Project Completion Report
Rocky Mountains Cooperative Ecosystem Studies Unit (RM-CESU)

Project Title: Impacts to Grizzly Bear and Wolverine from Development in the Upper Flathead River

Project Code (such as UMT-72 and/or the "J" number): J1434080018, UMT-160

Type of Project (Research, Technical Assistance or Education): Research

Funding Agency: National Park Service

Partner University: The University of Montana

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Start Date of Project: April 1, 2008

End Date of Project: December 31, 2012

Funding Amount: $187,413

Project Summary
There were 3 subproject reports produced. These are attached as Appendices A., B., and C.

Number of students participating in this project: undergraduates, graduate students, degrees conferred.

N/A

Lessons Learned from this project.

This project started as a project to develop baseline information on key wildlife species in an area proposed for resource development. However, after the project started, the proposed development was cancelled resulting in cancellation of the funding to complete the project. It would have been possible to complete the original work plan for this project however, since funding was terminated, the project was ended prematurely and prior to completion of the original work plan objectives.

Otter Progress Report

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December 2008

Our overall project objectives are to summarize existing information and collect additional ecological data for river otters in the area of the proposed mine and coal bed methane development and adjacent to this area to: 1) quantify the current baseline conditions for these species regarding their distribution, and the status of the prey species they depend on; and 2) assess and project the cumulative impacts of proposed coal mine and coal bed methane development. These impacts will be measured using data about contaminant levels in order to assess impacts on this species.
We worked with otter researchers to determine potential mining contaminants most impacting to riverine food chains including otters. We concluded that mercury and selenium were the contaminants of most interest. We then worked with otter researchers to develop an efficient sampling design to measure these in otters. Kunkel worked in the field with researchers in Yellowstone National Park to examine field methodologies and assess otter sign and habitat. We concluded that hair snagging using snares was an efficient approach to meet our objectives. We developed a sampling design (attachment).

We conducted pilot work in the Flathead in the fall to search for otter sign for snare placement. We walked numerous segments of the river searching for sign and found none. We concluded that such an approach was going to be too labor intensive over a large area and at low otter density to be feasible. We worked with otter researchers and reviewed the literature to determine alternate approaches. We concluded that winter surveys will be most feasible because sign is easier to find in snow and access along the river will be easier with snow and ice. The concept was anecdotally borne out when we found fresh otter sign in the now along the river where we were building a wolverine traps and where I had searched previously in the fall. We will survey segments of the river after snowfalls and once solid ice forms. We may include aerial surveys should ground work continue to be challenging. Once otter sign is detected, we will place snares at these sites (see attachment).

We are working with Montana Fish, Wildlife and Parks and BC Ministry of Environment to obtain tissue and hair samples from trapper caught otters. We completed applications of all permits required for our otter work in BC and Montana.

OTTER PROJECT DESIGN: Projecting the impacts to river otters of the proposed Lodgepole coal mine and coal bed methane development in the upper Flathead River drainage in British Columbia

Any potential water quality impacts from development will spread at some level through the length of the Flathead River. Semi-aquatic mammals, especially mustelids are ideal sentinel species for assessing these impacts. Sentinel species are sensitive to pollutants, and useful for measuring or indexing levels of environmental contamination (Bowyer et al. 2003). Otters feed near the apex of the trophic pyramid and as they neither hibernate nor migrate, may be exposed year round to localized sources of pollution and may suffer acute and chronic effects of biomagnification of heavy metals (including mercury and arsenic), hydrocarbons, other contaminants (including selenium), acid mine drainage, salinity, and sodicity; all possible results of increased energy development. Because potential contaminants may accumulate in aquatic systems, impacts may only be measurable at the top of the food chain. Sublethal and chronic effects of contaminants can result in decreased reproductive success or survivorship both of which can lead to a decline in population densities (Ben David et al. 2002,). Declines in otters in North America and Europe have been tied to environmental contamination (Lariviere and Walton 1998). Examination of otters allows for an integration of impacts resulting from both on site disturbance\habitat fragmentation and impacts resulting from changes to water quality (Bowyer et al 2003). Thus examining otters may provide for the most direct and cumulative assessment of impacts from energy development potentially yielding measurable changes to individual and populations. Finally, otters tie aquatic systems to terrestrial systems and impacts affecting otters may alter structure and function of both ecosystems (Ben David et al. 1998, Bowyer et al. 2003). Use of sensitive and important components of the ecosystem allow for an initial assessment of pollution and provides a barometer for recovery.

Following the design of Bowyer et al (2003), we will compare physiological (blood, tissue, and fecal chemistry) of otters in areas with varying exposure to development and potential changes in water quality. The 2 comparison sites will be the Elk Valley where several operating coal mines are located and the upper Flathead where no coal mines are located. We will assess impacts on vital rates by comparing physiological values in wild otters in our project area to these values to values in otters from captive work and other study areas where vital rates have been measured (O'Connor and Neilson 1980, Kruuk et al. 1997).

We estimate a density of 1 otter/3 km of river (60 km of Flathead river from headwaters to US border = 20 otters). Bowyer et al. (2003) were able to detect differences in blood chemistry in 11 otters exposed to oil vs 11 not exposed. Mierle et al. (2000) reported 10 otters were required to detect a 5% difference in Hg levels at 95% CI. Osowski et al. (1995) found differences among Hg in 3 areas with samples sizes ranging from 9-23 in each. Mierle et al. (2000) and Ben David et al. (2001) reported that levels of Hg in hair and liver were highly correlated. As such we will use low invasive techniques to capture hairs from otters to assess relevant contaminant levels.

Depue and Ben David (2007) modified snare and foothold traps to collect hair samples from otters without capturing or injuring otters and with low nontarget capture rates. They found good success for collecting hairs along with high capture rates. They reported 16 trap nights/capture by snares and 29 trap nights per capture by modified foothold traps. They checked taps every 2-5 days.

To achieve adequate power to detect differences, we will attempt to sample at least 15 otters each from the treatment site (Elk River) and the control site (Flathead River) in 2008. At 30 nights/capture, using a trapline of 30 traps, 15 days would be required to capture hairs from 15 otters. Checking traps every 3 days (to optimize efficiency of people and fuel) would require 4-5 days of work per line. We could thus run both an Elk River and a Flathead line over a 15 day period with probably 15 person days of labor. We will supplement this sample with carcasses purchased from trappers in both areas. We anticipate 5 carcasses from the Flathead and 5 from the Elk.
We will work with local trappers in both areas to alert them of the project and perhaps enlist them in collecting samples. If possible we will work with individual trappers to develop techniques and traps lines for hair traps. We will work within a trapping window of August – October, however, trapping in winter also may improve success due to increased ability to find sign in snow and ice. We will plan for at least 2 15 day sessions in case of low capture success. We will combine one session with bear captures and wolverine trap building.

