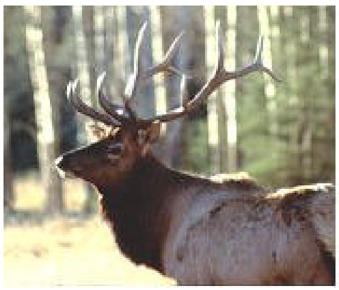
Ya Ha Tinda Elk and Wolf Ecology Project



First Year Progress Report

December 2001 to November 2002

Prepared by **Mark Hebblewhite**,
Ph.D. Prov.Candidate,
And **Dr. Evelyn Merrill**
Department of Biological Sciences
University of Alberta, Edmonton, AB, T6G 2E9

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SUSTAINABLE RESOURCE DEVELOPMENT

Ya Ha Tinda Elk and Wolf Project – Hebblewhite and Merrill, Nov 2002

EXECUTIVE SUMMARY

In November 2001, we began our research on the Ya Ha Tinda Elk population, representing the first time this important elk herd had been actively studied since the early 1980's. ***The overall objectives of the study are to understand how predation, human activity, and habitat-related factors affect the ecology and transboundary migration of the Ya Ha Tinda elk population and implications for Ecological Integrity Management in Banff National Park and provincial management objectives. Secondary research objectives are to foster a cooperative interagency management framework for this important resource between Parks Canada and the Province of Alberta.*** Our research approach involves determining differences between migratory and non-migratory elk in resource selection, survival, and human and predator predation risk.

In winter 2002 we safely captured 112 elk using a hay-baited corral trap at the Ya Ha Tinda ranch, radiocollaring 40 adult female elk with 36 conventional VHF collars and 4 GPS collars. We monitored winter home range use of these 40 adult females, and found winter home range use centered on the eastern grasslands of the Ya Ha Tinda, with average winter home range size of ~20km^2. Mid winter aerial elk surveys by Parks Canada and AB-Sustainable Resource Development counted approximately 1200 elk wintering at the Ya Ha Tinda.

We identified and monitored a total of 4-5 wolf packs that overlapped with the Ya Ha Tinda Elk herd. Wolf packs included 2 National Park packs, the Red Deer and Cascade-Panther packs, and 2-3 provincial wolf packs, the Ranch, Burnt Timber, and potentially lower Clearwater wolf packs. During winter 2002, 2 wolves from the Cascade pack were harvested in the Panther corners area, none known from the Red Deer pack, and up to 9 wolves from the Clearwater pack, although less is known about Clearwater pack in BNP because no wolves have been radiocollared in this pack for 4 years. We captured and collared a total of 4 new wolves during 2002, 1 from the Cascade-panther pack (Male #64), 1 from the Red Deer pack (Male #60), and 2 from the Ranch pack (Female's #61 and 62). Male #64 dispersed from the Cascade pack in September 2002 and was shot 30 km east of Ya Ha Tinda in late November 2002. No other radiocollared wolves died of any causes during 2002. Winter diet of wolves in our study area was 40% elk, followed by 30% bighorn sheep.

During summer 2002, we monitored movements of the surviving 38-radiocollared elk to determine migratory movements and seasonal home ranges. Mean migration date from winter to summer range was June 11th, and the return migration date was October 15th. Summer home ranges were larger, 98 km^2, and approximately 50% of the radiocollared elk migrated from the ranch. Mean monthly maximum counts of elk remaining on the Ya Ha Tinda winter range during summer were 354 elk, suggesting approximately 850 of the wintering elk were migrants. Differences between the ratio of migrants to residents in our collared sample and the elk population may be related to capture bias, and efforts

are underway to correct for this in 2003. However, this potential bias means we are underestimating the importance of migration to this elk population.

To investigate whether there were more elk resident now than in previous studies we assembled traditional ecological knowledge from Ranch Staff Johnny and Marie Nylund. The proportion of elk remaining on the ranch during 2000, 2001, 2002 varied from ~18 to 35%, compared to ~5-10% during the early 1980's. Therefore, this first years data and traditional ecological knowledge do support the contention that more elk are remaining on the ranch during the summer than historically.

Migrant elk traveled on average 31 km (range 21 to 69 km) to summer ranges, and 16 of 19 migrant elk migrated to summer ranges in Banff National Park. Important seasonal home ranges included the Upper Bow Valley, where 8 out of 19 migrant elk summered in areas such as the Lake O'Hara Fire Road, Hector Lake, Bow Summit, and the Lake Louise Ski Hill. The Upper Bow Valley is therefore an important and previously un-appreciated summering area for up to 40% of the migrating elk from Ya Ha Tinda. In support, on one aerial telemetry flight in mid July, researchers counted a minimum of ~100 elk in radiocollared elk groups in the Upper Bow Valley. Warden service aerial surveys in the Bow Valley of BNP counted approximately 160 elk during spring 2002 (before migration). Therefore, migratory elk from Ya Ha Tinda Ranch now constitute most of the elk in BNP (preliminary estimate of 700 migrant elk) during spring, summer and fall. This highlights the importance of the Ya Ha Tinda elk population to BNP and the importance of migration between summer ranges in BNP to winter ranges at the Ya Ha Tinda.

We recorded only 6 mortalities of radiocollared elk during the 7 months after elk collaring. Sources of mortality include grizzly bear (2), cougar (1), unknown predator (2), legal bowhunting (1), and 1 poaching incident still under investigation. Although sample sizes are small, this first year sample indicates the diversity of mortality sources in addition to wolf predation, and highlights the need for additional radiocollaring. Furthermore, because the 2 elk killed by grizzly bears were in BNP, this preliminary mortality data highlights the importance of elk migration to management of BNP's grizzly bear population.

Vegetation sampling to complement elk habitat mapping and resource selection analyses form a vital component of our research. We collected elk forage biomass data during the height of the growing season in July and August from 158 biomass sample plots. We focused biomass sampling in 2002 on under-sampled strata as determined from ongoing vegetation sampling plots conducted in cooperation with the University of Calgary. Sampling focused on Front Range backcountry locations, and high elevation areas around Ya Ha Tinda. Combined with UofC data collected in 2001, we have now collected over 450 elk forage biomass plots. To determine phonological changes in plant biomass and forage quality over time, we also revisited 29 elk forage phenology sample plots a total of 81 times each (average 2.5 visits) to estimate change in forage biomass over the growing season. We have also assembled the Ecological Land

Classification (ELC) database to assist in seasonal plant species phenology modeling for determining seasonal changes in elk resource selection.

Research activities during the upcoming field season include capture and radiocollaring 55 more adult female elk with VHF and ~10 GPS collars, 6-12 more wolves with 6 GPS and up to 6 VHF Collars, and continuing radiotelemetry monitoring to estimate seasonal home range, survival, and resource selection. We are aiming to complete elk forage biomass sampling with a focus on the west component of the study area and upper alpine elevations.

Interim conclusions include;

(1) More elk appear to be remaining at the Ya Ha Tinda winter range than expected due to population changes and more than were resident during the early 1980's.

(2) Of approximately 1200 elk, only 350 remained on Ya Ha Tinda during summer, however, 50% of our radiocollared elk migrated. Therefore, our collared sample may disproportionately include more residents than in the population, and underestimate the importance of migration to this population.

(3) Mean migration dates to and from the winter ranges were June 11th and October 12th, and mean migration distance between summer and winter ranges were a straight-line distance of 31 km (range 21 to 65 km).

(4) Most (84%, or 16 of 19) of the collared migrant elk returned to summer ranges inside BNP.

(5) The Upper Bow Valley was an important summer range, including 8 of the total 19 migrant elk, or 42% of all migrant elk.

(6) Bow Valley elk populations were ~160 in 2002, therefore, elk from Ya Ha Tinda now represent the most abundant elk in BNP for 5-7 months of the year.

(7) Although preliminary, a diversity of mortality sources was recorded for the 6-radiocollared elk mortalities; 2 grizzly bear, 1 cougar, 1 unknown predator, and 2 human hunting – 1 legal and 1 illegal.

(8) Our preliminary year highlights the importance of the Ya Ha Tinda to the ecological integrity of Banff National Park, and vice-versa, the importance of the Ecological Integrity of Banff National Park to Provincial elk management.

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Mark Hebblewhite,
Ph.D. Provisional Candidate
Department of Biological Sciences
University of Alberta
Edmonton, AB, T6G 2E9

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Introduction

The headwaters area of the Red Deer, Panther, and Clearwater rivers on the east slopes of the Rocky Mountains in Banff National Park (BNP) and the Province of Alberta are an important area for wildlife conservation, containing nearly intact native assemblages of large carnivores and ungulates in large, functioning ecosystems. The ecology of the Eastern slope area, including all three of these major rivers, is closely tied to the ecology of the Ya Ha Tinda Ranch, a high elevation grassland outside BNP that provides one of the most pristine winter ranges for ungulates in Alberta. Historically, the majority of the elk migrated between summer alpine meadows inside BNP to winter range around the Ya Ha Tinda Ranch (Morgantini and Hudson 1988). However, since 1995 there has been an apparent increase in the proportion of non-migratory resident elk and decline in the proportion of migrants (Parks Canada, unpubl. survey data). Increasing non-migratory elk may have negative impacts on provincially significant rare montane rough-fescue grasslands, with the potential to reduce overall carrying capacity for elk (Morgantini 1995).

Management of the lands adjacent to Banff surrounding the Ya Ha Tinda Ranch have undergone recent expansion in oil and gas exploration, commercial forestry, use of prescribed fire, hunting and trapping of wolves and elk, and increased recreational development. These activities outside the park have been hypothesized to affect elk population dynamics within BNP through their effects on predator-prey processes and forage dynamics. For example, increased wolf harvests adjacent to BNP may create a predation risk gradient across park boundaries, increasing survival rates of non-migratory resident elk that remain on the Ranch year round relative to migrants (park elk). Alternately, habitat enhancement forestry projects outside BNP may have increased foraging benefits to elk that do not migrate into BNP. Dramatic future changes are proposed for areas adjacent to BNP.

These ecological processes such as migration are taking place in two different jurisdictions with different management directives. The Ya Ha Tinda ranch (YHTR) is a federally owned and operated horse ranch. Historically, the Ranch was within the park boundaries, but was excised from the Park in the 1930's (Morgantini and Hudson 1988). Despite the ecological importance of this area to BNP, management of wildlife and lands in the Ya Ha Tinda are the responsibility of the province of Alberta, and have been managed historically for differing management goals. The primary purpose of the Ya Ha Tinda Elk and Wolf project, as part of the East Slopes Ecosystem Project (ESEP), is to provide reliable knowledge of current patterns of habitat ecology, ungulate foraging ecology, elk migration, and wolf ecology for a research area centered on the Red Deer River in the Ya Ha Tinda Ranch area in the province of Alberta to the rivers upper headwaters in Banff National Park. Information gathered will provide Parks Canada and the Province of Alberta with information necessary for wildlife management to foster trans-boundary interagency ecosystem management.

1.0 Study Area Description

The study area encompasses the upper foothills, montane, subalpine and alpine ecoregions of Alberta's eastern slopes of the Rockies. Climate is severe in winter punctuated by short warming Chinook periods and high winds and snowfall increases with elevation and along an east-west gradient towards the continental divide. Summers are short and warm, with most precipitation falling in spring and early summer. The study area focuses on an approximately ~5000 km^2 area defined by the movements of the Ya Ha Tinda elk herd, on of Alberta's largest elk herds. The Ya Ha Tinda Ranch (YHTR) is a large montane grassland on the Red Deer River just east of Banff National Park, and 80km west of Sundre. The YHTR has served as the wintering ranges of ~160 horses for Parks Canada Warden service since the 1930's. Located in the Front ranges of the Rockies, the YHTR is also the wintering range for approximately 1000 elk that summer in the upper elevations of the front and main ranges of Banff National Park. Elk migrate as far as 80 km to the Bow Valley and even areas in Kootenay and Yoho National Parks in B.C. (Morgantini and Hudson 1988). Vegetation in the study area is diverse, varying with elevation and along an east-west moisture gradient. At the YHTR, montane grasslands are dominated by rough fescue (*Festuca campestris*), and mixed aspen (*Populus tremuloides*) stands. Supalpine vegetation is characterized by lodgepole pine (*Pinus contorta*),engelmann spruce (*Picea engelmanni*), and subalpine fir (*Abies lasiocarpa*) stands, with abundant avalanche slopes and subalpine meadows. Alpine habitats are typically >2500m elevation, and are composed of alpine grass and shrublands.

Elk are the most common member of a diverse ungulate guild including mule deer (*Odocoileus hemionas*), white-tailed deer (*O. virginianus*), bighorn sheep (*Ovis canadensis*), mountain goat (*Oreamnos americanus*), a small band of mountain caribou (*Rangifer tarandus*), and feral horses (*Equus hemionas*). Wolves are the primary predator of elk, but other predators include coyotes (*Canis latrans*), grizzly bears (*Ursus arctos*), black bears (*U. americanus*), cougars (*Felis concolor*), wolverine (*Gulo gulo*) and lynx (*Lynx canadensis*). Human use varies spatially and seasonally and is lowest during winter. High horse-based human use centers on the Bighorn campground at the YHTR during the summer, declining into the eastern parts of BNP, and increases again towards Lake Louise.

2.0 Study Objectives

The overall objectives of the study are to understand how predation, human activity, and habitat-related factors affect the ecology and migration of the Ya Ha Tinda elk population. Furthermore, these research objectives are housed within the overall management objective of providing guidance for federal and provincial governments to improve the interagency management of wildlife populations in the Eastern slopes ecosystem.

2.1 First Year Objectives

Elk

1) Safely capture and radio-collar ~40 elk on the Ya Ha Tinda winter range using corral trapping and some limited helicopter netgunning.
2) Determine migratory routes, winter ranges, and summer ranges of elk. This will define the study area using ground and aerial radiotelemetry.
3) Test the use of GPS collars on elk with 4 test GPS collars.
4) Determine the relative proportion of migrant to resident elk in our collared sample and the population.
5) Collect pellet samples to estimate diet selection for assessing habitat selection.
6) Determine population characteristics such as population size and cow: calf ratios for migrant and resident elk for 2001/02
7) Obtain long-term population survey data from Parks Canada and AB-SRD on elk populations in and adjacent to the Ya Ha Tinda Ranch.

Wolves

1) Identify all resident wolf packs using the winter and summer ranges of this elk population.
2) Capture and radio-collar members of all wolf packs in the study area.
3) Snow backtrack wolves to determine prey composition, encounter rates with different prey species, and habitat use.
4) Collect ground and aerial telemetry locations to describe wolf resource selection.
5) Determine wolf population characteristics such as pack size, litter size, and mortality.

