Elk Calf Survival Salmon River Mountains, Idaho: Summer 2004

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Abstract

The Rocky Mountain elk (Cervus elaphus nelsoni) population in the Big Creek and Cold Meadows area of the Salmon River Mountains has declined in recent years following a 50 year period of population growth. Elk calf recruitment has been below management objectives of 24 calves per 100 cows since 1995. Previous research has demonstrated that fecundity is high, but calf survival through the first year is low. Summer predation by gray wolves, black bears, and cougars on the calves could be limiting population growth. At the same time, density dependant factors such as age structure and herd composition ratios may be acting on the population. Environmental changes related to recent fires altered available feed and cover. I documented and analyzed the change over summer months of calf:cow ratios from May 28 to August 10, 2004. I classified 1,323 elk during 67 occasions. I determined a calf:cow ratio of 33:100 by August 10. I found that the summer calf ratios at Cold Meadows were significantly lower than within Big Creek. Predator scat analysis suggested bears and wolves were consuming young calves throughout the study period. Understanding elk calf summer survival can assist managing entities in land management practices, elk herd assessment and predator management policy.

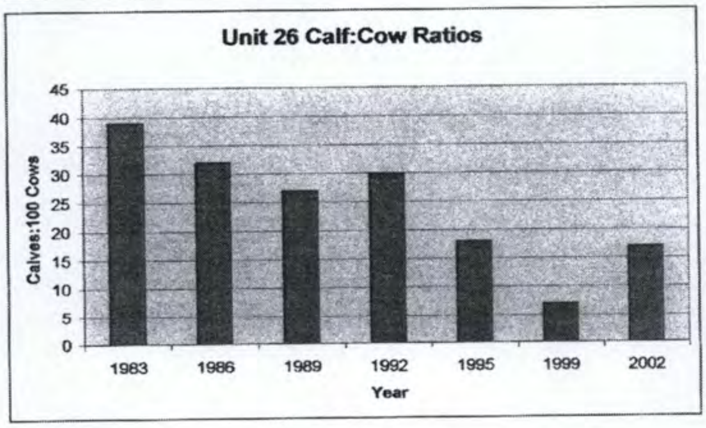
Introduction

Recruitment of elk calves into elk populations has become a major source of concern for wildlife biologists in management agencies. During the summer of 2003 at the University of Idaho Taylor Ranch Field Station I became interested in the Rocky Mountain elk (*Cervus elaphus nelsoni*) populations located in the Big Creek drainage and Cold Meadow area. I observed that herd compositions appeared to show a low calf composition and recruitment into a declining population. Through changes in herd composition counts near the field station mortalities were suspected, but few remains were found and the causes generally unknown.

Akenson et al. (2002) large carnivore-ungulate research on Big Creek documented low calf:cow ratios and low bull:cow ratios in a declining elk population. These results were similar to the findings of helicopter aerial surveys conducted by Idaho Fish and Game (IDF&G) during the winters of 1999 to 2002. IDF&G aerial estimates showed calf:cow ratios to be low in 1995, 1999, and 2002 when compared to data from 1983 through 1992 (Figure 1). Management objectives call for minimum of 24:100, but estimates have been below this goal during March aerial survey flights since 1995 (Rohlman 2003).

The situation of low calf recruitment has been identified elsewhere and investigated in many regions (Singer et. al 1997, Huff and Varley 1999, Mech et. al 2001, Zager et. al 2002). The Clearwater and Lochsa rivers have been studied extensively by Idaho Department of Fish and Game since 1973 to investigate the causes of low recruitment numbers. Over the course of many years of study they have found that 3 factors are affecting elk calf recruitment: 1.) Balance between elk density and habitat, 2.) Number and age structure of bulls, and 3.) Calf mortality (Zager et. al 2002).

Figure 1: Idaho Department of Fish and Game GMU 26 calf:cow ratio estimates



Interest in the decline of calf recruitment in the Salmon River Mountains caused further investigations into the potential causes. One hypothesis was that an old age structure of cows and low bull ratios were resulting in low reproductive rates for the population. Fecal hormone testing for progesterone levels in cows in the Big Creek drainage revealed that > 90% of cow elk tested in April were pregnant (Akenson et al. 2002). This would suggest high reproductive fecundity, but low survivorship of the elk calves. Therefore, mortality of the elk calves during their first year may be the cause of low calf recruitment rather than low birth rates. Several factors are hypothesized to be contributing to low survivorship.