Wolverine Progress Report

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December 2008

Our overall project objectives are to: 1) quantify the current baseline conditions for wolverine regarding their distribution, density, seasonal habitat use patterns, movement patterns, dispersal requirements, and the status of the prey species they depend on; and 2) assess and project the cumulative impacts on these species of proposed coal mine and coal bed methane development, transportation route development, and human site developments at 3 scales: site-specific, watershed, and regional. We will measure these impacts using data about survival, habitat use, movement and dispersal in order to assess impacts on ecosystem function, integrity, and connectivity.

To meet these objectives, we have initially proposed 2 approaches. The first approach would use grid based hair sampling of the project area to determine wolverine distribution, density and habitat use. It might also allow for long term monitoring of population trends. The second approach would use capture, radio collaring and monitoring of wolverine movements to assess distribution, seasonal habitat use, movement patterns and diet.

Following the first approach, Garth Mowat and Kyran Kunkel developed a wolverine hair snag grid design to estimate relative abundance and distribution of wolverines in the project area (attached; Fig. 1). Based on our first year budget and cost of the grid sampling and our project objective priorities for year 1 we concluded that our resources should rather be placed into trapping and collaring wolverines this first winter. We will assess our success this winter and use results of the capture work to redefine the hair sampling design and determine if we implement in year 2.

We developed a wolverine capture and collaring design for year 1 focused in the Flathead (attached). Our design will focus trapping efforts near proposed developments and over as large a surrounding area we can cover to assess biotic potential of the area for wolverines.

We worked with other wolverine researchers, local biologists, and trappers to determine trap design and placement. We conducted reconnaissance of the area to examine potential trap sites. We selected >20 trapping sites in the Flathead and built and placed 14 “log cabin” and “portable” traps in an approximately 1,000 km2 area.

We worked with wolverine researchers to select the best wolverine collars to meet our objectives. Wolverines present numerous challenges for collaring. We selected Lotek 6000 GPS collars due to reliability and previous use on wolverines and light weight. We will set acquisition interval at 4 hours which will allow us at least 1 year of battery life. The collars store all data on board.

We collected bait for trapping. We established and equipped a field camp.

Wolverine Trapping Plan

December 2008

We will attempt to capture and collar 8 wolverines in winter 08-09. We divided the study area into a south (Flathead) and north (Elk) core of ~4,000 km^2 each. Our priority for this winter will be the south core. We built and will run 14 traps in the south core using 2-3 persons ($\geq$1 lead bio on the team). The south core will include Corbin mine area. Traps will generally be placed along roads with snow machine access. Each person will run a separate line of traps (~6-8) and communicate via sat phone. We will start trapping in early February and continue until early April (late winter yield highest success). Our current budget allows for 6-8 weeks of trapping. If we run 15 traps over that period at a low rate of trap success (1/75 traps nights) we expect 8 wolverines. We will run trap crew for 10-14 day sessions. Kunkel and McLellan each have has 4-6 weeks for this effort. M. McLellan will have 8 weeks. We will hire 1 other jr, bio for 8 weeks. Apps has 1-2 weeks. Mowat will try to make 1 week available.

We will prebait traps and trap sites with meat scraps and scent lures 1–2 weeks prior to commencement of trapping to increase the chance of a wolverine visiting the site. We will use beaver (*Castor canadensis*) carcasses, road-killed ungulates, and frozen salmon (*Oncorhynchus* sp.) as trapping bait.

We will operate traps more or less continuously throughout the trapping season. We will visit traps daily unless we use a remote trap transmitter. We will monitor traps with trap transmitters daily and visit them every 3–4 days for maintenance and rebaiting. We will use 2 types of trap transmitters; old radiocollars from previous wildlife studies and purpose-built trap transmitters (Holohil Systems Ltd., Carp, ON, Canada). We will check traps regularly for excessive snow buildup on the lid, thick ice formation around the open lid, freezing of the cable system and trigger, and freezing of bait to the trap floor.

We will immobilize wolverine by jab stick or air pistol with a Domitor/Ketamine solution. We will weigh animals and take standard measurements. We will collect blood, hair, and tissue samples. We will monitor heart rate, respiration, and body temperature during processing. We will inspect animals for injuries. All capture and handling procedures will be conducted under University of Montana Institutional Animal Care and Use Committee review and approval.

Personnel

Lead bios – B. McLellan, Kunkel, Mowat, Apps

Jr bios – M McLellan, part timers, interns

Equipment

Kunkel has 1 snow machine

Mowat has 1 machine we can use?

Purchase 2 new and trailer for project

Bruce has 1 truck for 4 weeks

Kunkel has 1 truck

Collars and handling equipment are order and will be available by late January 2009

Appendix C.

GRIZZLY BEAR RESPONSE TO HABITAT & HUMAN INFLUENCE IN THE FLATHEAD & LOWER ELK DRAINAGES, BRITISH COLUMBIA

Progress & Data Summary

Year 1 - 2008

Clayton Apps, PhD

Bruce McLellan, PhD

Chris Servheen, PhD

US Fish & Wildlife Service / University of Montana

December, 2008

ACKNOWLEDGEMENTS

This report addresses 2 components of a multi-species research effort initiated in 2008 that includes grizzly bear, wolverine and otter. Committee members providing direction to this overall work are Chris Servheen, Bruce McLellan, Clayton Apps, Kyran Kunkel, and Garth Mowat. Funding during 2008 was provided by the United States government through the Rocky Mountains Cooperative Ecosystem Studies Unit. In-kind support was provided by the British Columbia Ministry of Forests and Range, Research Branch, and we are grateful for field assistance and advice provided by Joe Caravetta and Frank DeBoone of the Ministry of Environment, Conservation Officer Service. Important contributions to grizzly bear capture were provided by Clay Wilson of Bighorn Helicopters and Michelle McLellan. Safe and proficient telemetry/download flights were piloted and assisted by Mike Dupuis of Wildlife Observation Service, Volker Scherm of Bear Air, and Irene Teske of the Ministry of Environment.

INTRODUCTION

The Crown of the Continent (COC) defines a region where many natural resources are shared among provincial, state, and federal jurisdictions on both sides of the USA-Canada border. Here, the conservation of wide-ranging carnivores has been highlighted as a significant and challenging issue[1]. Of particular concern are the long-term cumulative impacts of existing, planned and projected human activities within the southern Canadian Rocky Mountains, particularly within the Flathead and Elk drainages. This landscape defines the focal area (Figure 1) for a study of multi-scale responses by grizzly bears (*Ursus arctos*) and wolverines (*Gulo gulo*) to human activities and actions, in the context of underlying and changing habitat conditions. In addition to behavioral and ecological responses, data specific to population vital rates are being collected with the expectation that population-level responses will also be addressed, particularly if the research time-frame extends beyond 4 years. In this report, we summarize the approach, activities, and preliminary data for year-1 (2008) specific to grizzly bears and human use. Although traps have been built and placed, actual field work on the wolverine component is scheduled to commence in February 2009. The overall research program is also addressing toxicological impacts to river otters (*Lutra canadensis*), progress on which is being reported separately.