Forage Analyses

1) To collect summer elk habitat quality sample plots at peak biomass throughout the study area building on work by Sachro and Gates at University of Calgary.
2) Collect seasonal repeat sampling forage phenology plots to determine how biomass and quality of forage change over time.
3) Focus both phenology plots and biomass plots on the area in and surrounding the Dogrib Fire to address specific objectives for the *Chisholm-Dogrib Foothills Model Forest Funding* Program (see separate section below).

Project Management

1) Develop ACCESS databases for all elk, wolf, and forage data to ease data management and analyses and standardize data collection across collaborative projects.
2) Obtain required spatial/GIS data for GIS – analyses from Parks Canada, AB-SRD, and other research and area partners (i.e. Sunpine, Miisatakis institute)
3) Obtain required climatic data for temperature, precipitation, and snowfall from Parks Canada, AB-SRD.
4) Obtain funding for increased flight costs required for aerial monitoring of elk required for the project that are to be radiocollared during the upcoming field season.

3.0 Methods

3.1 Elk

3.1.1 Capture

Elk were captured primarily using a large corral trap baited with alfalfa hay and cracked oats during winter. Rocky Mountain Elk Foundation –Canada loaned the use of the elk trap, and BNP transported the trap to the Ya Ha Tinda. The corral trap was located in the mare pasture grassland area of Ya Ha Tinda ranch within an old creek bed with some shelter from the wind. The trap consisted of a large corral (capture corral), four holding chutes or pens, a working area, and a circular squeeze tub (See Appendix A). The trap had 3.5-meter walls to reduce visual and auditory stimuli, and to prevent escape. The trap doors were closed with a long cable attached to a weight that dropped and released the doors. The cable was connected to a rope inside a heated hut where technicians would sit to monitor the trap and pull the trigger at the most opportune moment. A portable ground livestock scale (0-5000 lbs) was set inside the last chute closest to the squeeze tub with a plywood platform on top to weigh elk. Elk were moved from the corral to the holding pens, onto the scale, and then into the squeeze where they were blindfolded, haltered and processed.

The corral trap was baited primarily with 130 bales of 2nd cut alfalfa hay and occasionally with oats. We used non-certified weed free alfalfa from Paul and Kathy Kroshko in Sundre, AB. Although not inspected, the Sundre agriculture inspector did a site visit at our request and thought the hay was likely weed-free. During each trapping period the trap was pre-baited with 3-4 square bales inside the trap and 2-3 bales spread outside the trap to lure the elk inside. Once the elk became familiar with the trap and entered more readily, bait was reduced to 1 square bale inside and 1 square bale spread outside as a lure. Oats did not appear to make a significant difference in the number of elk that entered the trap.

We also used aerial netgunning to augment elk capture efforts in March 2002. Elk are more vulnerable to capture myopathy than wolves, and so aerial chases of elk were $\leq$ 5 minutes. Once successfully netted, Bighorn Helicopter (Clay Wilson) capture crews quickly subdued the elk, radiocollared, sampled blood, sex, aged, and released captured elk.

3.1.2 Handling

Elk were handled without immobilization by physical restraint using the squeeze chute in the trap or restraint with nets in netgunning. Hair samples were collected for DNA and blood samples were taken from the jugular or lateral saphenous vein for blood chemistry, pregnancy tests, and DNA research. Two -10 elk from each capture session were fitted with either an 800g VHF radio-collar or a 1200g GPS collar. Captured elk were also marked with one or two ear tags (one on each ear), weighed (in kg), examined for body condition (estimated based on fat located on ribs and back), and aged (by tooth replacement and wear and by sampling incisors for aging). All ear tags used during 2002 were green All-flex livestock tags.

3.1.3 Radio Telemetry

We attempted to obtain aerial locations every 7-14 days throughout the year, augmented by ground telemetry. Telemetry locations were classified as either confident locations, Class 1, or Class 2 locations, where for reasons such as signal bounce or animal movement the researcher was not as confident in the accuracy of the estimated location. However, methods for elk differed from wolves in that whenever possible from the ground, radio-collared elk were remotely observed and all tags and collars present were recorded using a high power spotting scope, and cow: calf and demographic data were recorded (see 4.1.4).

We defined seasonal ranges based on mean date of migration for the population, and divided seasons ranges into winter and summer individually for each migrant elk according to their date of migration between non-overlapping winter and summer home ranges. We used ARCVIEW Animal Movement extension to analyze annual and seasonal home ranges for wolves and elk, respectively, using the 100% Minimum Convex Polygon (MCP) method.

3.1.4 Ground Observations

For groups of collared, tagged, and/or uncollared elk, we always recorded time, date, location, and the numbers of tagged elk in the herd, when possible. In addition, we used standardized criteria (Smith and MacDonald 2002) to sex- and age-classify elk in groups to obtain demographic data such as cow: calf ratios, and other behavioral observations. Observations were made from sufficient distances to eliminate or reduce the risks of disturbing elk.

3.2 Wolf

3.2.1 Capture

We used a combination of 3 methods for capturing wolves; foothold trapping, aerial darting, and helicopter netgunning. Foothold trapping is appropriate in the summer, but labour intensive (~1 wolf/120 trap-nights in BNP region).

<u>Summer Capture: Foothold trapping</u>.

We trapped for wolves during May, June, and July to radiocollar wolves in the Red Deer and Ya Ha Tinda wolf packs using modified steel foot-hold traps (Livestock Protection Co. Ltd, Alpine, TX). These traps have been adopted by the USFWS and USFS for humane use by wolf researchers. Trapping protocols were developed to reduce risk of injury, non-target capture, and risks to personnel. Frequent ground checks ($\geq$1/24hours) on traps minimized time spent in traps, reducing likelihood of injury. In addition, we used radio-trap transmitters that notify when the trap has been triggered. When combined with trap transmitters, traps can be checked up to 4-6 times/24hours.

Once captured, wolves were physically subdued using a forked stick or snare pole, and then chemically immobilized. Where wolves weigh <15 kg (i.e. pups) or under special circumstances (i.e. lactating alpha female), wolves were physically restrained without the use of immobilization drugs. Non-targets will be physically restrained, inspected for injuries, administered local or long-lasting antibiotics, and released on site.

Winter: Aerial Darting and Netgunning

Wolves were aerially darted and immobilized using Pneu-Dart™ wildlife darts (see dosages below) with the lowest possible gunpowder charge (i.e. brown charge on Pneu-Dart™) to reduce risk of dart impact injury under direct veterinary direction. Once darted, we followed wolves until they succumbed to the drug, or >15 min, and then landed and radiocollared the wolves. We did not successfully capture any wolves using helicopter netgunning.

3.2.2 Handling and Immobilization

Wolves captured by foot-hold trapping were immobilised with either 5mg/kg of Telazol™ (tiletamine hydrochloride (HCL) and zolazepam (HCL), A.H. Robbins Co., Richmond, VA) at a reconstituted concentration of 100mg/ml (Ballard et al. 1991), *or* a combination of 2 km/kg of Telazol and 1.6 mg/kg of Xylazine (Rompun®). The Telazol:Xylazine combination has the advantage of having anaesthesia readily reversible with Yohimbine (Antagonil™). Wolves captured by aerial darting were immobilized with one of two immobilization drugs, either Ketamine (4 mg/kg) and Medetomdine (0.075 mg/kg), or a higher dose of straight Telazol (10mg/kg) to compensate for elevated stress associated with the helicopter chase. The Ketamine: Medetomdine combination provides a lower volume of drug required than the Telazol and anaesthesia is readily reversible with 0.4 mg/kg of atipamezole (Antisedan™) delivered intramuscularly, which provides smooth and rapid reversal.

Vital rates were monitored throughout handling. Hypothermia (temp ~<37? C) was countered using heat pads, insulating ground sheets, sleeping bags and human body heat. Hyperthermia (temp >41? C) was reversed using cool distilled water in the groin and armpit regions, icepacks, and chemical ice packs. We outfitted wolves weighing more than 15 kg with a VHF radiocollar (LOTEK Engineering Ltd.). We recorded body measurements, weight, sex, breeding status, body condition, blood samples for DNA and serology research, hair samples for DNA, recorded photos, fitted a radiocollar, and released the wolves.

3.2.3 Winter tracking

Both radiocollared and non radio-collared wolf packs were snow backtracked to collect information about wolf pack composition and size, home ranges, small-scale landscape use, encounter rates with elk and other ungulate prey, and to locate wolf-killed elk and other prey. Wolves were backtracked to avoid disturbing wolves by locating fresh wolf tracks and following them backwards to the previous days location.

3.2.4 Radiotelemetry

Radio-collared wolves were relocated approximately every 7-14 days from the air, and occasionally more frequently from the ground. We collected aerial locations from helicopter or fixed wing Cessna Skymaster 337 twin-engine aircraft. From the ground, wolves are remotely located using the bisect of 2-3 bearings taken from a portable radio telemetry receiver in 2-3 locations. These locations are usually between 0.5 km and 2.0 km away from the radio-collared wolf, and standard operating procedures have been developed to reduce risks of disturbing the animal (Hebblewhite 1998). Aerial telemetry followed Parks Canada policies and standard operating procedures for reducing the risks to humans and disturbance to wildlife.

4.0 Results

4.1 Elk

4.1.1 Animal capture and handling

We captured 116 elk over 23 active trap nights between Jan. 21, 2002 and April 6, 2002. Ten of those nights were successful. Of the 116 elk, 18 were recaptures, and 5 recaptures were previously tagged by other studies (see Table 1) and 2 of those were recaptured twice. We tagged all elk captured in the corral trap, and weighed a total of 53 tagged elk. Age-classes of captured elk were 70 Adult female elk, 4 YLY females (yearlings were not always distinguished), 10 YLY males (spikes), 10 YOY male, 10 YOY female, and 1 Adult male. We weighed a total of 51 elk. Weights for adult females ranged from 197 to 272 kg with an average of 241 kg (n=27, Stdev=28.6). Yearling females averaged 173 kg (n=5, Stdev=33.3). YOY females averaged 112 kg (85 – 122 kg, n=5, Stdev=9.4). Young adult males averaged 228 kg (209 – 247 kg, n=2), yearling males averaged 186 kg (107 – 230 kg, n=7, Stdev=45.5), and YOY males averaged 119 kg (110 – 126 kg, n=7, Stdev=5.6). Four adult female elk (Elk 167, 168, 171, 172) were netgunned and collared by Bighorn on Feb. 26, 2002.

We radiocollared a total of 39 female elk (35 Adult female, 4 yearling). Four collars were GPS collars. One of the GPS collars turned immediately to recovery mode and was successfully recovered with the LOTEK remote release mechanism on Apr. 17, 2002. Weights for collared females ranged from 125 to 281 kg with an average adult weight of 241 kg (n=19). A list of all elk captured and radiocollared and their tag numbers is presented below. For a list of all elk tagged during 2002, see Appendix A. Migratory status appeared unaffected by capture method or time of year of capture.

4.1.2 Radio Telemetry

Radiotelemetry data collected from Feb 2002 to Nov 2002 on radiocollared elk are summarized in Table 2 through 5. In April, we identified a previously collared elk in the population that we monitored, increasing the total number of collared elk to 40. We collected a total of 1734 telemetry locations on a total of 40 radiocollared elk, with 98.9% of locations Class 1 in Winter, and 84.7 % Class 1 in summer due to difficulty of ground telemetry in the backcountry on migrant elk. We collected 34.8% of all telemetry locations by aerial telemetry, compared to 65.2% by ground telemetry, and the numbers of locations were approximately equally distributed between migratory strategies. We flew a total of approximately 98 hours of fixed wing aerial telemetry between and ~2 hours of rotary wing aircraft on 28 flights from Jan 2002 to Nov 2002. Average number of elk and wolves relocated/flight was 28, and flight costs averaged $60.4 / aerial telemetry relocation.

Table 1: Elk radiocollared during winter 2002 at the Ya Ha Tinda Ranch.

Tag #	Age	Sex	Date Captured	Weight	Collar	Status	Summer Range
98	AD	Female	2/1/2002	UKN	VHF	Migrant	Bow Valley
99	AD	Female	2/1/2002	UKN	VHF	Resident	Ranch
100	SUBAD	Female	2/1/2002	UKN	VHF	Resident	Ranch, Upper Scalp Creek
101	AD	Female	2/1/2002	UKN	VHF	Migrant	Wildhorse/Dogrib Burn
102	AD	Female	2/1/2002	UKN	VHF	Migrant	Bow Valley
103	AD	Female	2/1/2002	UKN	VHF	Resident	Ranch, Canyon Creek
104	AD	Female	2/1/2002	UKN	VHF	Migrant	Clearwater
106	AD	Female	2/1/2002	UKN	VHF	Resident	Ranch, Upper Scalp Creek
119	AD	Female	2/1/2002	UKN	VHF	Unknown	Mortality, April 2002
120	AD	Female	2/1/2002	UKN	VHF	Resident	Ranch
122	AD	Female	2/7/2002	216	VHF	Migrant	Panther/Corners
124	AD	Female	2/7/2002	198	VHF	Migrant	Upper Cascade
129	AD	Female	2/4/2002	UKN	VHF	Resident	Ranch/Corners
133	AD	Female	2/4/2002	UKN	VHF	Resident	Ranch/Scalp
135	AD	Female	2/4/2002	UKN	VHF	Migrant	Divide/Scotch
137	AD	Female	2/4/2002	UKN	VHF	Resident	Ranch/Scalp
149	AD	Female	2/7/2002	266	VHF	Migrant	Bow Valley
150	AD	Female	2/14/2002	260	VHF	Resident	Ranch/Scalp
154	YLY	Female	2/7/2002	175	VHF	Resident	Ranch
158	AD	Female	2/14/2002	258	VHF	Resident	Ranch/Scalp
161	AD	Female	3/13/2002	212	VHF	Migrant	Bow Valley
165	AD	Female	3/22/2002	270	VHF	Migrant	Clearwater
166	AD	Female	3/22/2002	234	VHF	Resident	Ranch
167[a]	AD	Female	2/25/2002	UKN	VHF	Migrant	Divide/Scotch
168[a]	AD	Female	2/25/2002	UKN	VHF	Migrant	Panther/Corners
169	SUBAD	Female	3/13/2002	125	VHF	Resident	Ranch
171[a]	AD	Female	2/25/2002	UKN	VHF	Migrant	Bow Valley
172[a]	AD	Female	2/25/2002	UKN	VHF	Resident	Ranch
173	AD	Female	3/22/2002	175	VHF	Migrant	Bow Valley
175	SUBAD	Female	3/14/2002	172	VHF	Resident	Ranch
177	AD	Female	3/14/2002	272	VHF	Migrant	Divide/Peters
179	AD	Female	3/23/2002	256	VHF	Migrant	Divide/Peters
181	AD	Female	3/14/2002	247	VHF	Resident	Ranch
182	AD	Female	4/5/2002	259	GPS	Resident	Ranch
185	AD	Female	3/23/2002	274	VHF	Migrant	Upper Panther
186	AD	Female	4/5/2002	225	VHF	Migrant	Upper Panther
192	SUBAD	Female	4/5/2002	174	GPS	Unknown	Collar Failure
193	AD	Female	4/5/2002	281	GPS	Migrant	Bow Valley
196	AD	Female	4/6/2002	265	GPS	Migrant	Scotch

a- Captured by helicopter netgunning, remaining elk corral trapped

Table 2. Summary table of telemetry locations by season and migratory status, including confidence code for telemetry location.