Predation on elk calves by wolves (*Canis lupus*), black bears (*Ursus americanus*), cougars (*Puma concolor*), and other lesser predators can be a major mortality factor affecting population dynamics. Predisposing conditions such as a protracted calving period and small birth weights can increase the mortality rate for neonatal calves. (Toweill and Thomas 2002). All 3 of these large carnivores occur within the study area (Akenson and Akenson 2002). Following the 1995 reintroduction of wolves to central Idaho they have resided within the study area. In two recent studies from Idaho it was reported that during the winter elk are killed in proportion to their occurrence with other ungulates by wolves but calves are killed disproportionate to their proportion in the population. Cougars were shown to also select calves, though not as strongly (Husseman et. al 2003, Akenson and Akenson 2002). Previous carnivore research on Big Creek found that “from the standpoint of determining ultimate numbers of elk and deer it may be concluded that lion predation was inconsequential. While predation by mountain lions appears ineffective in limiting ungulate populations, the damping of oscillations of these populations can be important. The damping and protraction of fluctuations in ungulate populations can only have a beneficial effect on the environment” (Hornocker 1970).

Black bears are opportunistic predators for which predation is a learned behavior. Generally young bears are not effective, but older black bears can be an efficient predator

(Beecham and Rohlman 1994). Under certain circumstances bears can constitute a significant mortality source for elk calves especially when elk populations are depressed (Toweill and Thomas 2002).

In a dynamic environment the factors of calf survival are variable among years and populations. While calf:cow ratios are used to estimate calf production and survival, they are not always indicative of population trends; instead they represent a combination of survival for calves and adults (Peek 2003). The influence of predation is an integral and essential component of the elk ecology. The effects and influence of such predation are considered of great importance in the maintenance of ecologic stability in a wilderness environment (Hornocker 1970). While predation is not the sole factor limiting recruitment of elk calves into the population, it is one of interest that warranted investigation at this time in a wilderness region.

Habitat quality is likely the strongest influence on elk populations within a region (Toweill and Thomas 2002). In the year 2000 several massive fires burned through much of the study area and dramatically impacted the vegetation structure of the region. This event is certain to have an impact on elk populations by increasing feed quality and quantity while decreasing escape cover and concealment at calving grounds.

The point of interest is that long-term low calf recruitment can lead to an elk population decline. Many old cows with few new calves to replace them in an aging population will suffer from reduced fecundity and potentially collapse if low recruitment does not return to a sustainable level. The problem of continued low calf recruitment poses a considerable threat to the population stability for these elk. An increase in the calf recruitment is essential for long term viability of this population.

The purpose of this study was to identify some of the factors limiting the recruitment of elk calves during the summer season within the populations located in the study area.

The objectives of this project were to:

1. Determine calf:cow ratios in 2 study units throughout summer months.
2. Identify calving and nursery areas used by elk in the study area.
3. Document changes in calf:cow ratios throughout summer months.
4. Compare differences in calf:cow ratios between high and low elevation units.
5. Determine presence of elk calf remains in carnivore diet through scat analysis.

Study Area

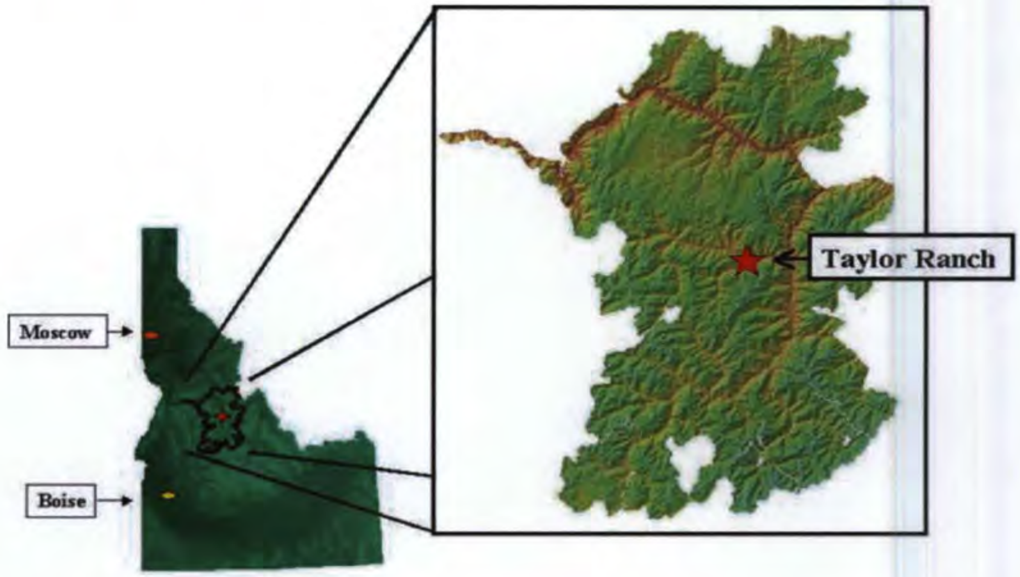
Big Creek and Cold Meadows are located in the 2.35 million acre Frank Church River of No Return Wilderness in central Idaho. The University of Idaho Taylor Ranch Field Station is located on Big Creek, a main tributary to the Middle Fork of the Salmon River (Figure 2). This facility with its amenities was the base for all activities on the project. Other lodging was accommodated at the U.S. Forest Service cabins at Cold Meadows, at Root Ranch on Whimstick Creek, and at Mile High Outfitters on Cabin Creek.

