray, 4 black TCS
Clearwater	BNP	Clearwater, Harrison Flats	unknown	unknown none
Saskatchewan Crossing	BNP	Howse, Mistaya, Bow Summit, Helen?, S. Saskatchewan	0 - 5	3 gray, 1 black TC
Palliser	BNP	Upper Spray, Palliser, Albert, Kootenay S. of KNP	3 - 6	2 gray, 4 black TCS
Kootenay	KNP	KNP, Upper Beaverfoot, Lower Simpson, Mitchell, Cross	4 to 8	8 gray TCS
Yoho	YNP	YNP, Moose, Dainard, Mid Beaverfoot	3 to 6	2 gray, 4 black TCS
Columbia	na	Columbia Valley - Brisco to Kinbasket	7	1 gray, 6 black S
Canal Flats	na	Radium - Skookumchuck	2 to 6	2-3 gray, 2-3 black S

[1] Minimum and maximum pack numbers, November 2008 - April 2009

[2] T = tracking C = camera S = sighting

[3] Six observed in Bow Valley while cameras concurrently documented 2 in Spray

APPENDIX 3

Parks Canada Parcs Canada

Canada

Canada

Thanks for helping us monitor carnivores this winter in Banff, Kootenay and Yoho National Parks! Using tracking transects, a series of digital video remote monitoring cameras, and sighting/sign reports from active parks' users (forms included), this National Park sponsored project will attempt to determine the presence or absence of: Cougar, Lynx, Bobcat, Wolverine, Fisher, Marten, Weasel, Wolf, Coyote, Fox, Black and Grizzly Bear at various locations. *Using the track identification key provided*[1]*, please record any sign of these animals, that you encountered from your travels in this area.* We hope your data will assist Parks wildlife mangers in ensuring viable carnivore populations for many years.

Cam McTavish - (McTavish Biological Services, smctavis@telus.net, 403-678-6711)

Dr. Mike Gibeau - (Carnivore Specialist, Mountain National Parks)

Alan Dibb – (Wildlife Specialist, Lk. Louise, Yoho and Kootenay National Parks)

Jesse Whittington - (Wildlife Specialist, Banff National Park)

1. *Our sincerest "Thanks" to Ben Gadd for his permission in using these materials copied from his most excellent tome "Handbook of the Canadian Rockies"!!*

APPENDIX 4

CARNIVORE MONITORING - WINTER 2008/2009

PARTICIPANT:_____

DATE OBSERVED	LOCATION[1]	AGE OF SIGHTING /SIGN[2]	SPECIES and TYPE OF SIGN[3]	ESTIM. NUMBER OF ANIMALS	DIRECTION OF TRAVEL[4]	COMMENTS[5]

1. LOCATION: Include trail, approximate distance from trailhead, other descriptors

2. AGE OF SIGHTING/SIGN: For example "3 days" or "a couple of days" etc.

3. SPECIES and TYPE OF SIGN: "Wolf tracks", "Cougar scat", "Coyote scent marks"

4. DIRECTION OF TRAVEL: For example "up valley" or "East" or "towards trailhead" etc. 5. COMMENTS: Should we need further info., please consider leaving your contact particulars

QUESTIONS? Please call Cam McTavish at 403-678-6711 or smctavis@telus.net

(Thanks so much for helping us out!! Hopefully your work will help ensure long-term carnivore populations in our Parks.)

APPENDIX 5

CARNIVORE MONITORING – BANFF, YOHO AND KOOTENAY NATIONAL PARKS

(Please complete one form per species)

DATE: _____month,_____day, 200__year.

SIGHTING: yes or no (circle one)

SIGN: tracks,scat,scent marks (circle one or more), other _____.

SPECIES: fox, coyote, wolf, weasel, marten, fisher, wolverine, bobcat, lynx, cougar, black bear, grizzly bear (circle one)

LOCATION:__

ESTIMATED AGE OF SIGN:_____ (ex: "2 days" or "about one week")

ESTIMATED NUMBER OF ANIMALS:_____

ANIMAL DIRECTION OF TRAVEL:_____ (ex: "north" or "toward trail head")

COMMENTS:_____

_____

Our sincere "Thanks" for your help!

APPENDIX 6

Lynx
Front 9–10 cm across
Hind 8 cm
16–35 cm apart
Scat 2 cm thick

Cougar
Track 9–10 cm across
30–50 cm apart
Scat like that of lynx

Coyote
Track 6–7 cm long
10–40 cm apart
Scats 2 cm thick
Twisted, often
with hair

Wolf
Front 12 cm long
Hind 11 cm
65–200 cm apart
Scat 2.5 cm thick
Often with bone chunks

Red fox
Front 6 cm long
Hind 5 cm

Typical sets for dog-family species

Grizzly bear
Front 15–20 cm long
Note long claws
Hind 25–30 cm
Tracks 60 cm apart
Scat 6 cm thick

Black bear
Front 10–13 cm long
Note short claws
or none showing
Hind 18–20 cm long
30 cm apart
Scat 3.5 cm thick