	Migrant	Resident	Totals (% Class 1)
Winter	521	555	1076 (99%)
Summer	297	361	658 (85%)
Total	818	916	**1734**

Despite potential biases in collecting ground telemetry on migrant elk during summer, there was no significant difference in the proportion of locations collected by the 2 methods between resident and migratory elk during summer (Table 3, 3-way contingency table G=1.5, P>0.05). This was likely because of the ground telemetry on migrant elk that summered along the Icefields Parkway.

Table 3. Summary telemetry table by collection method; ground and aerial telemetry, for migratory and resident elk in winter and summer, Feb 2002 – Nov 2002.

	Air	Ground	
Migratory – Winter	138 (24.5)	427 (75.5)	565
Migratory – Summer	197 (54.7)	163 (45.3)	360
Resident – Winter	130 (25)	390 (75)	520
Resident - Summer	142 (47.6)	156 (52.3)	298
Totals	**607** (34.8)	**1135** (65.2)	**1743**

We collected an average of 43.6 telemetry locations per radiocollared elk (range 20-66 not including mortalities and GPS collared elk), and 42.0 and 45.4 locations for migrant and resident elk, respectively. On average, we collected 27.1 locations during the winter and 17.3 locations during summer (June 11 to Oct 15), with few differences between migrant and resident elk in terms of seasonal sampling intensity.

Table 4. Summary table of mean telemetry locations per radiocollared elk, Feb 2002 to Nov 2002. Not including GPS collar data.

	Mean	N	Range	Std Dev
Winter Total	27.1	40	4-41	10.42
Resident	*28.9*	*18*	*4-41*	*10.91*
Migrant	*25.6*	*22*	*10-40*	*10.03*
Summer Total	17.3	38	2-30	6.41
Resident	*17.5*	*17*	*10-30*	*4.96*
Migrant	*17.2*	*21*	*2-30*[a]	*7.51*
Resident Total	45.4	22	20-66	15.71
Migrant Total	42.0	18	20-63	16.11
Total	43.6	40	4-66[b]	15.79

a- includes GPS collared elk and 2 elk that were killed immediately after migrating (without these, the minimum is 9)

b- Minimum of 20 not including GPS collared elk

4.1.3 Migration

Migration was defined as the date upon which elk left their seasonal home range without returning and when they set up their summer home range. Mean migration date of elk migrating from the Ya Ha Tinda winter range for non-overlapping summer ranges during summer 2002 was June 11. Average migration time varied across elk, and was limited by sampling intensity during early June when telemetry flight search time increased dramatically in response to migration. However, estimates of the period elk spent in migration during spring were approximately 7 days, ranging from 1 to 30 days before settling into a new summer home range.

We classified resident elk as those elk that either did not leave the ranch during summer or who had sympatric summer and winter home ranges. Many residents undertook short-term, short-distance migration, especially during the month of July, as seen on Fig. 1 where the peak in the % of elk migrating from the Ya Ha Tinda winter range approached 70%. During this period insect harassment and high temperatures may have been a proximal queue to such short-term migratory movements. However, some gradation of migrant/resident behavior was observed, and further work is required at the Home range scale to define migratory behavior in such resident elk. Fall migration appeared to take longer than spring migration, and mean fall migration date was October 15. Average approximate times of migration during fall took 20 days, ranging from 4 to 25. All migratory elk had returned to the Winter Range by Oct 26.

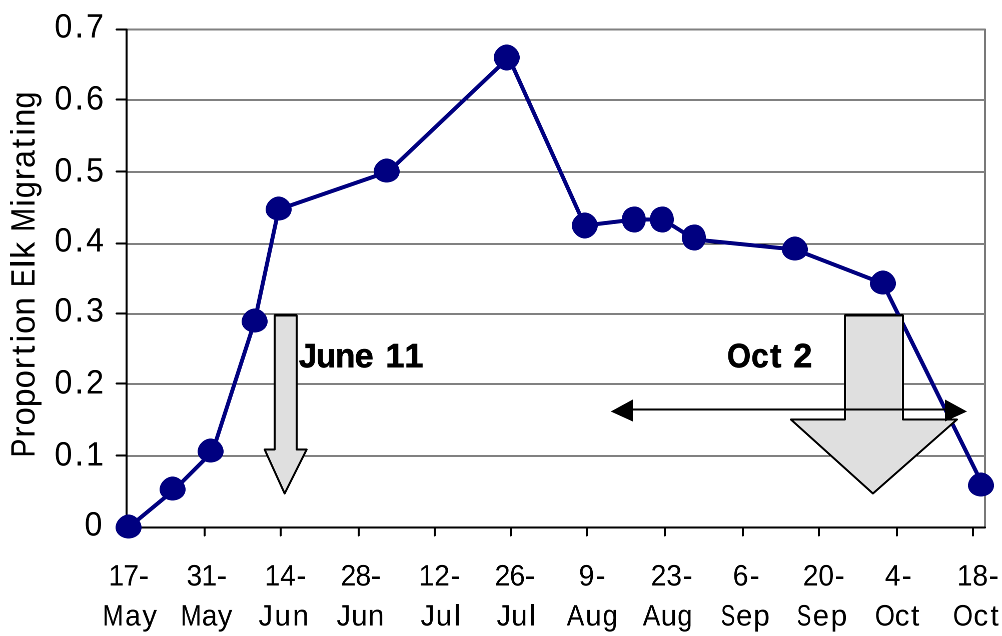


Fig. 1. Proportion of total radiocollared elk migrating, and mean dates of migration and approximate duration of migration, Nov 2001 to Nov 2002.

4.1.4 Home Range Analyses

We used ARCVIEW Animal movement's extension to conduct MCP home range analyses. All elk had enough telemetry locations to estimate a winter MCP home range, and all but 3 elk (Elk 196, 119, 173) had sufficient locations (Table 5) to estimate summer home ranges. Elk 196, 173 and 119 were killed prior to or early in migration, preventing seasonal home range calculations. We distinguished seasonal home ranges for migratory elk on an individual basis by identifying the exact date of migration between non-overlapping home ranges using telemetry data. We discriminated 3 migratory states based on telemetry locations; winter range, summer range, and a migratory state where we located some elk en route from their winter and summer home range. Such telemetry locations fell outside of 95% Adaptive kernel home ranges that were used to screen out these transitory movements. For resident elk without as clear discrimination between winter and summer ranges, we used the mean date of migration to distinguish winter and summer seasons, 11 June.

There was larger variation in summer home range size than winter home range size (Table 5, Fig. 2, 3). Migrants had slightly larger summer home ranges than residents (99.3^2 vs. 88.7 km^2), although this difference was not statistically significant (t-test, $P=0.11$). However, migrant elk had summer home range centers that were an average of 33.7 km from the centre of winter home ranges (Fig. 2), compared to 3.1 km distant for resident elk, and this distance for resident elk did not significantly differ from 0 km ($P=0.4$)

Migrants and residents did not differ in the size of winter 100% MCP home ranges (21.0 and 21.6 km^2, respectively), and mean winter home range size for all elk was 20.5 km^2. Winter home ranges showed little variation in size (Table 5, Fig.3), and were centred on the eastern portion of the Ya Ha Tinda Ranch (Fig.3).

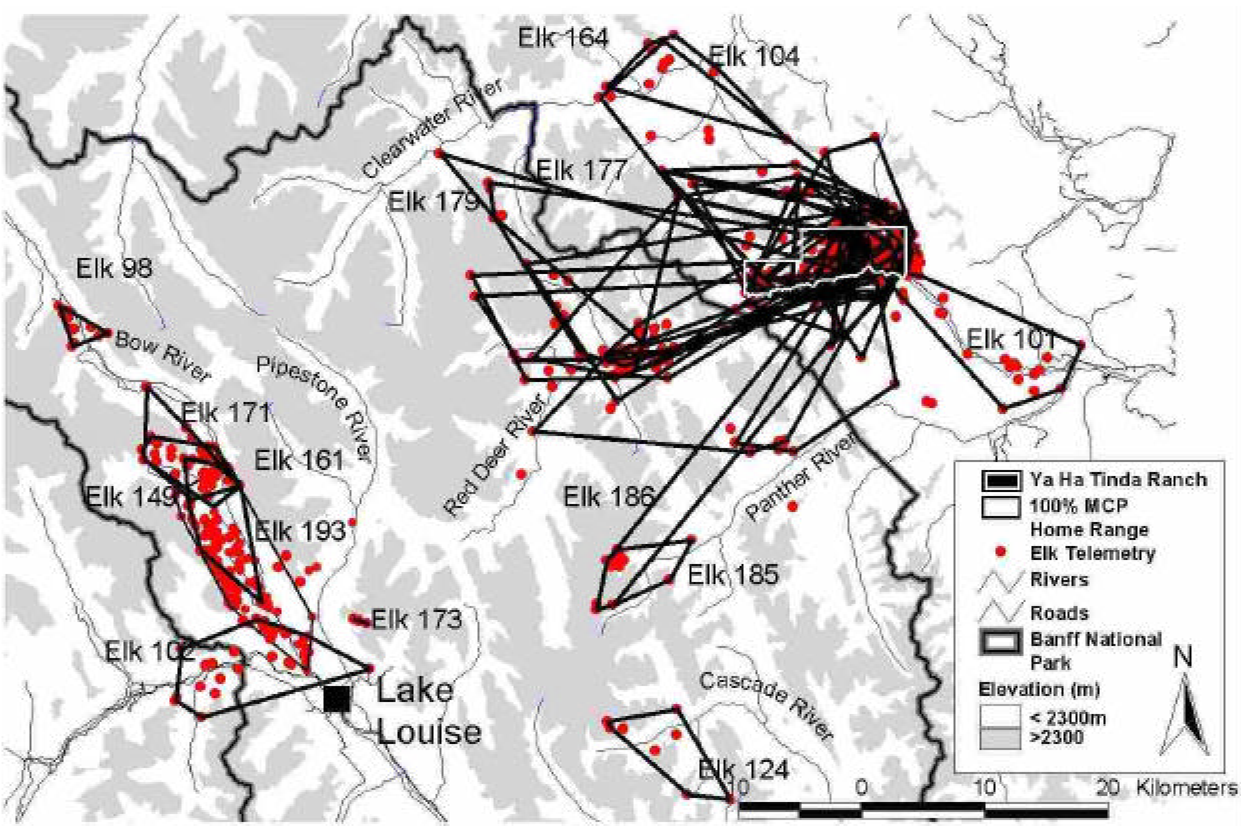
Table 5. Home range summary statistics calculated using 100% Minimum Convex Polygon for resident and migratory elk, Feb 2002 to Nov 2002.

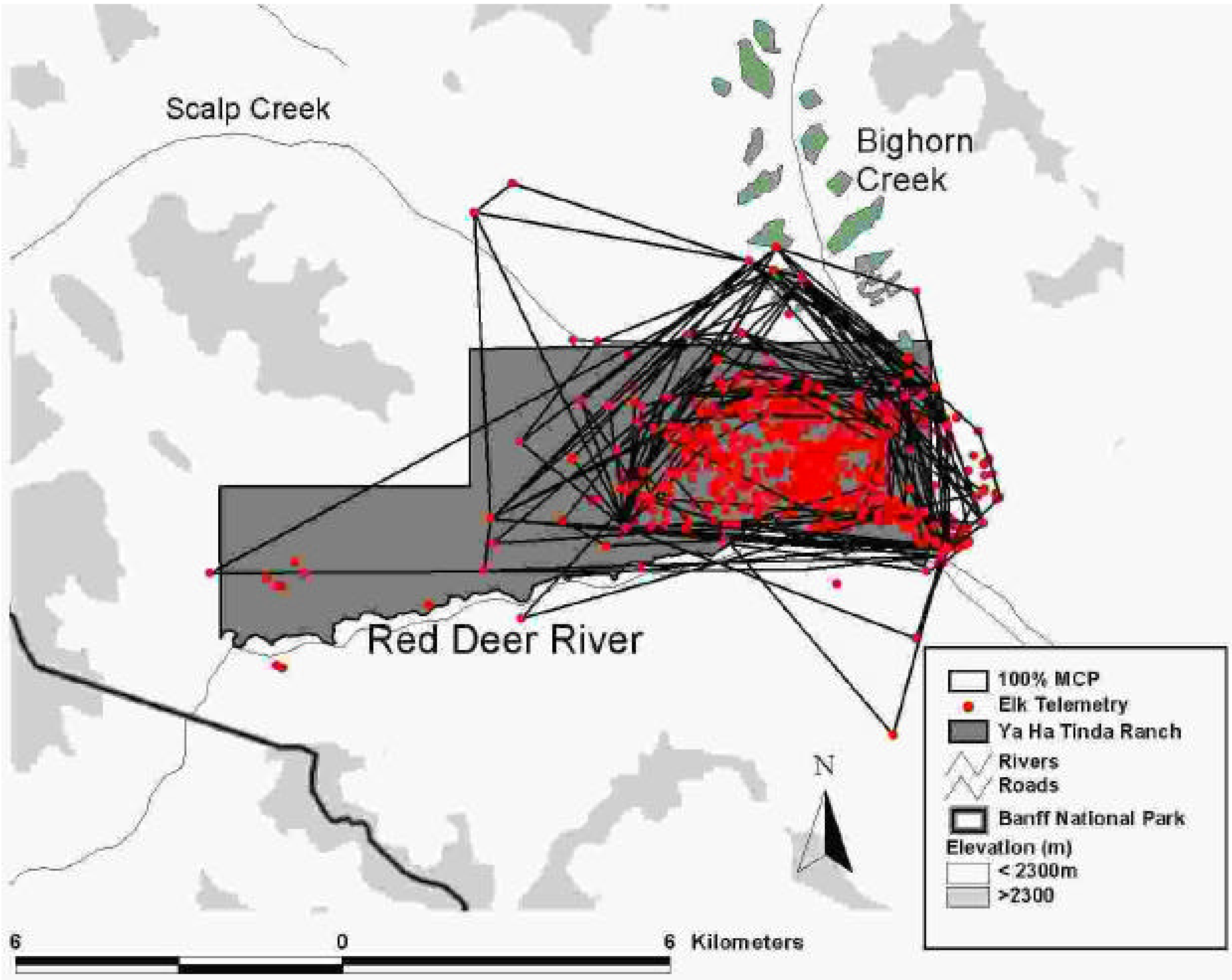
		WINTER		SUMMER		Distance in km
Elk #	Status	MCP (km^2)	n	MCP (km^2)	n	
GR98	Migrant	40.42	45	5.28	13	63.85
GR99	Resident	16.86	46	52.25	13	0.31
GR100	Resident	16.88	39	140.06	12	7.49
GR101	Migrant	15.36	31	75.93	16	13.53
GR102	Migrant	14.21	33	70.96	19	60.90
GR103	Resident	17.63	45	63.63	15	1.52
GR104	Migrant	16.12	36	156.88	13	14.52
GR106	Resident	27.25	45	112.33	13	2.84
GR119	Unknown[1]	11.50	25	---		
GR120	Resident	20.92	46	47.32	16	0.47
GR122	Migrant	22.09	40	99.10	11	10.78
GR124	Migrant	18.35	33	32.08	8	43.75
GR129	Resident	34.49	45	102.50	14	2.63
GR133	Resident	16.74	42	121.15	16	5.43
GR135	Migrant	25.14	35	188.49	30	18.48
GR137	Resident	40.70	43	84.84	10	3.10
GR149	Migrant	29.73	36	32.69	20	57.73
GR150	Resident	23.15	38	243.70	15	7.89
GR154	Resident	17.56	35	40.35	14	0.59
GR158	Resident	17.47	30	100.94	13	1.79
GR161	Migrant	26.78	24	24.19	23	56.35
GR165	Migrant	18.68	20	46.78	12	21.89
GR166	Resident	19.86	22	42.81	7	1.87
GR167	Migrant	27.30	34	101.29	18	21.98
GR168	Migrant	18.94	36	200.13	13	16.37
GR169	Resident	15.95	25	91.18	13	2.04
GR171	Migrant	27.69	30	37.73	23	57.23
GR172	Resident	25.89	32	117.40	21	7.51
GR173	Migrant	11.06	22	---	3	49.95
GR175	Resident	12.21	23	12.80	9	1.81
GR177	Migrant	19.34	23	245.18	18	15.64
GR179	Migrant	14.09	13	195.77	7	16.49
GR181	Resident	18.09	22	46.39	8	4.65
GR182	Resident	16.40	16	---	7	1.44
GR185	Migrant	19.52	17	23.25	10	32.73
GR186	Migrant	10.60	21	89.61	10	25.79
GR192	Unknown	---		---		
OR14	Migrant	19.71	14	180.82	25	18.43