Observations took place at 2 study units. The first study unit was Big Creek complex that encompassed the middle to lower regions of the Big Creek drainage and tributaries. This low elevation study area extended along Big Creek from Acorn Creek to Goat Creek. The stream corridor elevation ranged 1158 m at Goat Basin to 1370 m at Acorn Creek. However, some of the peaks rising above the riparian corridor are much higher. The Big Creek complex was at a much lower elevation by comparison to the Cold Meadows unit.

This lower elevation complex was composed of Douglas fir (*Pseudotsuga menziesii*), mountain mahogany (*Cercocarpus ledifolius*), and bluebunch wheatgrass (*Agropyron spicatum*) plant communities. Bluebunch wheatgrass, Idaho fescue (*Festuca idahoensis*), cheatgrass (*Bromus tectorum*), and arrow leaf balsamroot (*Balsamorhiza sagitata*) are important species for elk foraging. The riparian zones and flood plains contained grassy meadows and riparian shrubs and trees. Most of this low elevation study area was burned during the Diamond Point Fire of 2000 changing the ecosystem dramatically by altering the vegetation structure. During the regenerative state there was an increase in forage ability in grasses, forbs, and shrubs because of the reduction in overstory.

The second complex was the Cold Meadows high elevation site. The elevation of this study area varied from 1701 m at Whimstick Creek to 2402 m on Runaway Ridge (Topozone 2004). The Cold Meadows area was dominated by coniferous forest vegetation with species composition varying in accordance with elevation and fire disturbance. Ponderosa pine (*Pinus ponderosa*), Douglas fir (*Pseudotsuga menziesii*), and Engelmann spruce (*Picea engelmanni*) composed the forest types. Large portions of the Douglas fir and Spruce zones were dominated by lodge pole pine (*Pinus contorta*) in seral stages following forest fires. The meadows were composed of moist to wet soils and supported sedges, grasses, forbs, and shrubs important for elk foraging (Wing 1969). Most of this high elevation study area was burned in the 1988 fire season. Lodgepole saplings regenerated throughout the old burns to create good escape cover for elk from predators.

Figure 2: Location of study area.



Methods

Data Collection

Beginning May 30 observational records of elk were made along established pack trails and in locations previously known to be frequented by elk. Initially we located calving locations and as the calves reached the age to join the herd we shifted the focus to larger nursery groups. While locating elk was the primary interest we also recorded predator presence on our datasheet (Appendix VI). We used 10x binoculars to locate and count animals. A 20-60x spotting scope was used to perform composition counts for cows, calves, and bulls. Each count was performed for a minimum time period of 1 hour, unless the elk left the area and could no longer be observed. Using two observers counts were made independently by each observer and then compared afterwards. In most cases when large herds were encountered a count was made in the evening and then another in the morning of the same herd of animals to try to include all animals during peak feeding times. Following the proposal protocol within each study unit a minimum of 30 independent herd samples were taken to provide a total sample size of no less than 60 independent herd observations for age composition. A total of 67 herd observations were made from May 30 to August 10. A herd was considered more than one elk, including a single cow with calf.

In addition to ground searching we used a fixed wing Cessna 185 to locate animals not seen or easily accessed from the ground. Four observational flights were made over the entire study area by two observers with the pilot. Observational flights were performed during early morning while elk were still feeding in open terrain. During these flights Global Positioning System (GPS) coordinates were taken on groups of elk observed and then transferred to MapSource topographical maps. The flights were performed in the manner outlined in "Estimation of wildlife population ratios incorporating survey design and visibility bias" (Samuel et al. 1992). GPS tracking mode was used to plot the flight times and patterns (Appendix III). Locations of herds were recorded along with the total number of animals, composition of cows, calves, and bulls. Yearlings were not calculated from the air because they were not easily identifiable at the altitudes flown. Digital photographs were taken of groups for later analysis of vegetation and to verify count accuracy. Each flight was approximately 1 hour in length and originated at Taylor Ranch Field Station and ended at Cold Meadows airstrip.