Below, we describe activities and progress for 2008 specific to grizzly bear space-use and movements as well as human use. Background specific to hypotheses and models to be evaluated through this research will be presented in future years. Ultimately, outputs from this study will inform the quantitative assessment of current and projected cumulative human impacts on carnivores within our study area and elsewhere across the COC.

[1] Apps, C. D., J. L. Weaver, B. Bateman, P. C. Paquet, and B. N. McLellan. 2007. Carnivores in the southern Canadian Rocky Mountains: core areas and connectivity across the Crowsnest Highway. Wildlife Conservation Society Canada Conservation Report No. 2, Toronto, Ontario, Canada.

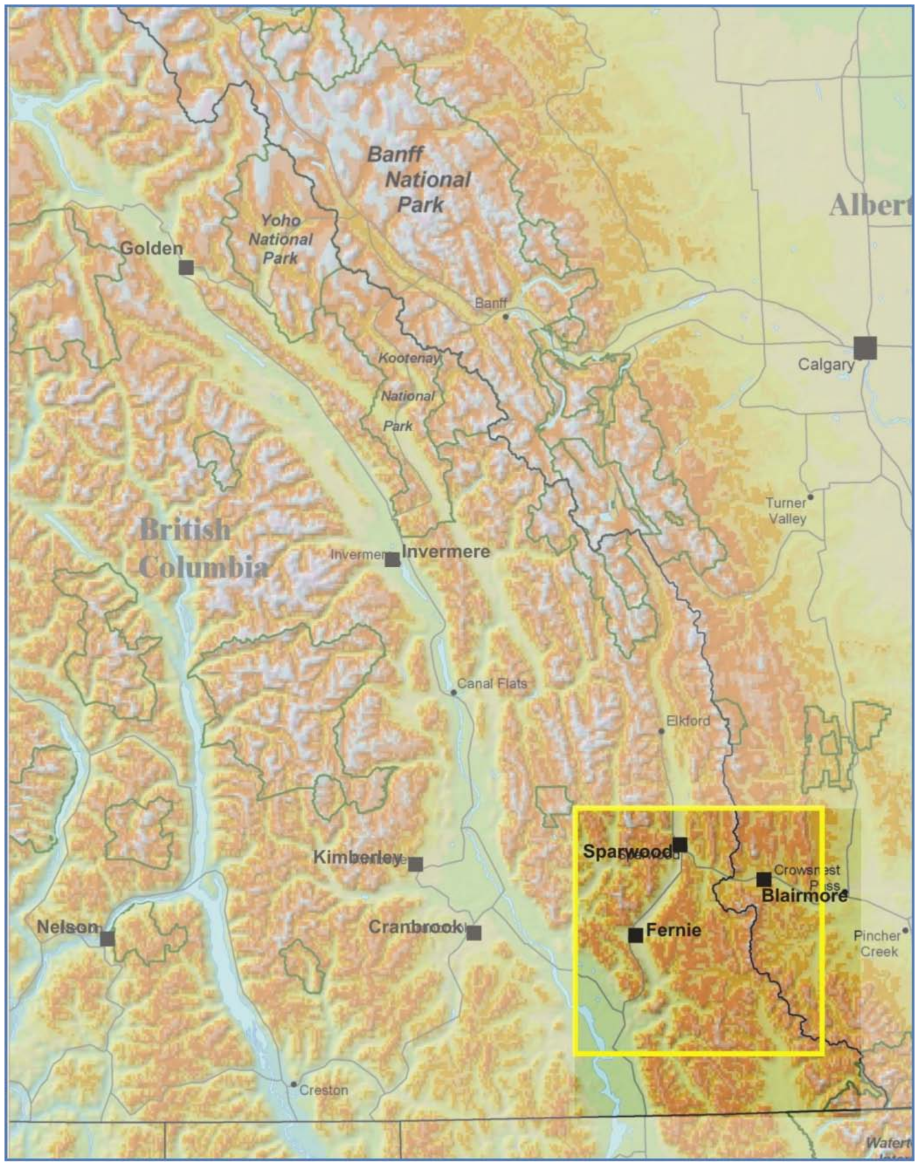


Figure 1. General location of lower-Elk / upper-Flathead study area for evaluating carnivore response to habitat and human influence.

GRIZZLY BEAR SPACE USE AND MOVEMENTS

Approach

We are sampling space use and movements by grizzly bears by deploying GPS tracking collars on adult individuals captured within our defined study area. Collars deployed are primarily Lotek™ (Newmarket, Ontario) 4000 and 4400M remotely-downloadable GPS collars with considerable scheduling flexibility (including remote re-programming upon deployment). We programmed collars to attempt fixes at intervals ranging from 0.75 to 2.0 hrs, and they are expected to function for 2 years prior to battery replacement with shut-down during the winter denning period. Some collars are also set to collect activity data in 5-min increments. Collars are programmed to release and drop after 2 years, and we modified the collars with canvas “rot-off” spacers as a back-up in the event that release mechanisms fail. We captured potential study animals during June and October using standard helicopter-darting and cable-snare methods. We employed fixed-wing and helicopter aircraft to monitor the status of deployed collars, download data, and recover dropped collars.

Preliminary Results and Data

Collaring Results - During 2008, we captured and collared 6 (3M, 3F) grizzly bears that are known to reside at least partially within our study area (Table 1 <Deleted due to detailed information>). We used helicopter search and darting to collar 2 males and 1 female during June and another female during October. We employed ground-based trapping to collar one male and one female in October. One female from an existing long-term monitoring program (southern Flathead) has been found to reside within our study area and we include her as a study animal. While she is currently carrying a conventional VHF collar, we may elect to switch this to GPS during spring capture work. One female from previous research had been carrying a GPS collar with a functioning VHF beacon. We attempted to re-capture and change the collar on this female but we were not successful before the collar dropped. We recovered this collar, and an additional collar that had dropped in 2007. In October, we also recovered the collar we deployed in June on M14, which had dropped prematurely as noted below.

At present, we have 3 GPS collars in hand that are available for re-deployment upon refurbishment and battery-pack replacement. One GPS collar sized for a large male was not used and is available for deployment in the spring.

Below, we briefly summarize the history and status of each study animal to date. We identify each animal according to a numbering convention that is a continuation of a collaring program in the Hwy-3 region from previous years.