Table 5 Continued

Elk #	Status	WINTER MCP (km^2)	n	SUMMER MCP (km^2)	n	Distance in km
GR193	Migrant	28.93	430	79.90	272	57.72
GR196	Migrant	23.19	1278	---		
	MEAN	20.9	73.6	94.4	21.1	19.7
	Range	10.6 - 40.7	13.0	5.3 – 245.2	3.0	0.3
	StDev	7.2	208.2	64.7	42.8	21.0

1- Assumed Elk 119 was a resident for purposes of calculating migratory status seasonal home ranges for comparisons.





4.1.5 Preliminary Mortality / Survival Data

We monitored a total of 40 radiocollared elk for approximately 7.2 months each between Feb and Nov 2002. We recorded 6 mortalities during this period (Fig. 4). Elk 119 was killed by a cougar 1.1 months after collaring in Bighorn creek. Elk 173 was killed by Grizzly 59 in Pipestone Bowl behind the Lake Louise Ski Hill in June, and her collar was recovered with the assistance of Barb Bertch, Lake Louise Warden. Elk 196 was likely killed by a Grizzly bear near Prow Mountain in the Red Deer River during migration on June 15. Elk 186 was killed by an unknown predator late on approximately September 15 in the Upper North fork of the Panther River. Elk 101 was

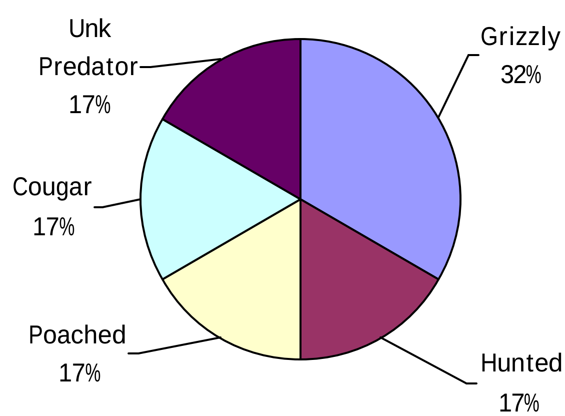


Fig. 4. Causes of mortality of radiocollared adult female elk (n=6) Feb 2002 to Nov 2002.

apparently shot by a poacher in WMU 417 just east of the Ranch and WMU 418 near Wildhorse creek, and is under investigation by Jim Mitchell, Sundre F&W Conservation Officer. Elk 175 was legally harvested by a Bow Hunter from Calgary on September 13th 1km from the Ranch Buildings. With only 6 mortalities, conclusions are extremely preliminary, at best, but reveal a diversity of mortality sources. Continued collaring to increase sample size and monitoring is required for an accurate estimate of cause-specific mortality rates of adult radiocollared female elk during.

In addition to monitoring adult female radiocollared elk, we recorded incidental observations of elk calf mortality in and around the Ya Ha Tinda Ranch. Through researcher, ranch staff, and reliable sightings from the public, we documented 7 total calf mortalities from 06/10 to 07/03. These were wolf (2), grizzly (2), coyote (2), and 1 horse caused elk calf mortality. Despite biases associated with location of uncollared elk calf mortalities, these data may be useful over the course of the study to shed some insight into elk calf mortality, and highlight the need for potential study.

4.1.6 Cow: calf survey data

Cow: calf ratio data summarized from January 2002 to April 2002 (Fig.5) showed cow: calf ratios declining from ~18% to 12% by April. Although I have not summarized previous years cow: calf ratios from AB-SRD data to date, April cow: calf ratios were considered lower this year than previous years, perhaps due to the severe late winter conditions. We have not summarized summer season Cow: calf ratios to date.

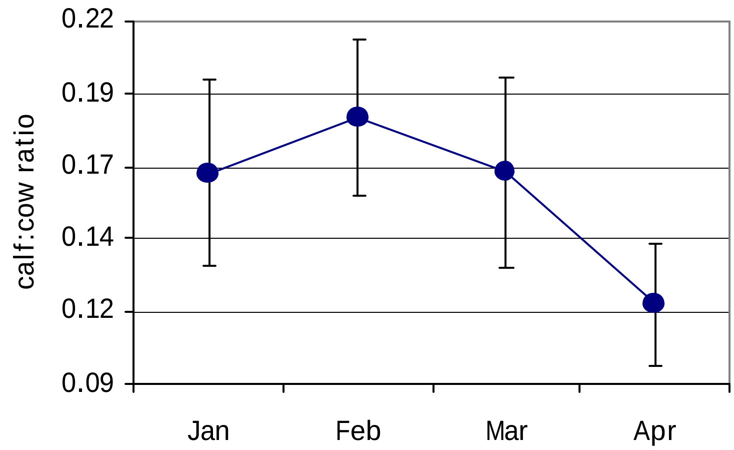


Fig. 5. Ya Ha Tinda winter 2001/02 calf:cow ratios. Samples sizes per month of classified elk were 505, 734, 534, and 881, respectively, for January to April.

4.1.7 Elk Population Data from BNP – AB-SRD data.

I assembled data from Jim Allen, AB-SRD, and from Tom Hurd, BNP, of winter Elk population size at the Ya Ha Tinda and surrounding areas in the Red Deer River, Clearwater River, Panther River, and Corners areas from 1974 to 2002, including this past winters survey. This past year's surveys were flown on Feb 1, and Mar 3 by AB-SRD and BNP, respectively. Data collection guidelines were similar between Parks Canada and AB-SRD surveys, where all major winter ranges and suitable habitats are flown in a helicopter. For groups >50 elk, photos were taken and pin counting used to tally numbers of elk. Counts represent a minimum and biases associated with differing sight ability conditions between and among years and observers (BNP, AB-SRD) are not accounted for. Jim Allen, AB-SRD is currently developing a sight ability model approach that could potentially be applied in combination with data from (Hebblewhite 2000) to develop a sight ability model for the Ya Ha Tinda.

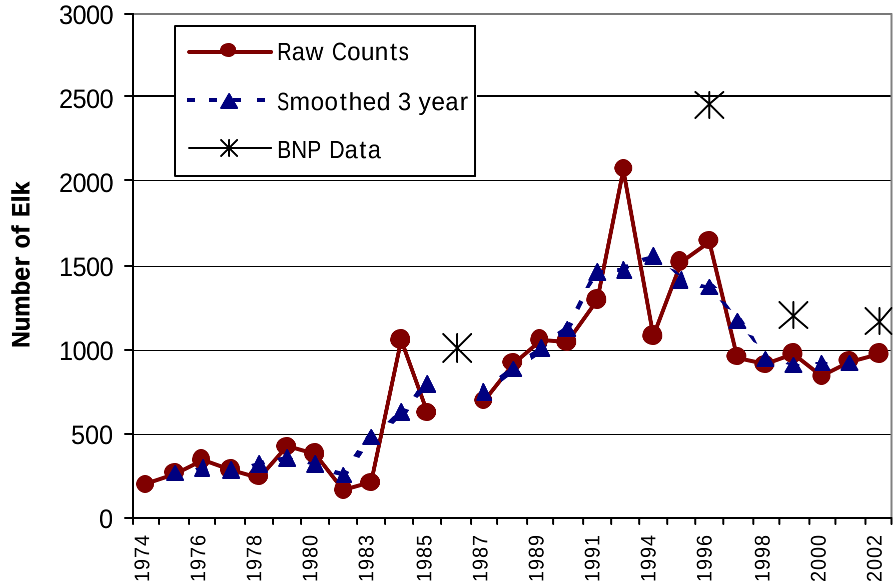


Figure 6. Winter elk population counts at the Ya Ha Tinda Ranch and adjacent WMU's and BNP elk survey zones from 1974 to 2002.

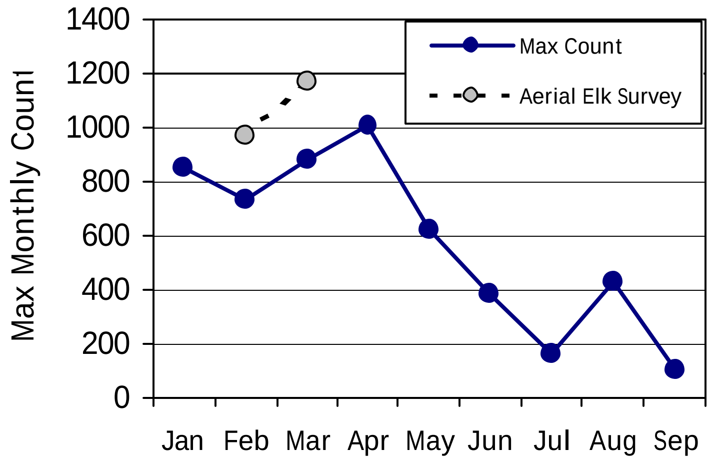


Fig 7. Maximum monthly aerial and ground sightings of elk on the Ya Ha Tinda Ranch, Jan 2002 to Sept 2002. Feb and March AB-SRD and BNP aerial surveys data are shown for comparison.

BNP counts are consistently higher than AB-SRD counts, although the total numbers of surveys is only 4. Although more detailed analyses are required, mean dates of the

BNP aerial surveys were March 4, whereas AB-SRD counts are usually conducted earlier in the winter, around the approximate date of Feb 1st. Differences between mid and late winter counts of elk in the study area may reflect differences in distribution, not counts. More detailed analyses of the spatial distribution of AB-SRD and BNP aerial elk surveys to determine spatial biases will be conducted in the future.

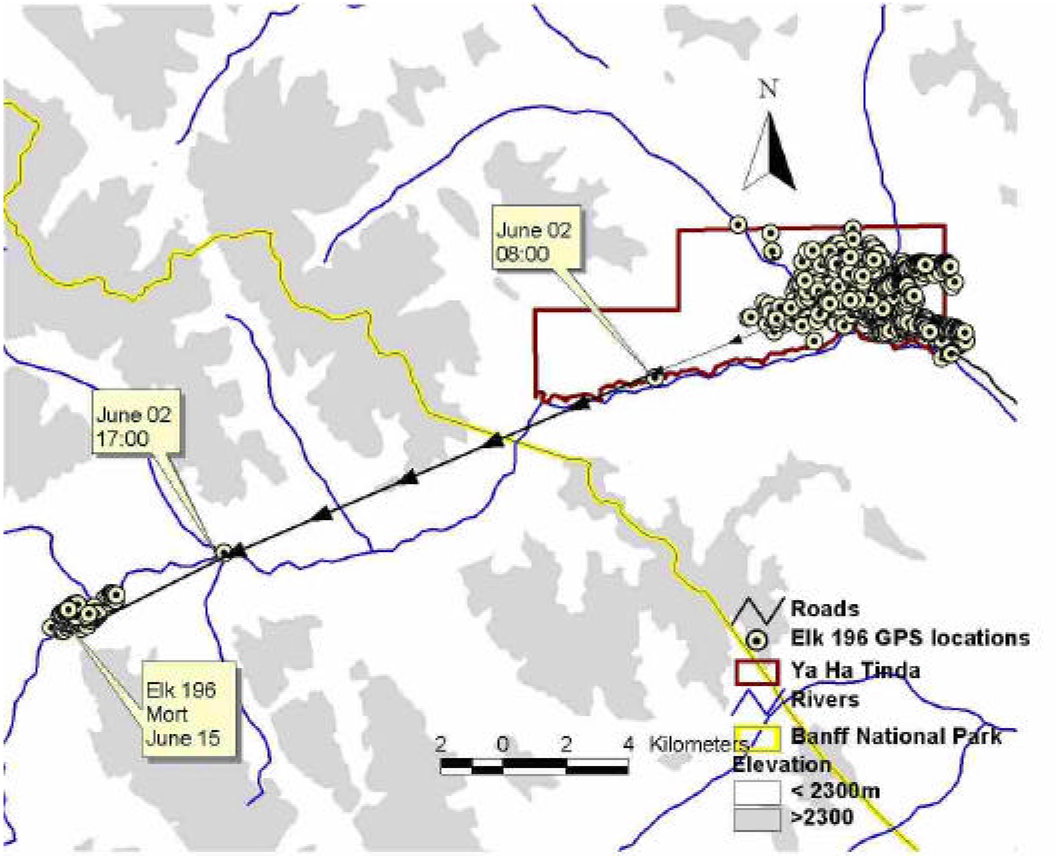
Marie Nylund compiled summer population counts from 1996 to 2002. Minimum counts were ~200 on Aug 15/2000, ~150 on Aug 1/2001, and 250 on Aug5/2002 (this year). For comparison, we compiled the maximum monthly count of elk observed during aerial and ground telemetry (Fig. 7). During the summer, the average monthly maximum counts of elk observed on the Ya Ha Tinda Ranch during aerial and ground telemetry during the main summer months (June – Sept) were 324 elk counted during June, July, and August, compared to 250 observed by the Nylunds on August 5/2002. Compared to the 2 AB-SRD and BNP winter aerial elk surveys, we missed approximately 25% of the population during telemetry observations. Future work assessing the use of monthly maximum counts for surveying summer populations of elk at the Ya Ha Tinda is required.