Mule deer
Track 6–8.5 cm long
55–65 cm apart

Scats for mule deer and white-tailed deer are 1.5–2 cm long pellets

White-tailed deer
Track 5–9 cm long
30–50 cm apart

Elk/wapiti
Track 11.5 cm long
75–150 cm apart

Scats 2 cm long

Moose
Track 15 cm long
100–170 cm apart
Scats 4–4.5 cm long

Caribou
Track 12–13 cm across
Scats 1.5 cm long

Bison
Track 13 cm across
150 cm apart
Domestic cow is similar
Scats large and sloppy

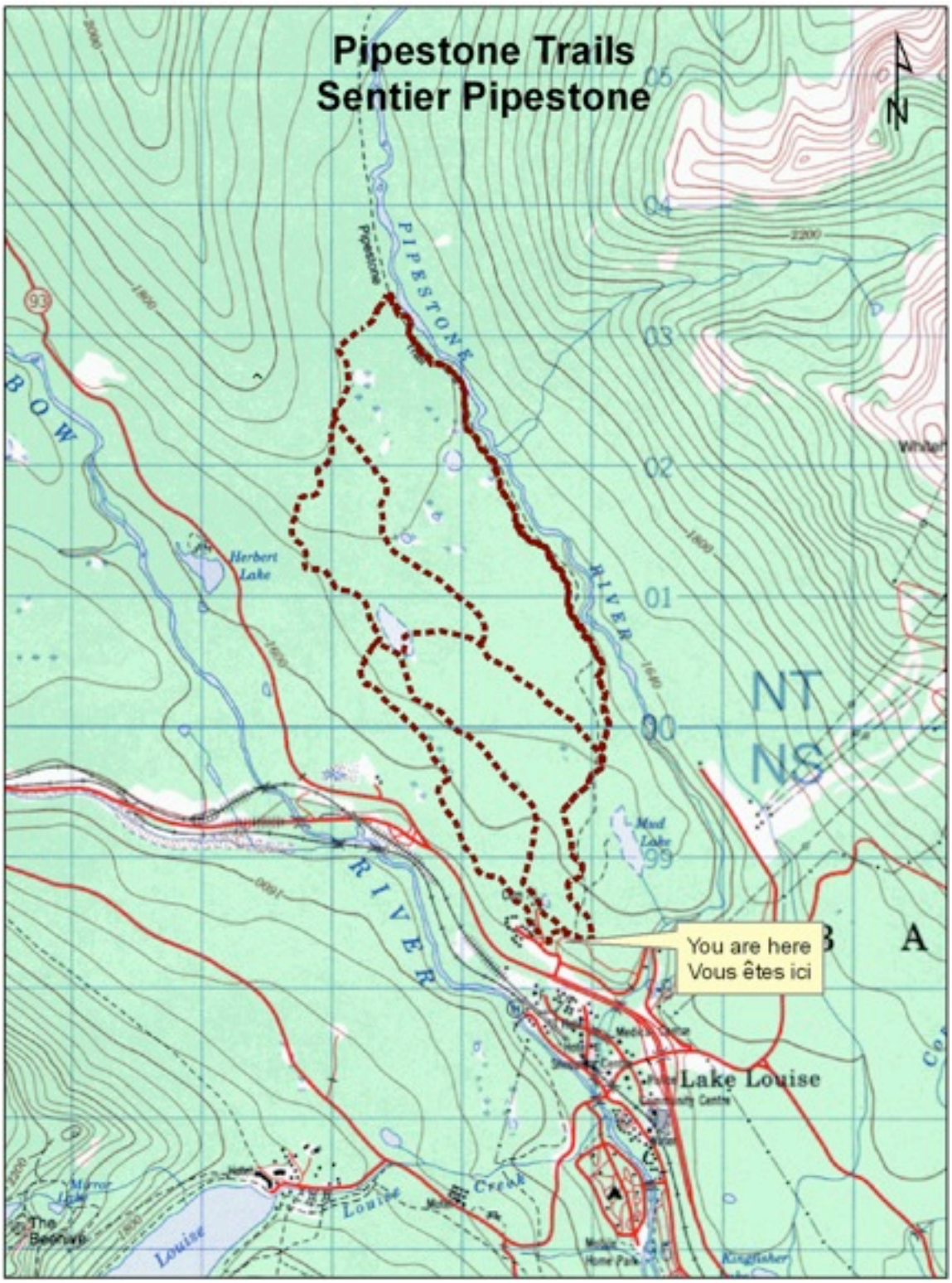
Bighorn and Dall sheep
Track 8–9 cm long
45 cm apart
Scats 1–2 cm pellets

Mountain goat
Track 8–9 cm long
35–40 cm apart
Scats 1–2 cm pellets

Scats of bighorn sheep and mountain goat are identical

Ptarmigan
Track 5 cm long
Sawdusty scats 0.5 cm thick

APPENDIX 7


Pipestone Trails
Sentier Pipestone
N
PIPESTONE
RIVER
BOW
RIVER
Herbert Lake
Mud Lake
You are here
Vous êtes ici
Lake Louise
Louise Creek
Louise
Mirror Lake
The Beehive
Kingfisher
NT
NS
A
B
05
04
03
02
01
00
99
93
2200
1800
1600