M14 - This male was captured in the vicinity of Olivia Creek on 31 May. He has a previous capture record from May 2005 in Ladner Creek, however his collar had failed shortly after and no GPS data has previously been collected from M14. Unfortunately, he slipped and dropped his collar on 3 June after only 4 days. During this period, he moved north across the Hartley Pass road into the headwaters of Sulphur Creek (Figure 2) and his collar functioned with a successful and reliable fix rate (SRFR) of 77%.

F19 – This female was captured within the Alexander Valley on 1 June. She was without cubs (although one, 2-year-old was seen very close by) and was mated with M20 at the time of her capture. A data download in early October indicated that she has resided largely within and moved extensively throughout the Alexander Valley (Figure 2). Her home range abuts against Highway 3 in the south, and she has made forays to the east across the Continental Divide into the Alison Creek drainage and to the west into Erickson Creek directly adjacent to the Elkview coal mine. Her collar functioned with a SRFR of 94%.

M20 – This male was captured within the Alexander Valley on 1 June (was mated with F19). We did not find this bear until early November, at which time he was near the headwaters of Nez Pearce Creek, north of Highway 3 in Alberta. We attempted a data download by aircraft prior to the programmed winter shut-off date of the VHF beacon but were not successful due to weather conditions. Since the collar is still functioning normally and is apparently still being carried, we anticipate a successful data download in the spring.

F21 – This female was captured from helicopter near Mid-Kooteny Pass on 9 September. She was fitted with a Televilt™ GPS collar, which is remotely downloadable, but, the reliability of the collars after downloads is reduced. Other than periodic VHF locations, we will wait until this collar is recovered to obtain GPS fixes. However, her last VHF location indicated that she had moved north to Cate Creek as of late October. She has 3 yearling cubs.

F22 – This female was captured by heli-darting in the vicinity of Flathead Ridge on 9 October and was with 3 cubs of the year. We did not download data from this collar prior to its programmed winter shutdown.

F18 – The collar on this female had been deployed in May 2007. We attempted to recapture her by heli-darting on 8 August 2008 in order to change her collar, but we were unsuccessful. Her collar then dropped (rotten/torn canvas insert) on 12 August adjacent to Sand Creek where we retrieved it. During her monitoring period, F18 used a core area centered on Fairy Creek, upper Iron Creek, the Lizard Basin, and Sand Creeks (Figure 2), with some of her movements in close proximity to relatively high levels of human activity. The 2 cubs-of-year with which F18 was observed during her initial capture were still with her as of August of the next year (2008). Her collar functioned with a SRFR (non-denning) of 86%.

M23 – We captured this young male (likely yearling) by ground-trapping (cable snare) near the upper Flathead River on 14 October. Like F21, he was also fitted with a Televilt™ collar and so we must also reserve any summary of his movements until the collar is recovered. A late-October telemetry flight indicated that M22 had moved south, into the Commerce Creek area.

F24 – This female has been carrying a VHF collar for several years as part of the southern Flathead population monitoring program (corresponds to identifier GF157; B. McLellan, MOFR). Her periodic VHF locations (average 28-day sampling interval) indicate that she resides in and around the Cate Creek drainage of the upper Flathead (Figure 2).

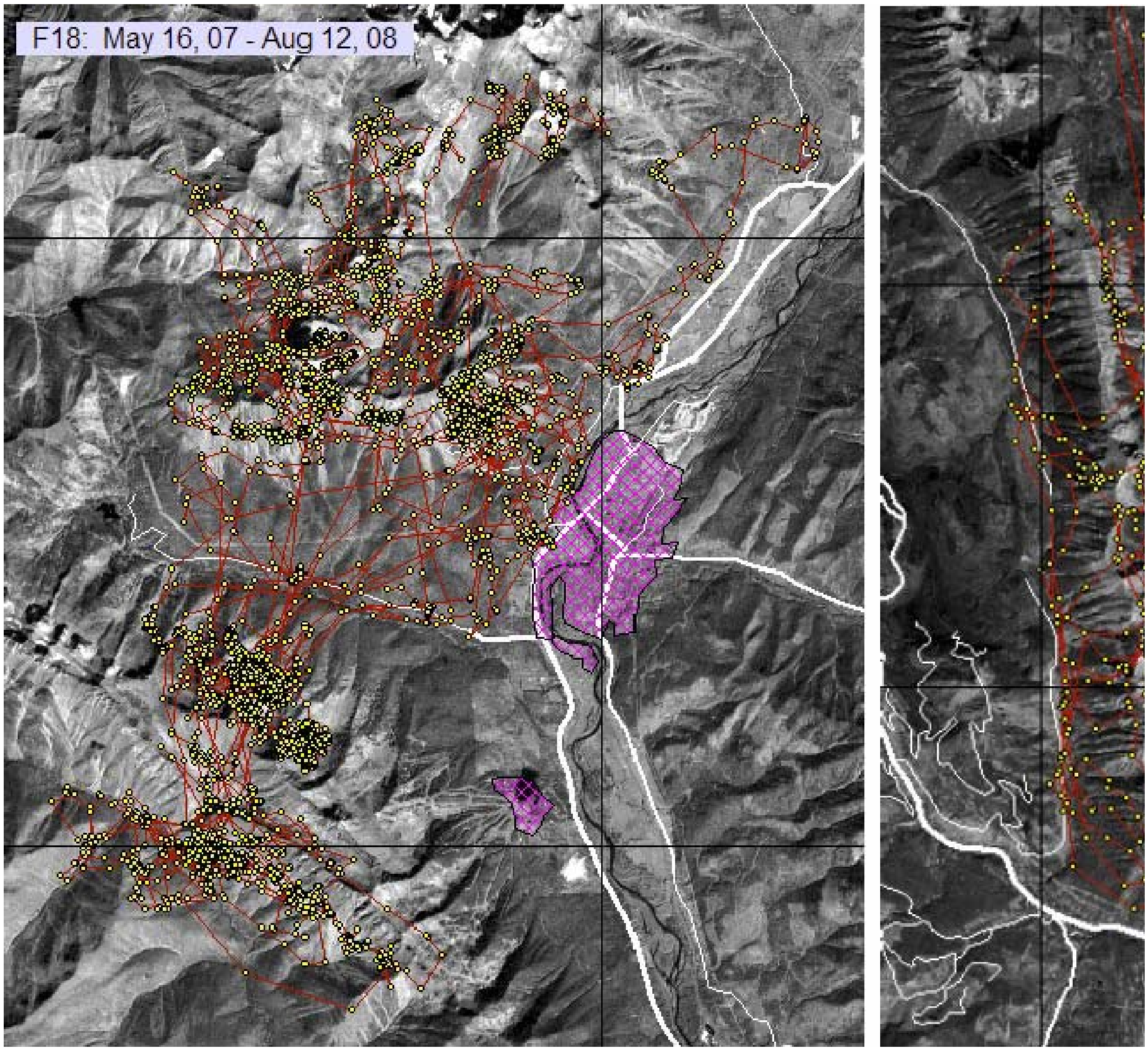


Figure 2. Plots of grizzly bear GPS location/movement data for select study animals in the lower-Elk and upper-Flathead drainages, British Columbia. Overlaid UTM grid is 10 km. Pink hatched area is urbanized, and roads and highways are shown in white. Figure continues on next page.