After the flights we hiked or traveled by horseback in a reverse pattern from Cold Meadows toward Big Creek. During our ground travel we visited calving and nursery areas identified from the air to record and compare the total number of animals, calf:cow ratios, and document neonatal mortality. This data was collected through direct observations of elk while hiking through the study areas or from stationary positions with binoculars and a spotting scope. We repeatedly surveyed each study unit cycling through the study area spending more time at points where elk were seen during the flights, had been previously located or fresh elk sign was found.

During our observations of elk the plant communities they were found in were classified by the dominant species. In forested communities a general grouping of the dominant tree species and an estimate of open, moderate, or closed canopy was recorded. Roughly < 25% cover was open, 25-50% was moderate, and >50% was closed canopy. Whether it was burned, regenerated forested or mature forest was documented. Other vegetative classifications were mountain meadow, riparian, shrub-steppe or bunchgrass.

All elk calf carcasses found were necropsied in the manner outlined in "Evaluation of Causes of Wildlife Mortality" (Roffe et al. 1996). Using an adaptation of Akenson and Akenson's 2002 predation study "Prey carcass investigation form" we recorded information from the carcass and around the mortality site to determine cause of death (Appendix VI). Due to limited sampling by necropsy we documented all predator sign encountered and carnivore-ungulate interactions observed while searching for elk. This included tracks, fresh scats, vocalizations, animal sightings from air and ground, and scavenged carcasses which were plotted (Appendix II).

Initially we only examined fresh scats from carnivores and scavengers whilein the field to determine presence or absence of elk calf consumption and only fresh scats with identified elk calf remains were documented. For the latter part of the study the fecal samples were collected in Whirl-pak® bags and the locations plotted on the GPS unit. The scats were then taken to the field station where they were washed over a series of three screens with wire mesh of 1", ½" and fine mesh respectively. Scats containing elk hair, hooves or other identifiable elk parts were documented. Other species consumed and identified were noted as well.

Figure 3: Scat analysis (Wolf scat containing elk calf hair and hooves).

Data Analysis

Day one began on May 30, 2004 and continued through day seventy-four on August 10, 2004. I evaluated the change in calf:cow ratios during summer using pooled data from all observations in both study units. Two ratio calculations were done, one recording all cows seen after the first calf was observed, and a second in which I did not begin counting cows in a herd until calves were observed with that herd. The latter resulted in a more accurate survival estimate ratio. I graphed 6 subunits to show their individual daily calf:cow ratios across time. All daily proportions were also combined and graphed across the entire study area through time to show the study population. I compared the means of each calf:cow ratio for each herd in the study area. I used Chi-squared analyses to determine: 1.) whether calf:cow ratios changed during summer, 2.) whether calf:cow ratios between the low and high elevation units were different, 3.) whether calf:cow ratios varied between early summer and late summer, 4.) whether calf:cow ratios within the low elevation and the high elevation showed significant change between the early summer (June 1- July 7) and late summer (July 8-August 7).

Results

We classified 1,323 elk during 67 observations over the course of the summer. These elk had a composition of 1107 cows, 187 calves, and 29 bulls (Table 1). This is not a population estimate, but repeat observations of the same cow-calf groups through time.

Table 1. Elk classifications by area

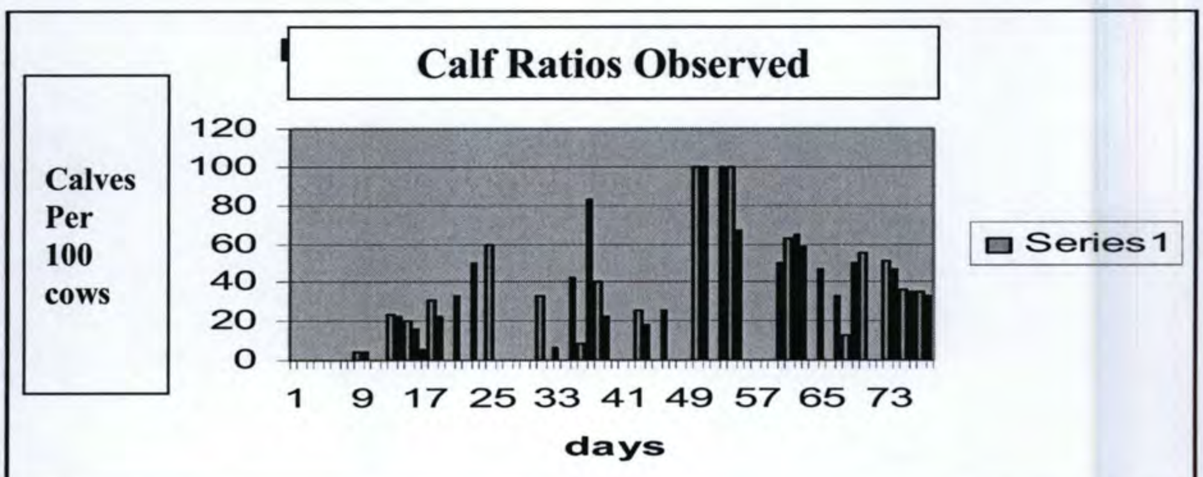
Area	Cows	Calves	Bulls
Cold Meadows	706	61	13
Whimstick Crk	36	16	1
Mile High	201	52	4
Cabin Crk	32	5	0
Big Crk	17	8	0
Cliff Crk	91	37	0
Miscellaneous	24	8	11
Total	**1,107**	**187**	**29**