4.1.8 GPS Collars

We deployed GPS radiocollars on 4 elk (gr182, 192, 193, and 196) on 3-4 April; 2 GPS_2000 collars on long-term loan from BNP, and 2 GPS_2200 collars on loan from the CESES at University of Alberta. One of the GPS 2000 collars failed immediately after being deployed on elk 192, and was successfully retrieved when the remote release device fired at about 200m distant on the ground. The collar malfunction was related to the long storage period between purchase and deployment in BNP. LOTEK has identified the problem and is refurbishing the collar.

Elk 196

Elk 196 was killed by what appears to be a grizzly on June 15^{th} at Prow Mountain Meadows and the collar was successfully retrieved. Fig. 8 shows her movements. She spent the remainder of April and May at the Ya Ha Tinda winter range, with a foci of use around Bighorn falls. On June 2, between 08:00h and 20:00h Elk 196 migrated from the Ya Ha Tinda to the meadows on the south side of the Red Deer river just north of Prow Mountain west of scotch camp for ~2 weeks. This was a straight-line distance of 25 km over 12 hours. Once Elk 196 had relocated to the meadows north of Prow Mt., her movement rates declined dramatically, suggesting calving behavior, which was confirmed by observation of a calf on a concurrent aerial telemetry observation. On June 12 she crossed the Red Deer River, and was killed near the hiking trail just east of the McConnell creek junction on June 15. Her collar collected locations on 97% of all 1955 attempts to collect a location (3D fixes 43%, 2D fixes 54%, Bad Almanac, High DOP, and <3 satellites were the remaining 3%).



Elk 193

Elk 193 migrated to the Upper Bow Valley centered on Hector Lake between 05/20 (East of Park Boundary in Warden Rock Meadows) and 05/29 (Mud Lake Ski trails, Pipestone River); unfortunately, there were no successful locations in the intervening 7 days. Elk 196 left the east slopes of Mt. Hector at just after 08:05 h on Oct 12, and by 20:00h was at Scotch camp cabin meadow, a straight line distance of 28km, and an actual route probably closer to 36-40 km. She spent 1 day at Tyrell flats on Oct 13th, and by Oct 14th was on Mares ridge at Ya Ha Tinda. Her collar collected 721 (or 52%) locations out of 1398 attempts to collect a location. The remaining failed locations were 47% too long to acquire a satellite, or 1% bad satellite geometry. Fig. 9 shows Elk 193's movements.

Elk 182 and Elk 4049

The remaining Elk 182's collar is still functioning and is scheduled for remote retrieval by the end of November. Finally, a GPS collared translocated elk (4049) as part of the UofA CESES project dropped its GPS collar in the Bighorn creek drainage around Nov 20. GPS data indicated the elk had been living on and around the Ya Ha Tinda Ranch since 09/12, and in the Clearwater, Timber, and Skeleton creek areas since 06/15. While in the ESEP study area, the collar collected 1338 locations, or 70% of all 1918 attempted locations.

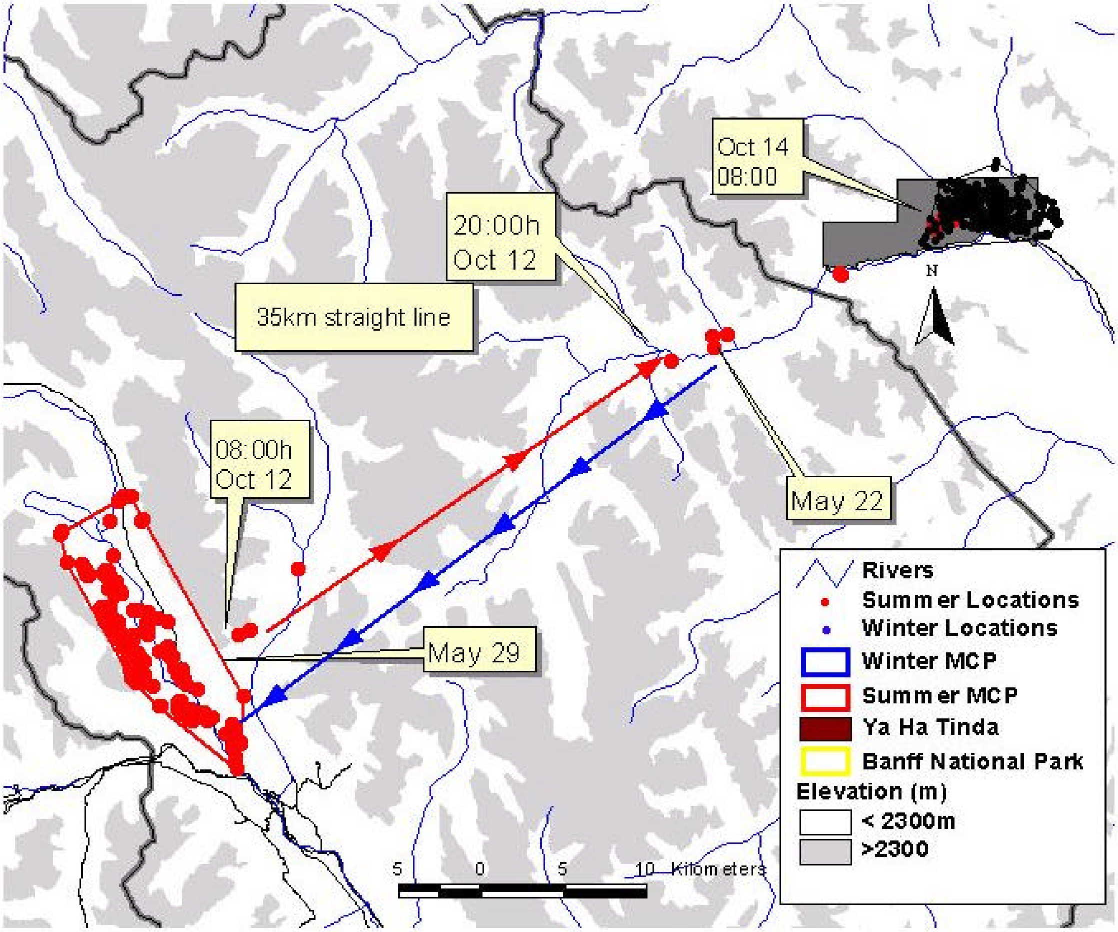


Fig. 9. GPS collared elk 193 migratory movements and seasonal home ranges.

GPS Collar Evaluation

Combined across the three successfully downloaded collars (Elk 193, 196, and CESES elk 4049), we averaged 73% successful Class 2D or 3D fixes (Fig. 10). Note that during GPS trials in the CESES study area, 2D Lotek 2200 fixes averaged only ~70m (Frair et al. 2002). Unsuccessful locations were ranked in order of importance; 1) too long to acquire satellites (13%), 2) <3 satellites, 3) GPS time N/A (3%), and 4) Bad Almanac (3%). LOTEK Collar Fix Rate in our study area (73%) was considerably lower than in the

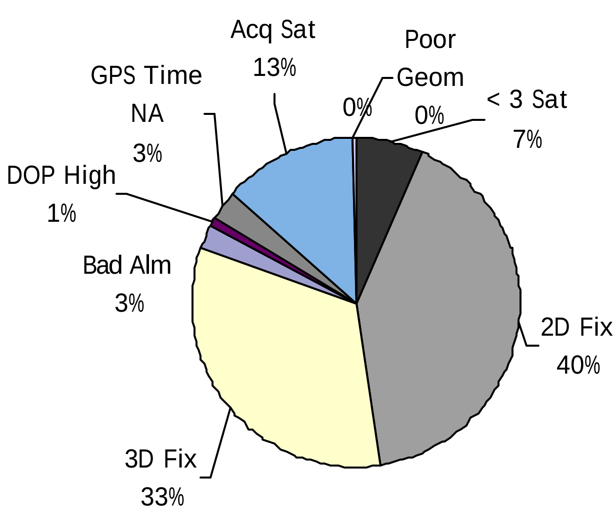


Fig 10. Proportion of GPS fix status from 3 LOTEK GPS collars (2 GPS_2200, 1 GPS_2000) deployed in the study area, April 2002 to Nov 2002. Total # of location attempts was 5272, and the # of 2D & 3D locations was 3955.

CESES foothills study area (~93%, J. Frair, pers.comm., Frair et al. 2002). We are investigating whether differences between the LOTEK GPS 2000 and GPS 2200 collars may explain the high proportion of Acquiring Satellite error messages in the Elk 196's collar. If differences between collar models explains the low fix rate of the GPS 2000 collar, then mean GPS 2200 collar fix rate for the 2 collars is ~84%, comparable to Frair et al.'s (2002) LOTEK 2200 evaluations under open conifer forest. However, these preliminary collar investigations highlight the need for a study-area specific GPS collar performance evaluation so that we can apply the methods of Frair et al. (2002) to correct for potential bias in both LOTEK 2200 elk collars and 3300 wolf collars.

4.1.9 Pellet Collection

Pellet samples were collected for diet composition analyses. Each sample constituted a composite sample of 5 individual pellets selected from 10 different pellet groups in a large area of similar habitat type – usually 2-5 ha, but sometimes larger if samples were difficult to find (i.e. Front ranges). Thus, each individual composite sample represents diet composition by elk sampled from 10 different pellet groups in that area during that time period. We stratified Pellet samples into three main groups; the Ya Ha Tinda Ranch, Front Ranges (i.e. Scotch camp, Divide, Panther), and Main Ranges (i.e. Upper Bow Valley). In addition, we sampled a total of 5 composite samples from the Dogrib burn to complement forage availability samples in this area. Table 6 shows composite elk pellet sample collection by season and strata. Each composite sample contains 5 pellets selected at random from 10 different pellet group piles overt a large 2-5 ha area. May is contained within the winter samples.

Table 6. Composite pellet samples collected from Feb 2002 to Nov 2002 across main strata and season. Each composite pellet sample constituted 5 pellets from 10 different pellet groups over a large (2-5 ha) area.

Strata	Winter	June	July	August	Totals
Front Ranges	2	9	11	3	25
Main Ranges	---	1	3	7	11
Dogrib Burn		1	2	2	5
Ranch	11	16	9	3	39
Total	13	27	25	15	80

4.1.10 Previously Radiocollared and Tagged Elk

We observed a total of 18 previously tagged elk during fieldwork since Nov 1 2001, listed in Table 7. Most of these were resident Ya Ha Tinda elk relocated to various release points in the Foothills, who then returned to Ya Ha Tinda. However, several elk are still unidentified. In addition, there were 3 translocated elk from the CESES project that spent time at Ya Ha Tinda Ranch during the past 1-year.

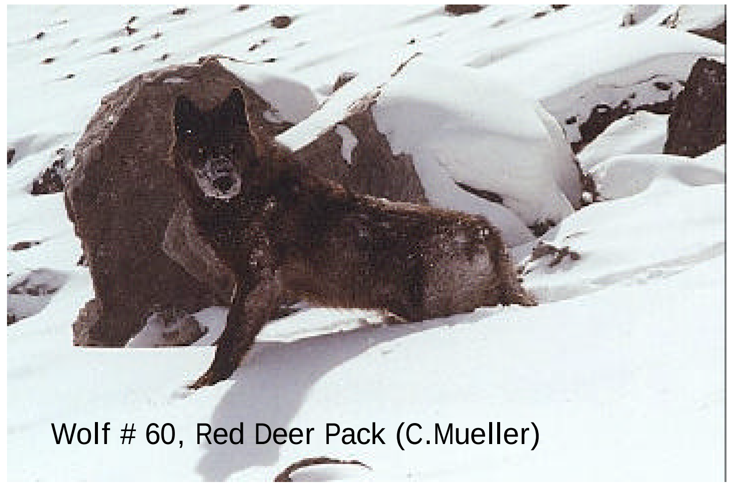
Table 7. Previously tagged elk observed at Ya Ha Tinda.

Elk Tag ID	Age-Sex (capture)	Source Population	Release Date	Release Site
BL125	ADF	?	N/A	
BL 158	ADF	?		
BL 622	ADF	?		
BL 171	ADM	Banff - Problem	?	Castle Junction
OR 158	ADF	Ya Ha Tinda	Jan 31/96	Elk ck. Flats
OR 190	ADF	Ya Ha Tinda	Feb 5/96	Elk ck. Flats
OR 40	ADF	Ya Ha Tinda	Feb 1/94	Peppers Lk. Rd.
OR 62	ADF	Ya Ha Tinda	Feb 2/94	Elk ck. Flats
OR 14	ADF	Ya Ha Tinda	Jan 30/94	Elk Flats
Pink 6	ADF	?	?	
PR 171	ADF	?	?	
PR 5	ADF (Calf)	Ya Ha Tinda	Feb 28/96	On Site
PR 9	ADF (Calf)	Ya Ha Tinda	Feb 01/97	On Site
RD 136	ADF	Ya Ha Tinda	Feb 12/95	N. Sask. River
RD 3	ADF	Ya Ha Tinda	Feb 15/94	N. Sask.River
RD 75	ADF	?	?	
YL 53	ADF	Ya Ha Tinda	Jan 19/94	Limestone – Wilson
YL 66	AdF (Calf)	Ya Ha Tinda	Jan 20/94	Limestone- Wilson

4.2 Wolves

4.2.1 Animal capture and handling

Winter Capture Attempts



Wolf # 60, Red Deer Pack (C.Mueller)

A total of two unsuccessful (29 Jan 2002 and 7 Mar 2002) and one successful wolf capture (20 Mar 2002) attempt was made in the park on the Red Deer wolf pack. A black, subadult male weighing 105 lbs was captured on Mar. 20, 2002, Wolf # 60. #60 was in prime condition. The wolf was darted from a helicopter by Dr. Todd Shury and immobilized with Telazol. Two unsuccessful capture attempts by aerial darting were made on the Panther wolf pack by Parks Canada (7 Mar 2002 and 20 Mar 2002) and one unsuccessful capture attempt was made by Bighorn netgunners on the Timber wolf pack on a moose kill approximately 11 km east of Mountain Aire Lodge on Feb. 26, 2002.