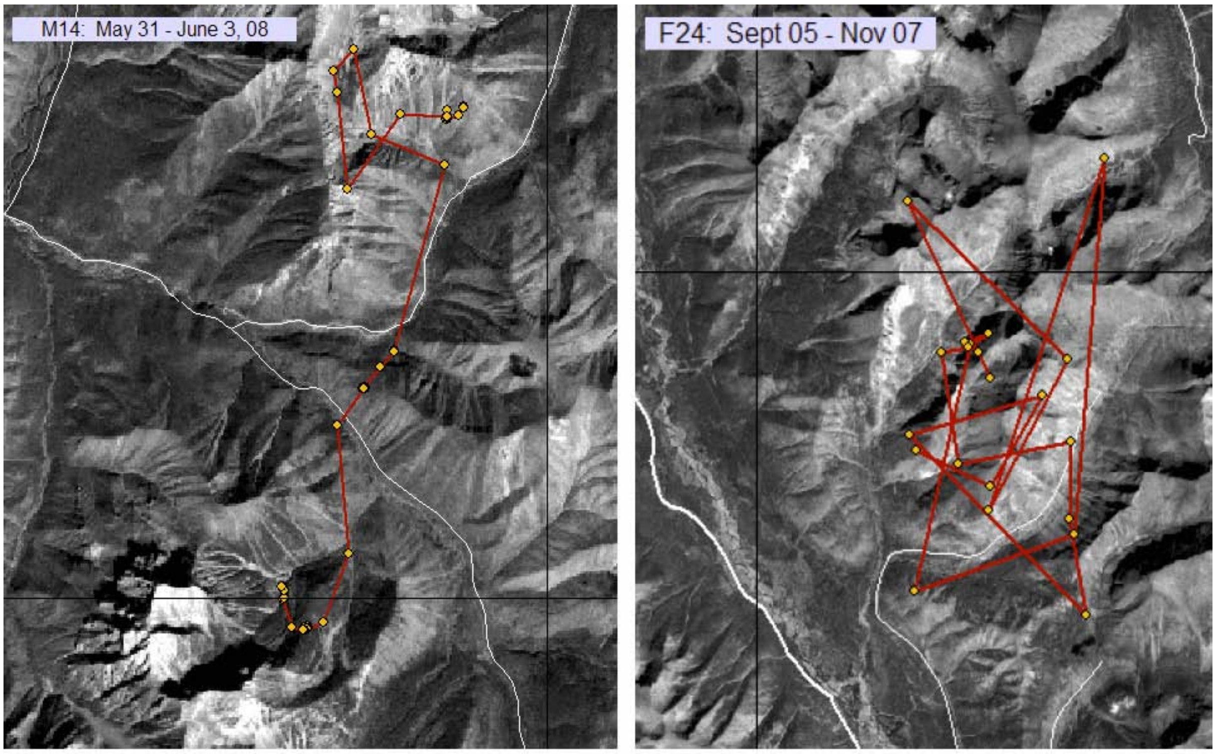


Figure 2. Study animal data plots continued.

HUMAN USE

Approach

Given our objectives, the sampling of human-use types and levels is an important aspect of this study that will be used to model broad-scale variation in human activity and factors that potentially explain variation in carnivore space-use, movements, and survival among landscapes, in addition to finer-scale spatio-temporal behavioral responses. We are presently sampling vehicle traffic as a direct proxy for human activity. We are using electromagnetic vehicle traffic counters (TRAFx Research Ltd, Canmore, AB) as our primary sampling tool to characterize and model spatial and temporal patterns of vehicle use.

In 2008, we purchased and deployed 8 TRAFx™ vehicle counters. We placed counters strategically, selecting locations that we expected to be informative and representative of the variation in vehicle traffic patterns within our study area (Figure 3). Each counter was programmed and calibrated according to the specific road type (e.g., width, lanes) and associated traffic patterns (e.g., type, volume, speed). Counters were deployed in early August and data were downloaded in mid-October. They will continue to collect data year-round, although we may choose to adjust sampling locations by season and/or year to optimize sampling and to opportunistically test localized behavioural responses by GPS-collared study animals.

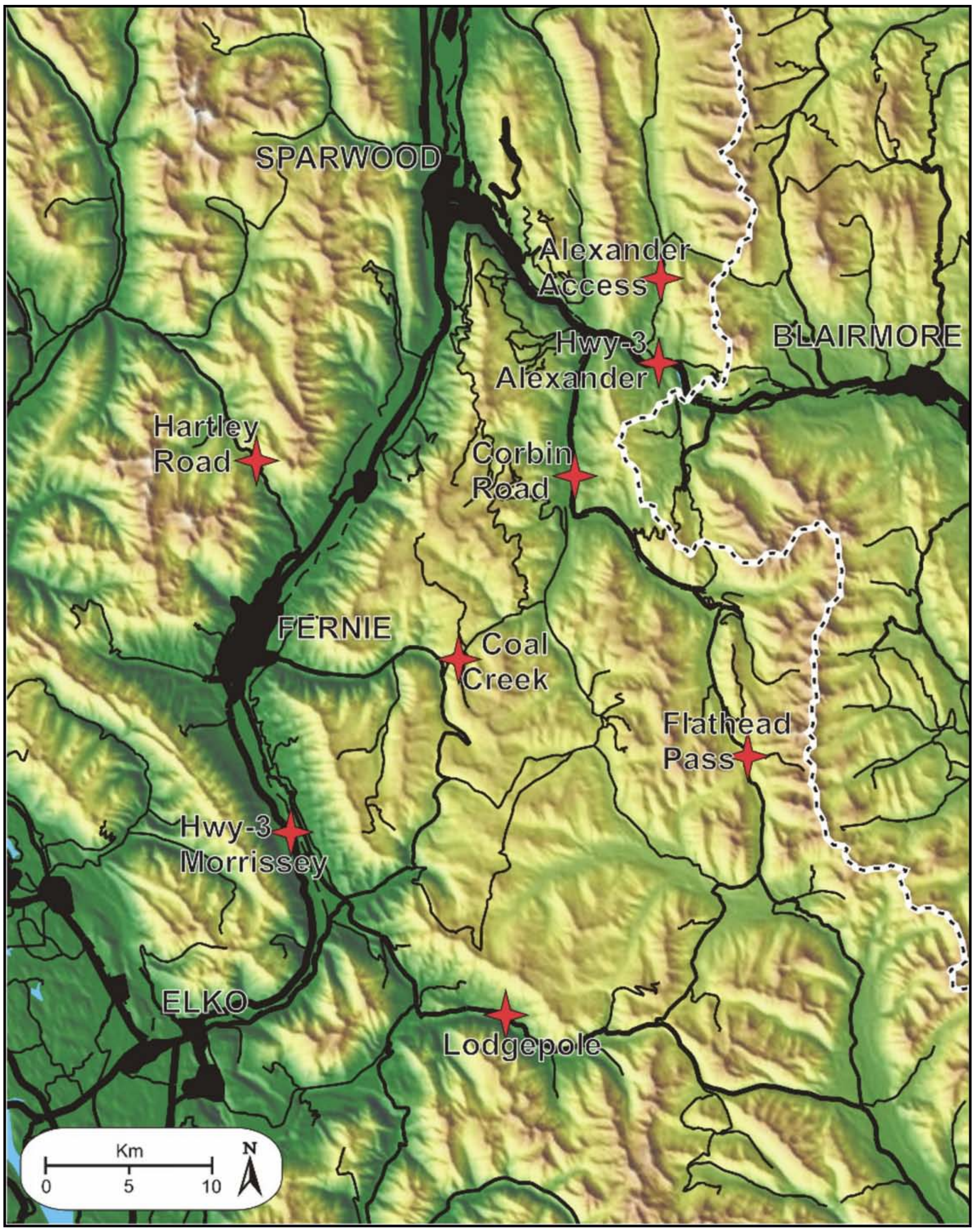


Figure 3. Placement of vehicle traffic counters, during August – October 2008, among 8 roads and locations within the lower-Elk and upper-Flathead drainages, British Columbia.

Sampling Results and Preliminary Data Summary

Of the 8 traffic counters deployed during the initial August – October 2008 sampling period, 1 (Hwy-3/Morrissey) failed due to a programming error or systemic malfunction. Below, we summarize the datasets downloaded from the 7 counters that functioned reliably (Table 2, Figure 4).

We sampled traffic volume and associated variation on Highway-3 at a site near the Continental Divide (HWY-3/ALEXANDER). Daily totals clearly indicate variation ranging from 2,513 to 7,040 vehicles per day, with traffic volume being higher in August, higher during weekends (especially Fridays and long-weekends), and lower during mid-week (Figure 4). The hourly summary illustrates an expected diurnal pattern of traffic volume that gradually peaks during mid-afternoon and with a nadir at about 3:00 AM (Figure 5). We expect that a significant proportion of the traffic on Highway-3 stems from vehicles traveling between Calgary and Fernie, and therefore traffic volume and pattern on Highway-3 may differ southwest of Fernie. As noted, data from the counter at this location are not yet available, but we will be comparing volume and pattern between these 2 locations in the future.

One counter was located on the paved access road to the Corbin mine and townsite (CORBIN ROAD). Given the industrial use of this primary access road, traffic totals reflect higher week-day use (Figure 4), and high diurnal variation (Figure 5). Other counters were situated on secondary-gravel and backcountry roads ranging from relatively high use (e.g., LODGEPOLE) to little use (e.g., FLATHEAD PASS). Both average traffic volume and patterns of daily variation tended to differ among roads (e.g., Figure 5).

Table 2. Daily vehicle traffic statistics, during August – October 2008, among 8 roads and locations within the lower-Elk and upper-Flathead drainages, British Columbia.

Station	Period Start	Period End	Mean	Median	SD	Min	Max	Wkday Mean	Wkend Mean
Coal Creek	05/08/2008	09/10/2008	8.7	7	6.1	0	34	7.1	13.1
Hwy3-Morrissey	-	-	-	-	-	-	-	-	-
Lodgepole	06/08/2008	10/10/2008	21.0	20	7.2	9	41	22.3	17.4
Flathead Pass	06/08/2008	08/10/2008	4.7	3	4.0	0	16	3.7	7.2
Corbin Road	06/08/2008	08/10/2008	259.2	284	67.5	138	367	293.0	174.8
Hwy3-Alexander	06/08/2008	14/10/2008	3806	3597	935	2513	7040	3884	3613
Alexander Rd	06/08/2008	14/10/2008	18.1	16	11.1	2	52	19.3	15.4
Hartley Road	07/08/2008	08/10/2008	37.7	37	18.6	5	80	31.2	53.8