Summer Capture

Wolf # 61, Alpha Female Ranch Pack

We trapped 2 wolf packs during the summer of 2002, the Ya Ha Tinda Ranch pack and the Panther / Cascade pack. We trapped the Ya Ha Tinda Ranch pack from May 25 to June 11 for a total of 210 trap nights, averaging 12 traps/night. We caught 2 uncollared wolves, #61 and #62, and 1 non-target capture, a female coyote. Both #61 and #62 were in decent summer condition; #61 was an older lactating alpha female almost completely white in colour, and a thin 90lbs, and #62 was a YLY female in decent condition. Trap injuries for both wolves and the coyote were slight, rated a 1 out of 4 using Kuehn's (Kuehn et al. 1986) trap injury scale where 1 is the lowest injury.

We trapped the Cascade/Panther wolf pack by horseback based out of Windy Cabin in the Panther river valley from July 3 to July 17 for a total of 77 trap nights with approximately 7 traps out per night. We captured 1 coyote female, 1 female YOY pup near the Panther densite, and 1 YLY male wolf, #64. The coyote was released without injuries; however, the pup had 1 broken metacarpal, ranking a 2 on Kuehn's trap injury scale. We examined the pup, sampled Hair for DNA, weighed, and released the pup back near the rendezvous site. The wolf, #64, was in emaciated condition, weighing only 75 pounds despite being a relatively large wolf (see body measurements), and had minor trap injuries.

Table 8. Summary of Radiocollared wolves captured during 2001/02

Wolf ID	Capture Method	Sex	Age	Weight (lbs)	Length	Color	Wolf Pack	Notes
60	Darting	Male	YLY 1.5 years	105	?	Black	Red Deer	
61	Trapping	Female	AD – 8 years	90	185	White	Ranch Pack	Alpha - Lactating
62	Trapping	Female	YLY 1.1 years	85	178	Grey/ Brown	Ranch Pack	
64	Trapping	Male	YLY 1.3 years	75	188	Black	Panther	Poor condition
pup	Trapping	Female	Pup – 8 weeks	25	65	Black	Panther	Released no collar

4.2.2 Wolf Pack Summaries

A total of five wolf packs were identified within the study area; their territories are shown in Fig. 12. These included the Ya Ha Tinda pack, the Burnt Timber pack, the Red Deer pack, the Cascade pack, and a pack in the lower Clearwater – 7-mile flat area. Our surveys and surveys by Park Wardens during the sensitive species surveys in March failed to find any wolf packs using the upper Clearwater River from 40-mile cabin to inside BNP. Pack sizes were estimated by visual locations and backtracking estimates.

Ya Ha Tinda pack

The Ya Ha Tinda pack home range centered on the Ya Ha Tinda ranch and extends south down the Red Deer River, west to the Banff National Park boundary, north along Scalp Creek and east over James Pass (Fig. 11, 12). The Ya Ha Tinda pack consisted of 7 to 8 wolves during early winter. Five wolves were sighted in this pack in the mare pasture on April 22. The Ya Ha Tinda pack was uncolored and we relied on track sightings and backtracking sessions, howling reports, and reports from ranch personnel to monitor movement and activity. We collected 15 pack locations using track sightings and howling locations, and 20 backtracking sessions totaling over 57 km (Fig.11). Several potential densites were located on the west side of Ya Ha Tinda Ranch. One site appeared to be visited more frequently by the wolves and with more activity during visits (more tracks, playsites, scat). On three occasions throughout the winter a dead horse or elk carcass were left out in an open area on the ranch to entice the wolves in for aerial darting. The Ya Ha Tinda pack would not approach the bait during daylight hours.

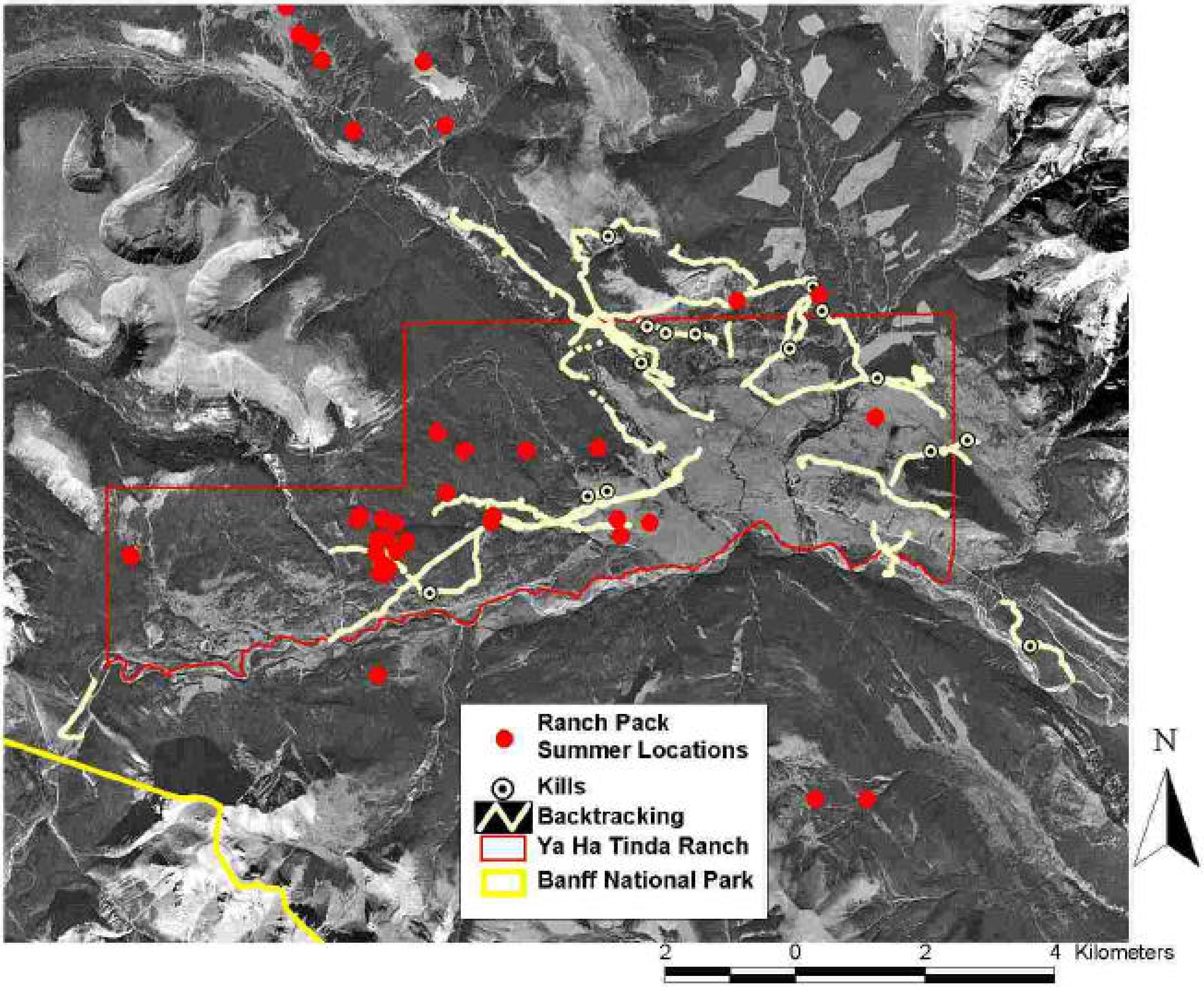


Fig 11. Snow backtracking, kills, and summer wolf telemetry locations for the Ya Ha Ranch pack, wolves F#61 and F#62.

Burnt Timber pack

The Burnt Timber pack was located southeast of the panther corners area, in the areas around North Burnt Timber Creek, and Sheep creek, as well as the lower panther river and Wigwam creek. We collected 4 locations using track sightings and one visual location from the air. Five backtracking sessions collected approximately 11 km of tracking. Four wolves, believed to be the Burnt Timber pack, killed a moose just 50 m from the forestry trunk road 11 km east of Mountain Aire Lodge on Feb. 24, 2002. Bighorn netgunners unsuccessfully attempted to capture these wolves at this kill on Feb. 26.

Red Deer pack

We collected 12 telemetry locations (10 aerial, 2 ground) between November 1 and April 30. Wolves counted early and late in season totaling 8 each time. Seven backtracking sessions totaling over 14 km. Two unsuccessful capture attempts by Parks Canada. Successfully captured a black subadult male wolf from this pack on 20 Mar

2002, named number 60. Pack home range seems to center around Scotch Camp area of Banff National Park, with movement east to the park boundary, north over Divide pass, west toward Douglas Lake, and south over Snow Creek Summit (Fig.12). The pack was located on the park boundary near Ya Ha Tinda twice but did not move any further east. The park boundary may also have been a range boundary between packs. Backtracking sessions showed the Red Deer pack overlapping with the Ya Ha Tinda pack and two lone wolves in this area with a high concentration of scent posts and scrapes. The Red Deer pack denned near Scotch camp, successfully raising 4 pups that were observed through June and July. Interestingly, we recorded 3 occasions of the Red Deer pack hunting mountain goats in areas above 2600 m; once North of the Drummond Icefield in a high col, once on the slopes of Mount McConnell (where they had successfully killed 1 goat), and once Dave Norcross observed the pack apparently hunting goats in McConnell/Roaring pass.

Cascade pack

We collected 12 winter telemetry locations and 27 summer locations. We collected only 2 backtracking sessions of 9 km total length. Nine wolves counted in early winter. Two wolves were found in trap line in the four corners in February, tracking indicated they were part of the Cascade pack. We counted five wolves total in late winter. We found a possible den location in the corners area (muted, isolated signal on telemetry flight). Summer denning occurred at the Panther densite in the seasonal closure area, and 3 pups were repeatedly observed through June and July.

Clearwater pack

Seven wolves crossed the road in the seven-mile flats area in mid December. Five wolves crossed the trunk road a few km east of seven-mile flats in late winter. Several other track surveys in the area in Feb and March confirmed 5-6 wolves using the area. No summer or denning information was obtained for this pack.

Bow Valley pack

The Bow Valley wolf pack overlaps with the Ya Ha Tinda elk population in the Upper Bow Valley during the summer migratory season (Fig. 12). Bow Valley monitoring was conducted under the direction of Tom Hurd, BNP, in cooperation with the CRWP. Ground and aerial telemetry collected 110 locations of the Bow Valley packs solitary collared wolf (wolf #63, Hope) between Apr 15 and Nov 1 of 2002.

Lone wolves

We collected 33 lone wolf locations along tracking sessions and road crossings. Three lone wolf backtracking sessions totaled 13 km. We sighted at least two different lone wolves in the ranch area. One was black, the other gray with a limp in rear left leg.

Table 8: Population Dynamics of Wolves in the Study area, including pack sizes and pup litter size for early (Nov. 1 – Jan 31), late (Feb. 1 – April 30) winter, Summer 2001/2002.

Wolf Pack	Estimated Pack size				Litter Size[5]
	Early winter[1]	Late winter[2]	Spring[3]	Fall[4]	
Ya Ha Tinda	7	5	4	14	6
Burnt Timber	4	5	Unk	Unk	3
Red Deer	8	8	5	11	4
Panther - Cascade	9	5	5	7-8	3
Lower Clearwater – 7-mile Flats	7	5	Unk	Unk	Unk
Upper Clearwater – BNP	0	0	0	0	0

4.2.3 Radio-telemetry

We obtained 152 locations on wolves in Red Deer (66), Cascade/Panther (39), and newly radiocollared Ya Ha Tinda Pack (47) from Nov 1, 2001 to Nov 1 2002. Through collaboration with BNP researchers, we collected 108 locations on the Bow Valley wolf pack during the summer season, the period of overlap with migratory elk, from April 15 to Nov 1, 2002. Seasonal breakdowns in number of locations /pack are 27/39 winter to summer for the Red Deer pack, and 14/25 locations for the Cascade pack.

Table 9. Wolf pack radiotelemetry summary, home range sizes, and summary of the kilometers tracked, Nov 2001 to Nov 2002.

Wolf Pack	**Number of Locations**	**Winter locations**	**Summer Locations**	**100% MCP km²**	**Km's snow tracking**
Cascade	39	12	27	361	29
Red Deer	66	14	52	702	14
Ya Ha Tinda	47	---	47	470	57
Bow Valley	---	N/A	108	602	N/A
Burnt Timber	---	---	---	~400	11

4.2.4 Home Range Analyses

The estimated MCP home range and size for all wolf packs observed in the study area during the last year range from 361 km^2 to 702 km^2 (Table 9). We estimated 100% minimum convex home ranges for the Bow Valley, Cascade, Ranch, and Cascade/Panther packs using ARCview Animal Movements Analyst, and estimated the home range from the Burnt Timber wolf pack using backtracking and reports from reliable observers.

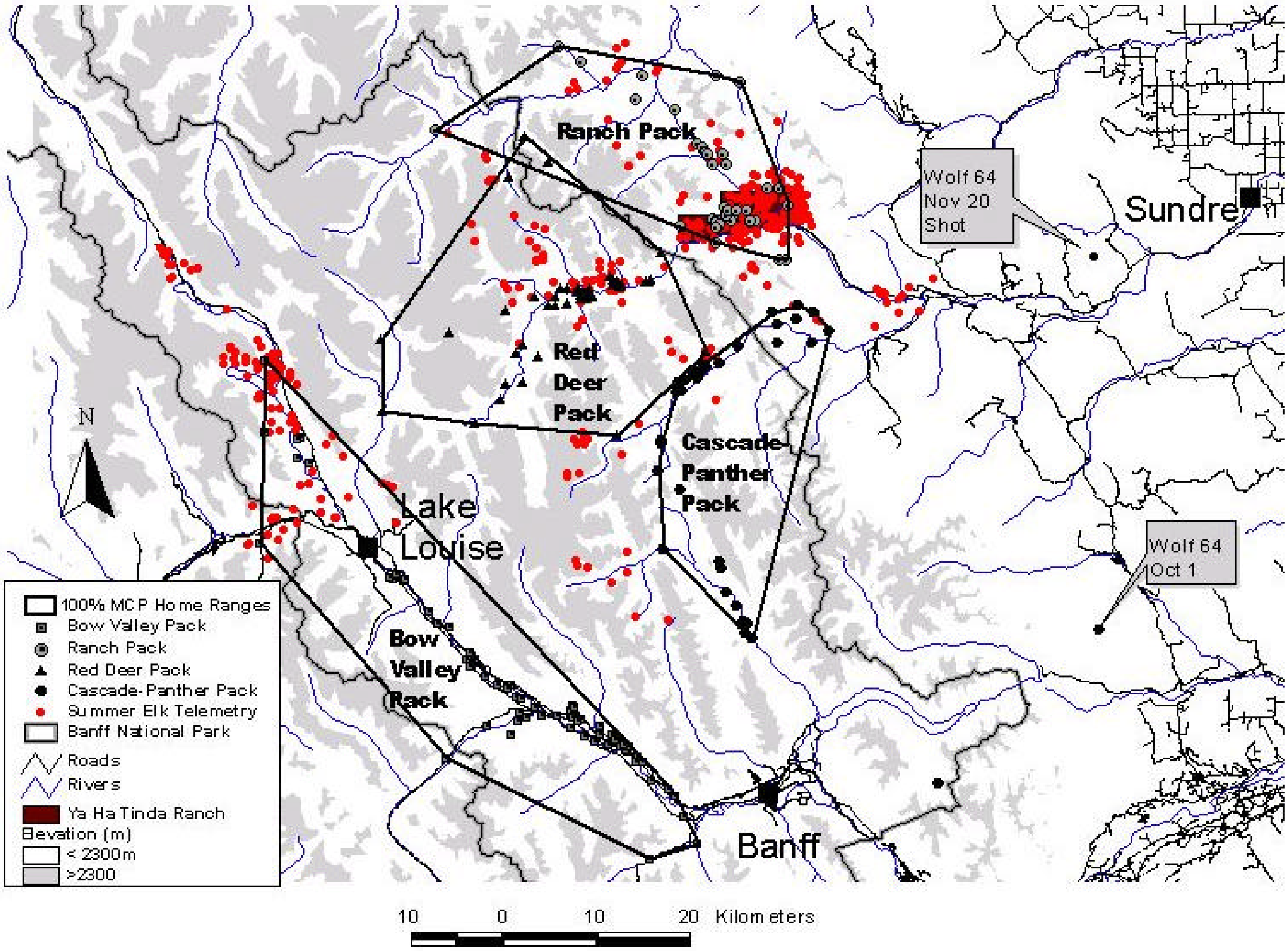


Fig 12. Wolf pack telemetry locations and 100% MCP home ranges, Nov 1st, 2001 to Nov 1st, 2002. Summer elk telemetry locations are shown for comparison. Locations for dispersing wolf M#64 are shown I, as well as his approximate mortality location.