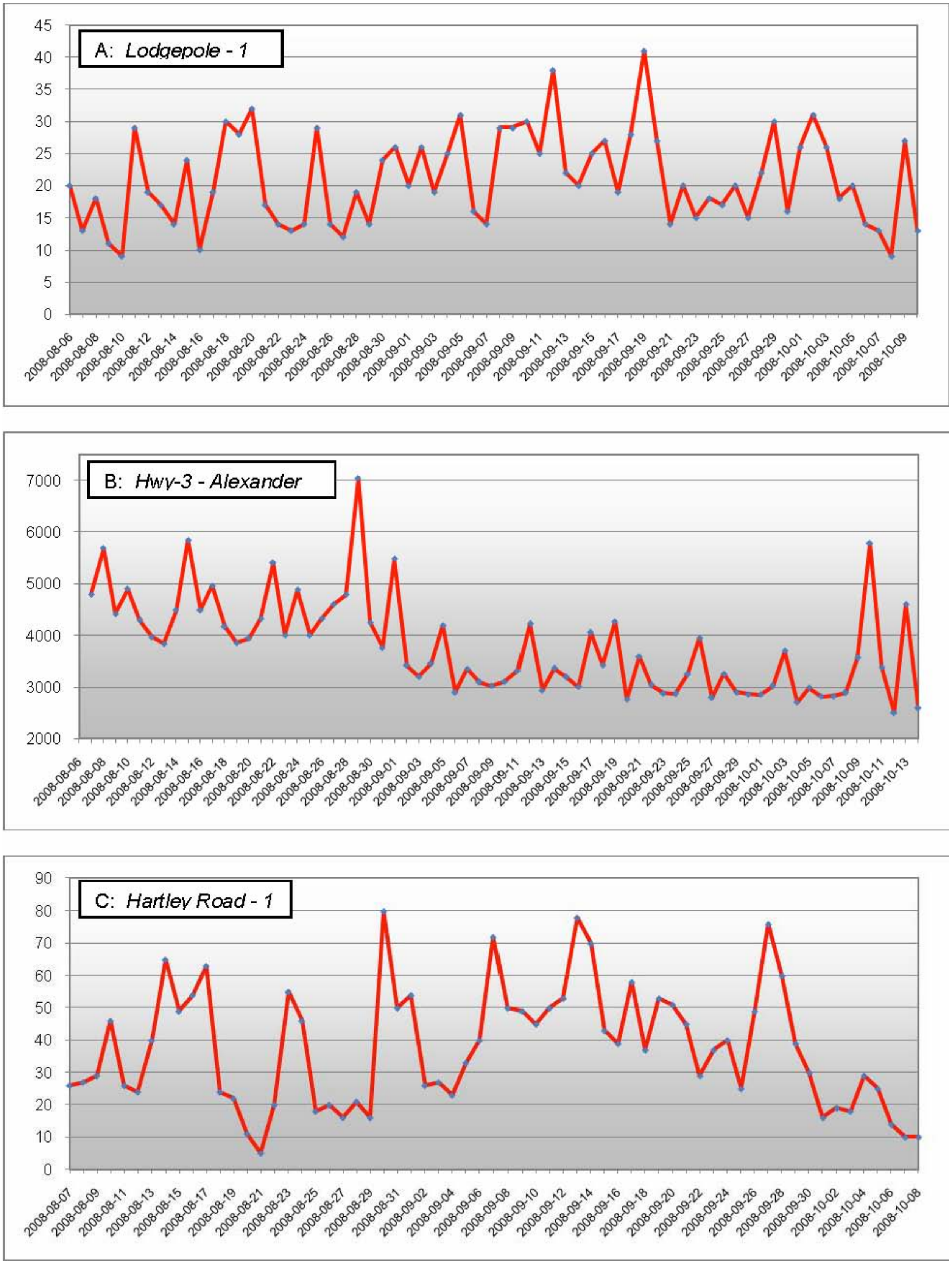
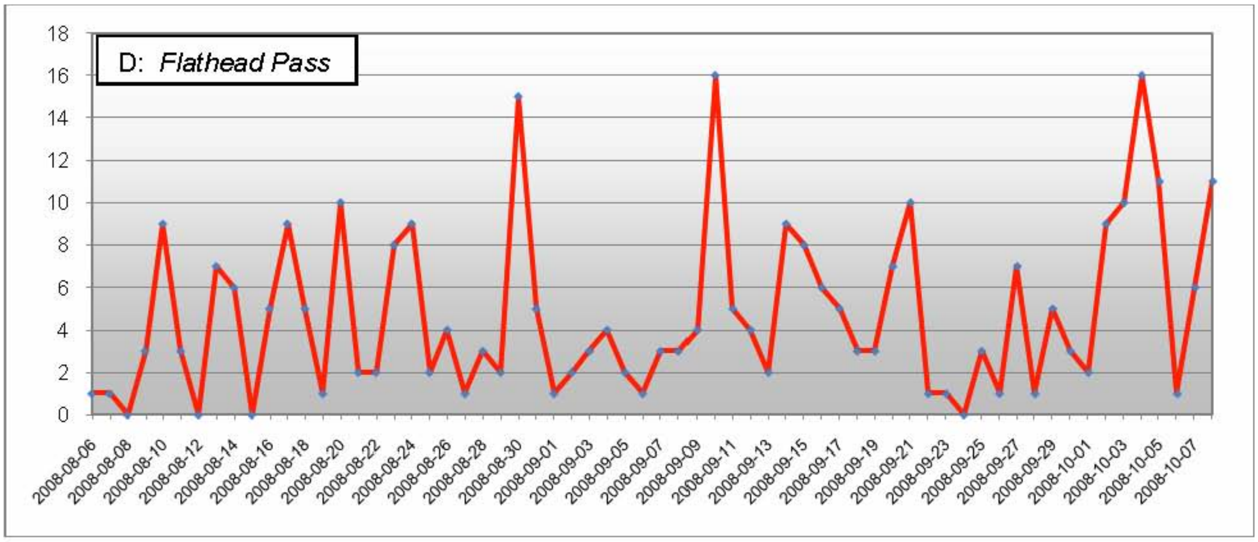
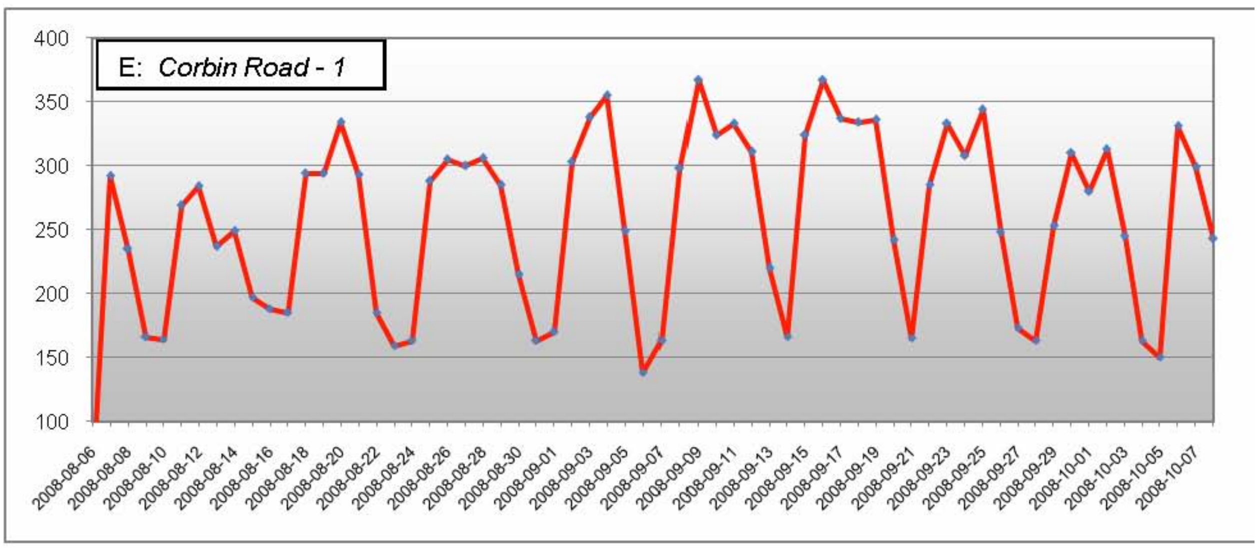


Figure 4. Daily variation in vehicle traffic, during August – October 2008, among 8 roads and locations within the lower-Elk and upper-Flathead drainages, British Columbia