4.2.5 Mortality, wolf trapping data

We recorded 1 mortality of a radiocollared wolf during the study period, and mortalities of approximately 11 other wolves in the study area (Table 10). Regional wolf harvest data are still being collected in cooperation with AB-SRD, but preliminary minimum estimates of the numbers of wolves harvested during winter 2001/02 in the Rocky Mountain House area were approximately 52 wolves as of March 2002 (Eldon Bruns, Pers.Comm).

Table 10. Wolf mortality in the ESEP study area, Nov 1, 2001 to Nov 20, 2002.

Wolf / Age-Sex	Pack(s)	Date	Source	Notes
Wolf 64	Cascade/ Panther	Nov 2002	Hunter	Dispersing YLY male wolf
Wolf AD Unk	Cascade/ Panther	Feb 2002	Trapper	Trapped by Corners area trapper
Wolf ADU	Cascade/ Panther	Feb 2002	Trapper ?	Carcass found south of Corners trap-line on Panther River
7-Wolves	Clearwater?	Feb 2002?	Trapper	Reported trapped by trapper/outfitter in Lower Clearwater adjacent to BNP
2 Wolves	Clearwater	Nov 2002	Hunter	Reported shot by hunters in Clearwater river adjacent to BNP

4.2.6 Wolf Kills

From Nov 1 2001 to Nov 1 2002, we found a total of 22 wolf-killed prey; 14 during winter (Nov1 to May 1), and 7 incidentally during the summer months (May1 to Oct 31). We found 12 kills made by the Ya Ha Tinda pack (9 during winter), 4 by the Cascade pack (3 during winter), 3 by the Red Deer pack (2 during winter), and 2 by the Burnt timber pack during winter. Across the study area during winter, elk were the most common prey species, composing 43% of all known wolf-kills (n=6). Adult female elk were the most commonly killed age-sex class (n=4), followed by unknown female, YOY, and Adult male (Fig.13). Sheep were the second most common prey species killed by wolves (30%), and of known age sheep, 3 were adult male, 1 was an adult female, and 1 was a YLY female. Deer (mule and unknown combined) comprised 21% of kills, and only 1 moose kill was found during winter.

Summer wolf killed prey were located incidentally, and included 5 elk (2 YOY, 2 ADF, 1 ADU), 1 mountain goat (Red deer pack), 1 Mule deer, and 1 White-tailed deer.

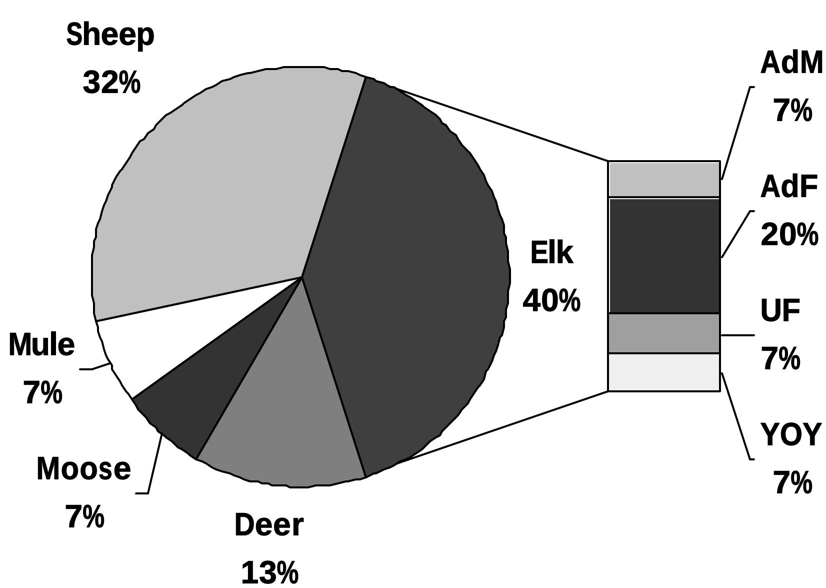


Figure 13. Composition of winter wolf killed prey by the Ya Ha Tinda, Cascade, Red Deer, and Burnt Timber packs, Nov 1, 2001 to May 31, 2002.

4.3 Forage Biomass and Phenology Sampling.

4.3.1 Review of FMF-Dogrib proposal objectives.

The objectives of our long-term ongoing research are to investigate both predation and forage (including effects of fire on forage) as factors affecting the demography of the Ya Ha Tinda Elk herd to provide recommendations that will help provincial and federal agencies meet ecosystem management objectives. One of the key management questions that this research will address is whether elk respond to large burns such as the Dogrib by shifting summering and/or wintering areas to take advantage of forage resources provided by the burn.

Our ***short-term goals*** for the **FMF-Chisholm/Dogrib Fire Research Initiative** are to estimate summer elk habitat quality at peak biomass and second, determine how biomass and quality of forage change over time to relate to use by migrating elk. We sampled elk forage biomass plots across the following strata: 1) 7 habitat types identified by Lindsay Sachro, University of Calgary (spring vegetation sampling workshop, UofC, April 2002), 2) three *fire ages* ($\leq$1 years-old (*Dogrib fire*), 2-5, 5 to 12 years) 3) 3 aspects, and 4) across an elevation gradient. In addition, we collected 8 biomass plots in 12-year old wildlife enhancement clearcuts in Bighorn Creek for comparison to burned treatments.

4.3.2 Forage Biomass Sampling

We sampled 159 elk forage biomass plots from July 1 to August 31, 2002. This year we focused on the Dogrib Burn, Clearwater, Scalp Creek, Sandhills Cabin, Windy Cabin, Barrier Cabin, and the Upper Bow Valley areas (Fig. 14). Biomass plots sampled during 2001 by Lindsay Sachro (n=300) are also shown in Fig. 14 for comparison. We sampled 41 forage biomass plots specifically within the Dogrib Fire study area, where we will focus our research during 2003. We sampled 25 forage biomass plots in the upper Bow Valley, focusing on Alpine and Avalanche terrain. Analyses are being conducted this winter to estimate plant community relationships and within strata variation (i.e. effects of burning) during this first winter to optimally allocate sampling effort during the upcoming field season.

4.3.3 Elk Forage Phenology Sampling

We set up a total of 29 Elk forage phenology plots across the study area (Fig. 14), with 6 in the Dogrib Burn area, and revisited phenology plots an average of 3.1 times over the summer. Late season snows in May delayed forage phenology by approximately 3 weeks, delaying and compressing the field season. Coupled with the intense burn in many areas of the Dogrib burn, delayed phenology and a slow start of growing season due to the burn meant that a later sampling start had little effect on plant phenology measurements.

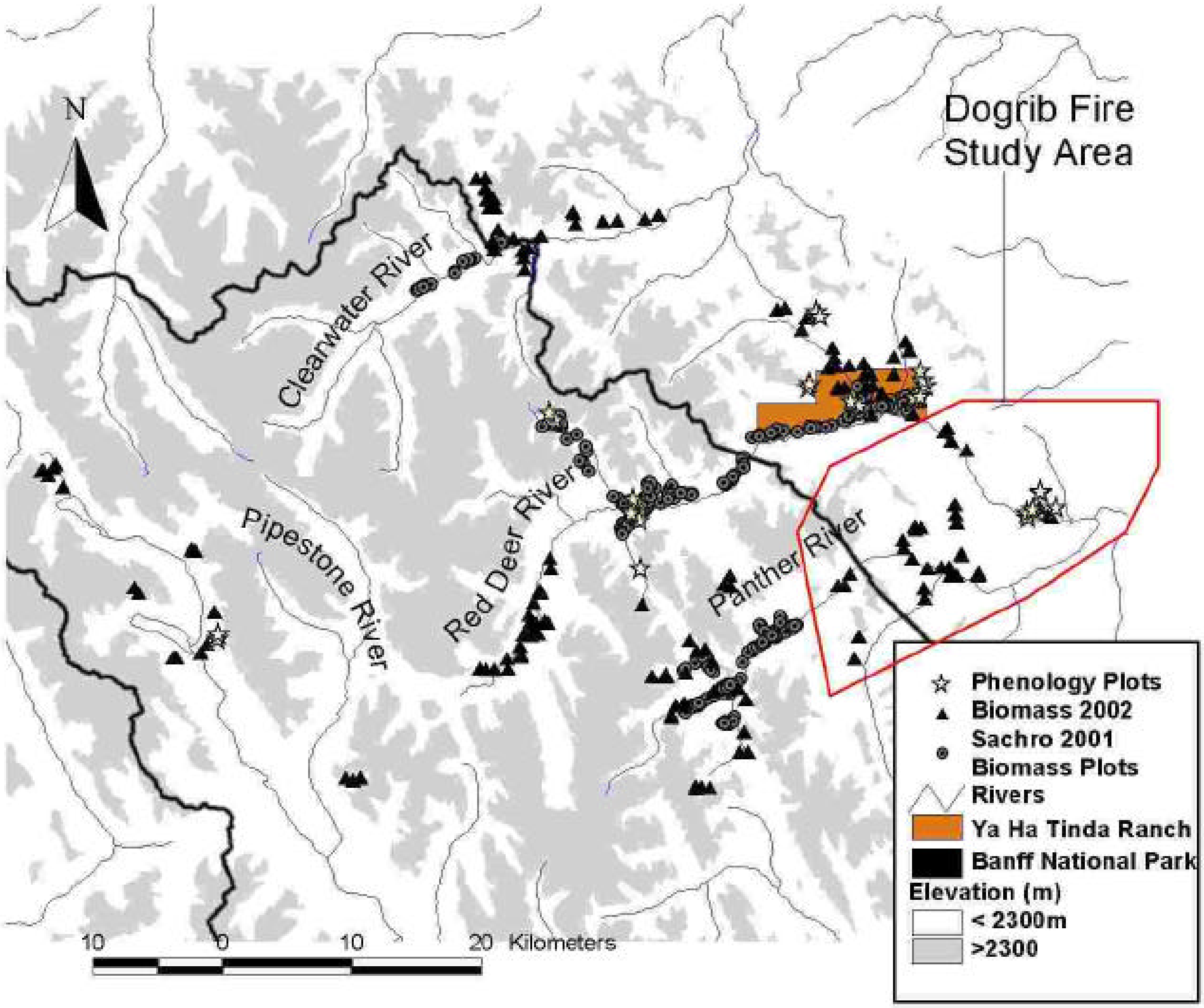


Fig 14. Map of Elk forage biomass plots from 2001 (n~300) and 2002 (n=159), and of the 30 elk forage phenology plots sampled during summer 2002.

4.4 Human Use Data and Traditional Ecological Knowledge

Johnny and Marie Nylund cooperated in a short-term project to describe ecological and human use data for the Ya Ha Tinda Ranch in August and September of 2002. See Appendix A5 in the Parks Canada report for a detailed description of all relevant wildlife sightings and human activities on the Ya Ha Tinda observed by Johnny and Marie Nylund since 1995. They also documented human use statistics at the Bighorn Campground (Fig. 15). The number of people was calculated using a mean number of people/occupied campsite of 3.5, and represent a conservative number of campers. These data do not include the nearby Eagle Creek campground.

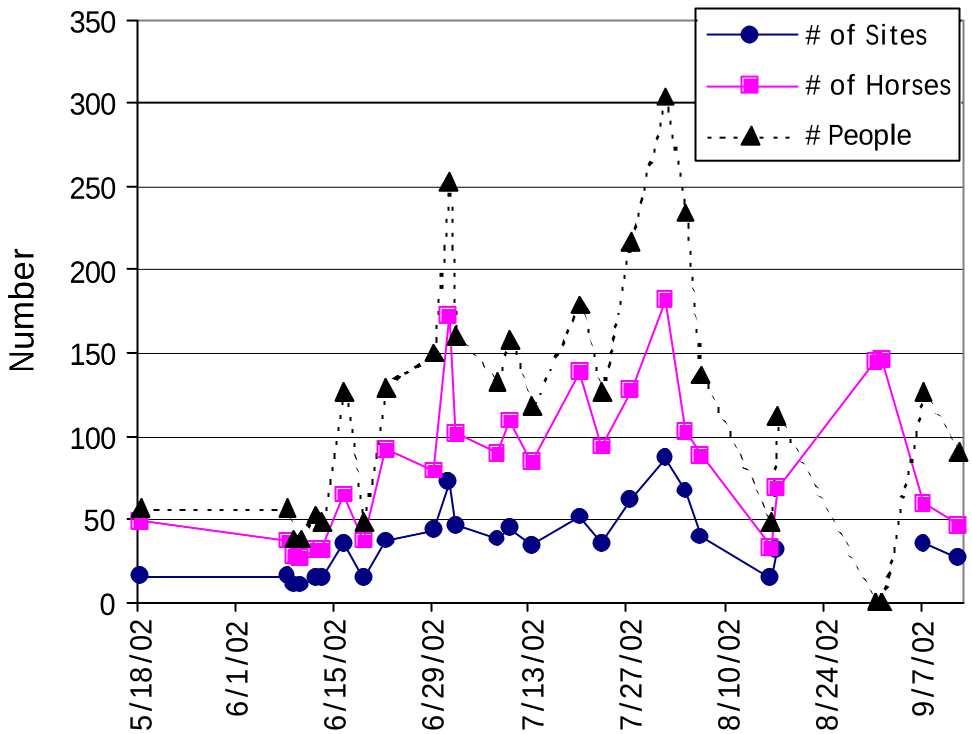


Fig. 15. Bighorn campground human and horse use statistics, summer 2002. Number of humans based on mean 3.5 people/site.

5.0 Assessment of First-Year Objectives

Elk

- During this first field season we successfully and safely captured 39 radiocollared elk, plus monitored 1 previously collared elk (orange 14), for a total of 40 collared elk.
- Collared elk were approximately 50:50 migrant vs. resident elk, achieving a balanced study design (Table 1).
- We successfully monitored both resident and migrant elk collecting an average of 43 telemetry locations per individual.
- The speed of migration made the specific determination of migratory routes with VHF collars (and even GPS collars) difficult.
- Four GPS collars were deployed, and 3 operated normally collecting data through the period. In addition, 1 CESES GPS collared elk relocated to the Ranch in September. With these data we can estimate an approximate 75% fix-rate for our study area. Identifying causes of this lower fix-rate compared to the CESES study area will be a priority in the next field season.
- We collected 80 composite pellet samples for diet composition analyses funded by RMEF-Canada.
- We determined winter calf:cow ratios, and attempted to determine spring and summer calving rates. Helicopter surveys will be critical to assess this in the future, especially for backcountry elk.
- Long-term elk population trends were obtained from AB-SRD and BNP.
- Collect pellet samples to estimate diet selection for assessing habitat selection.
- We monitored a total of 7radiocollared elk that used the Dogrib Burn area, including elk 101 who used the Wildhorse area intensively before being poached in September.

Wolves

- We successfully identified all resident wolf packs overlapping with the Ya Ha Tinda elk population; the Ranch pack, Red Deer pack, Bow Valley pack, Cascade-Panther pack, the Burnt Timber-Mountain Aire pack, and potentially 1 pack in the lower Clearwater.
- We successfully captured 2 wolves in the critical Ya Ha Tinda Ranch pack in June, and captured 1 wolf in the Cascade –Panther pack in July. We now have 4 packs out of a total of approximately 6 collared, and these 4 packs overlap the greatest with the winter and summer distribution of this elk population.
- We successfully collected over 100 km of snow backtracking during winter 2001/02. Tracking will be a priority for winters 2&3.
- We successfully collected ~270 ground and aerial wolf locations for the 4 radiocollared wolf packs, sufficient for seasonal home range analyses for all packs. Increased sampling with GPS Collars will fulfill predation modeling needs in years 2&3.
- We determined wolf population characteristics for all radiocollared packs, and 1 uncollared pack (Burnt Timber) during summer 2002.

Forage Analyses

- We successfully sampled 158 forage biomass plots, with sampling design emphasizing remote and previously unsampled areas to complement intensive sampling completed in Summer 2001 by Lindsay Sachro.
- We successfully visited 29 Forage Biomass plots 90 times, or an average of 3.1 times/phenology plot. Many forage phenology plots remained covered with snow throughout May, so for many plots, this meant we sampled them 1/month during the main growing season.
- For the FMF – Chisholm-Dogrib Fire research initiative, we successfully sampled 25 Elk forage biomass plots specifically within the FMF-Dogrib study area, and visited 6 phenology plots a total of 21 times.
- We sampled 8 biomass plots in the Bighorn Wildlife enhancement cutblocks to determine the value of these habitats ~12 years after habitat enhancement to elk.

Project Management

- We created ACCESS databases for all elk, wolf, and forage data with consultation with Database management specialists.
- We successfully obtained nearly all spatial data and climatic data required for future analyses from project partners and government sources.

6.0 Research Activities for the 2002/03 Year

6.1 Funding Granted

- **Canon – National Parks Science Scholars Program**
  Mark Hebblewhite was awarded 1 of 8 in the Americas (and only 2 in Canada) Canon-National Parks Science Scholars Program scholarships for PhD students. This award is adjudicated by the American Academy for the Advancement of Science (AAAS), and is designed to promote tomorrow's leaders in National Parks Science across the Americas. In additional to strong financial support for an annual student stipend, this funding also includes monies for additional technicians, computer equipment, travel grants, and conferences. The award is 3-years in length and totals 78,000 USD.

- **Alberta Enhanced Career Development – Training on the Job Program (TOJ).**
  In cooperation with the Central Rockies Wolf Project (CRWP) in Canmore and Dr. Carolyn Callaghan, we successfully obtained ~ $12,000 in matching funding for 2 research technician positions for the winter field season, 2002/03.

- **Patagonia.** – We successfully obtained a $1000 equipment grant for winter field equipment for research assistants from Patagonia with supporting letters from Rocky Mountain Elk Foundation.

- **Alberta Cooperative Conservation Research Unit (ACCRU)**

We successfully obtained a matching GPS collar equipment grant from ACCRU in June 2002, up to ~30,000. However, funding is delayed, pending dispersement of funds to ACCRU from government grants.

6.2 Funding Applied For

?? **Wildlife Habitat Canada**
We applied for a $25,000 research grant to augment increase aerial telemetry costs associated with this upcoming field seasons collaring efforts.

?? **Alberta Biodiversity Challenge Grants**
We applied for a ~ $18,000 research grant to add new research components to our forage biomass monitoring to assess the impacts of post-fire logging, post-logging fire, fire, and habitat enhancement projects on plant biodiversity and ungulate communities.

We will be developing proposals for RMEF-Canada and Alberta Conservation Association with the primary funding objectives to secure much needed funding for elk trapping efforts and aerial telemetry costs associated with radiocollaring efforts required to increase sampling intensity.

6.3 Capture and Handling

Elk- We will be collaring a total of **55** new elk this winter using 2 corral traps on short-term loan from *Rocky Mountain Elk Foundation – Canada*. have purchased 8 total GPS_2200 collars from LOTEK for winter deployment in 2002/03. We will be refurbishing the 2 GPS 2000 LOTEK collars on loan from BNP to update their technology as a means of addressing the low fix-rate of elk 193's collar. We have purchased 40 new LOTEK VHF collars, and have 5 old collars that are being re-deployed from mortalities.

Wolf – We will be hoping to deploy 6-10 collars on wolves in 5 wolf packs this winter; the Ranch, Red Deer, Cascade-Panther, Burnt Timber, and Lower Clearwater packs. We have purchased 6 GPS 3300 LOTEK wolf collars, and will be deploying up to 5 this winter starting in December on these 5 wolf packs. 1 GPS collar will be deployed on the Bow Valley pack during spring 2003 to capture the period of summer overlap with the Ya Ha Tinda elk population.

6.4 Vegetation Analyses

We will be conducting detailed plant community and fire-strata analyses during the winter 2002/03 in order to 1) design optimal sampling approaches for the final field season of the FMF Chisholm Dogrib research initiative and 2) to understand plant community relationships for GIS –based landscape classification in cooperation with Darrel Zell, Parks Canada. We will continue to collaborate with Dr. Cormack Gates at the University of Calgary in vegetation analyses.

During the summer 2003 field season we will hire 2 vegetation sampling crews; 1 focused on the Dogrib fire area, and another forage phenology crew to conduct elk forage phenology and forage biomass sampling in the western portion of the study area in the Upper Bow Valley.

6.5 Conference presentations

Mark Hebblewhite is scheduled to present a paper entitled " Application of resource selection functions to modeling predator-prey dynamics" at the first international Resource Selection Conference in Laramie, Wyoming, in January, and analyses are underway. I will also be presenting a paper and/or poster presentation at the Annual Alberta Chapter of the Wildlife Society Presentation in Red Deer in February, and is an invited speaker to the annual Banff National Park Science workshop meetings in January, 2003.

6.6 Ph.D. progress.

Mark has finalized his academic committee, which includes Dr. Evelyn Merrill, Dr. Mark Lewis, Dr. Stan Boutin, Dr. Cormack Gates, Dr. Cliff White (Parks Canada), and Dr. Mark Boyce. Mark Hebblewhite will be completing coursework during winter term 2003 in a models in biology course taught by committee member Dr. Mark Lewis. Mark's tentative date for candidacy exams is late April 2003, pending committee approval.

6.7 Public Outreach.

Mark gave the following public presentations during the last year:

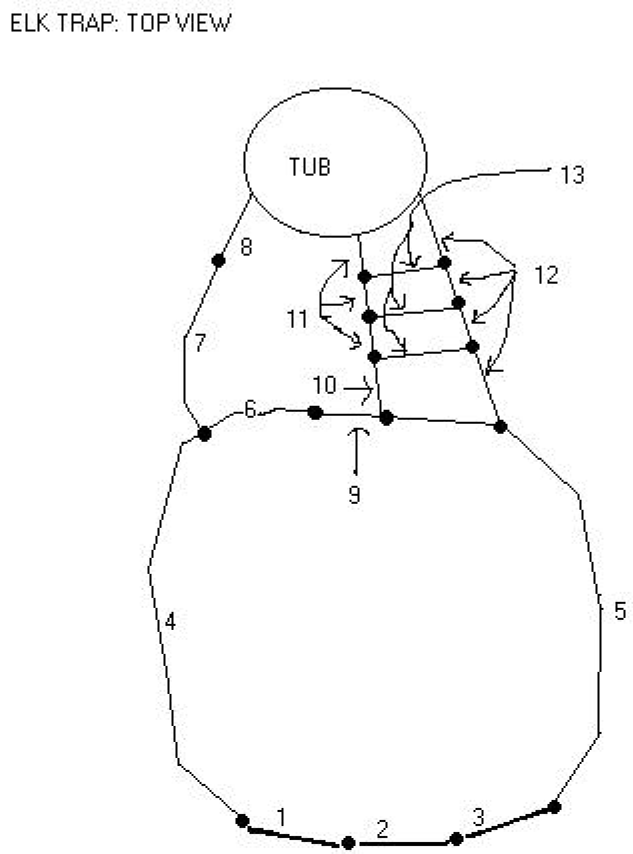
1) Sherwood Park Christian Academy High school Wildlife Class – 20 students, Nov 2002.
2) Sherwood Park Fish and Game Association – 50 people, Oct 2002.
3) Mountain Aire Community Association – 50 people, June 2002.
4) Banff National Park Warden and Administrative personnel staff update – June 2002.

6.8 Schedule of Research Activities During 2002/03

Activity	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Elk Capture and Collaring		X	X	X								
Wolf Capture and Collaring	X		X	X								
Aerial/ground Telemetry	X	X	X	X	X	X	X	X	X	X	X	X
Elk calf survival surveys	X	X	X	X	X	X	X	X	X	X	X	X
Wolf snow backtracking	X	X	X	X	X							
Conference presentations		X	X									
Ph.D Candidacy Exam					X?							
Vegetation Sampling		x		x		X	X	X	X	X		
GIS Vegetation Mapping with Darrel Zell					X	X	X	X	X	X		
Progress Report												X

Appendix A) Elk Trap Design

Fig A5. 1) Elk trap design used during the previous winter 2001/02 at the Ya Ha Tinda Ranch. Trap site location was in the Little Bighorn Pasture just south of the Hay she pasture in a small slough creek.



1, 2, 3=main gate panels, 4=general panels(19), 5=general panels(19), 6=general panels(4), 7=general panels(9), 8=work area gate, 9=work area swing gate, 10=work area swing gate, 11=chute swing gate(3), 12=chute outer panels(5), 13=chute slide gates(3).

Appendix B. All elk captured and ear-tagged during winter 2001/02.

Table A5.1 Ear tagged elk…

Tag Number	Age	Sex	Date Caught	Weight (kg)	Tag Number	Age	Sex	Date Caught	Weight (kg)
Pr5	AD	Female	2/4/2002	UKN	143	YOY	Male	2/4/2002	UKN
Pr9	AD	Female	2/4/2002	UKN	144	AD	Female	2/4/2002	UKN
97	AD	Female	2/1/2002	UKN	145	AD	Female	2/4/2002	UKN
105	AD	Female	2/1/2002	UKN	146	AD	Female	2/4/2002	UKN
107	AD	Female	2/4/2002	UKN	147	AD	Female	2/4/2002	UKN
108	AD	Female	2/4/2002	UKN	148	YLY	Male	2/7/2002	188
109	AD	Female	2/4/2002	UKN	151	SUBAD	Female	2/7/2002	219
110	AD	Female	2/4/2002	UKN	152	YOY	Male	2/14/2002	115
111	YLY	Male	2/4/2002	UKN	153	YLY	Male	2/14/2002	230
112	YOY	Female	2/4/2002	UKN	155	YOY	Female	2/14/2002	98
113	YLY	Male	2/4/2002	UKN	156	YOY	Male	2/14/2002	125
114	YOY	UNK	2/4/2002	UKN	157	YOY	Female	2/14/2002	122
115	YOY	Female	2/1/2002	UKN	158	AD	Female	3/23/2002	242
116	YOY	Male	2/1/2002	UKN	159	YOY	Female	2/14/2002	112
117	YOY	Female	2/1/2002	UKN	160	AD	Female	2/14/2002	268
118	YLY	Male	2/1/2002	UKN	162	YLY	Male	3/13/2002	220
121	YLY	Male	2/7/2002	163	163	YOY	Female	3/13/2002	85
123	YLY	Male	2/7/2002	208	164	YOY	Male	3/13/2002	126
125	AD	Female	2/7/2002	247	bl171	AD	Male	2/4/2002	246
125	AD	Female	2/4/2002	UKN	174	YLY	Male	3/14/2002	107
126	AD	Female	2/4/2002	UKN	176	YOY	Male	3/14/2002	119
127	AD	Female	2/4/2002	UKN	180	AD	Female	3/23/2002	243
128	AD	Female	2/4/2002	UKN	183	YOY	Female	4/5/2002	120
130	AD	Female	2/4/2002	UKN	184	AD	Female	3/23/2002	241
131	AD	Female	2/4/2002	UKN	188	YOY	Male	4/5/2002	121
132	AD	Female	2/4/2002	UKN	189	AD	Female	4/5/2002	225
134	AD	Female	2/4/2002	UKN	190	YOY	Female	4/6/2002	112
136	YLY	Male	2/4/2002	UKN	191	AD	Female	4/5/2002	272
138	YOY	Male	2/4/2002	UKN	194	YOY	Male	4/6/2002	110
139	AD	Female	2/4/2002	UKN	195	YOY	Male	4/6/2002	122
140	AD	Female	2/4/2002	UKN	197	AD	Female	4/6/2002	221
141	AD	Female	2/4/2002	UKN	Bl622	AD	Female	2/14/2002	197
142	AD	Female	2/4/2002	UKN	Bl622	AD	Female	4/6/2002	196

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