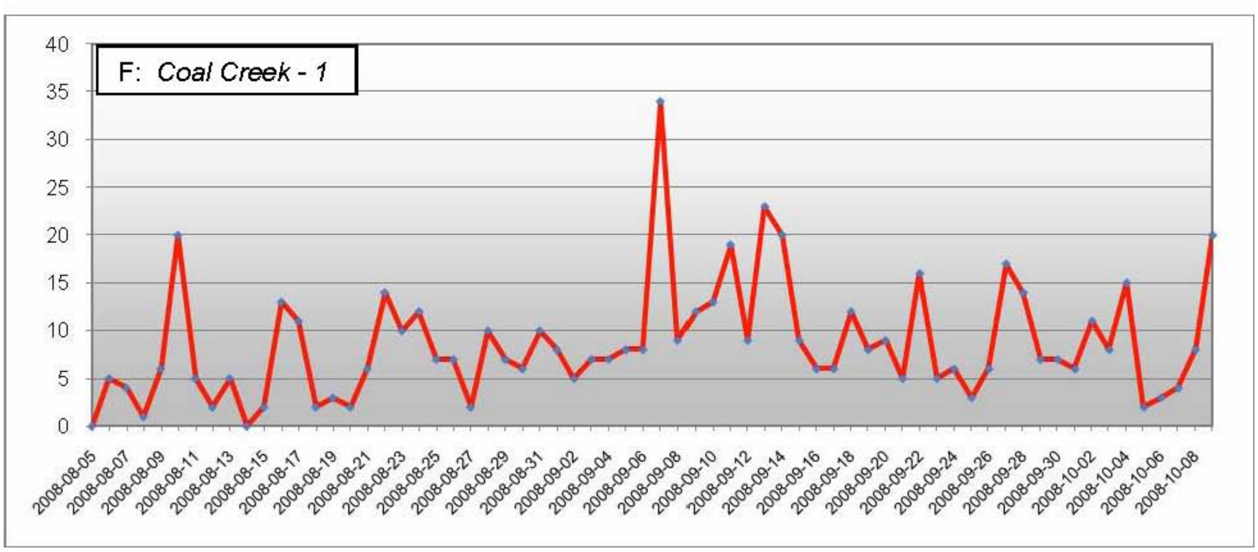


Figure 4. Continued.

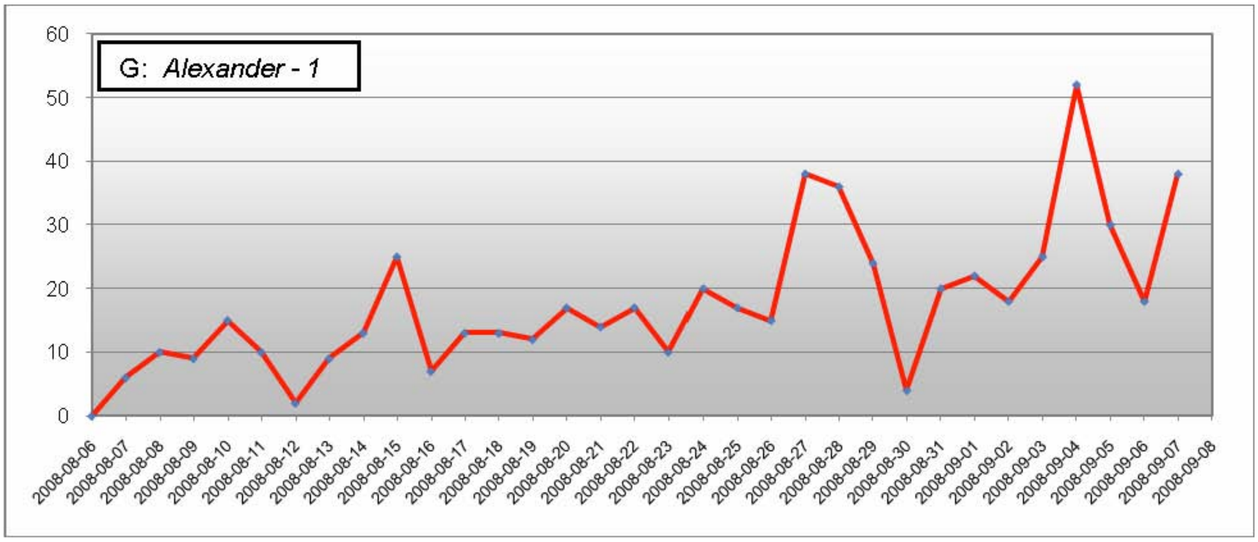


Figure 4. Continued.

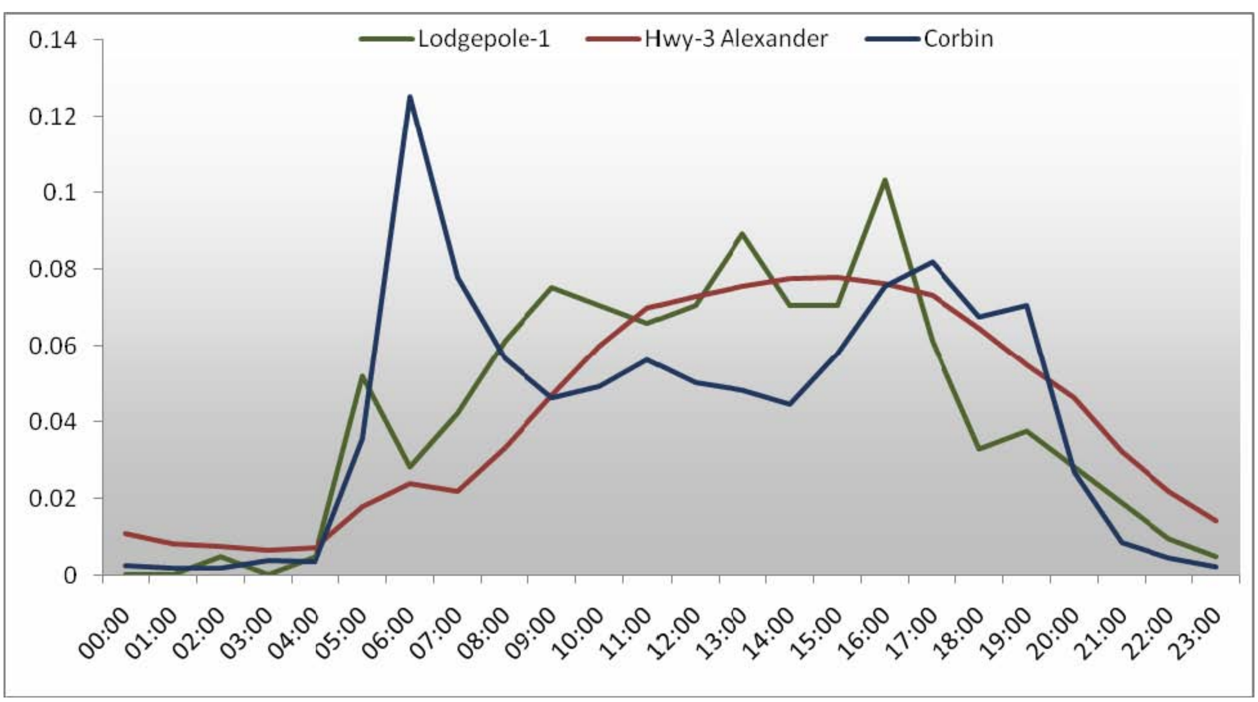


Figure 5. Comparison of diurnal distribution of vehicle traffic volume among 3 roads within the lower-Elk and upper-Flathead study area during August – October 2008.