When comparing the total number of cows observed to the number of calves observed across the entire study area for the summer months the observed mean across time was 16.8 calves per 100 cows. But, this is not an accurate calf ratio for survival because it includes repeat counts of large groups of potentially pregnant cows with no calves. When counting of cows in each unit did not begin until the presence of calves with them, the value increased to 35.6 calves per 100 cows. However, an end of the study period mean among the study units observed proportion of 33.1 calves per 100 cows is a more accurate estimate that represents summer survival of elk calves.

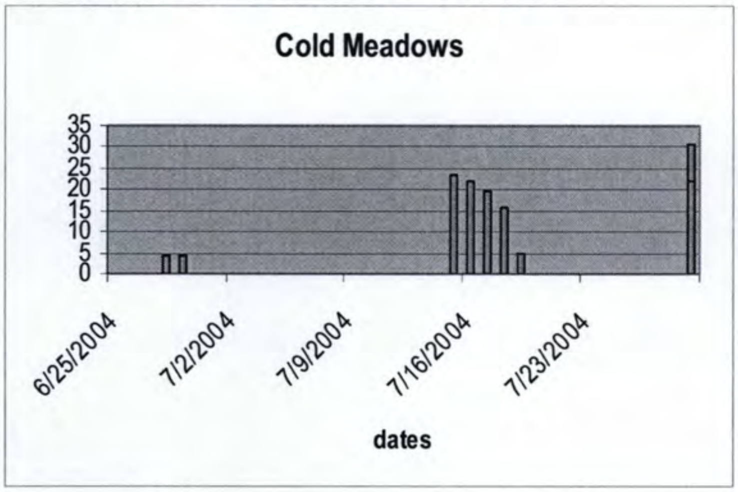
Cold Meadows and Whimstick Creek had a summer mean calf:cow ratio of 16:100, Mile High and Cabin Creek was 46:100, and lower Big Creek was 34:100. Using the Chi-squared analysis I found that the calf:cow ratio in the high elevation unit was significantly lower than in the low elevation unit ($\chi 2 = 43.41$, $p<0.05$). I found a significantly lower calf:cow ratio in early summer from June 1- July 7 than the late summer from July 8- August 7 ($\chi 2= 63.8$, $p<0.05$). When those statistics were further broken down into high and low elevation subunits I found no significant difference in the low elevation ($\chi 2= 0.029$, $p<0.05$) between early and late summer, but a significant difference did occur at the high elevations ($\chi 2= 45.2$, $p<0.05$).

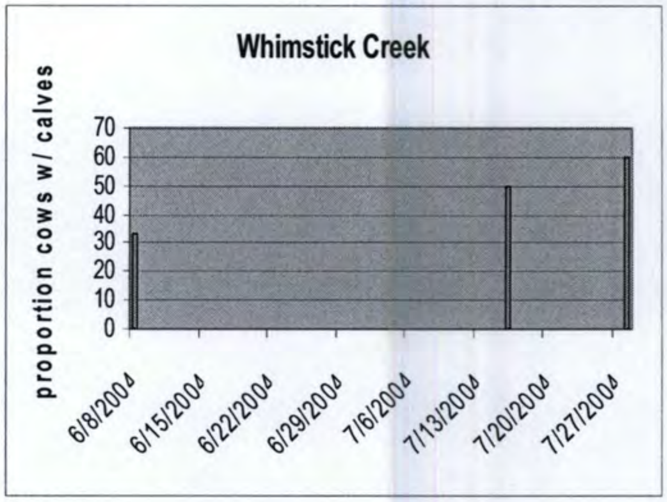
Below are graphs for individual herds in specified locations. Figure 4 depicts the population across the entire study period for the whole study area.

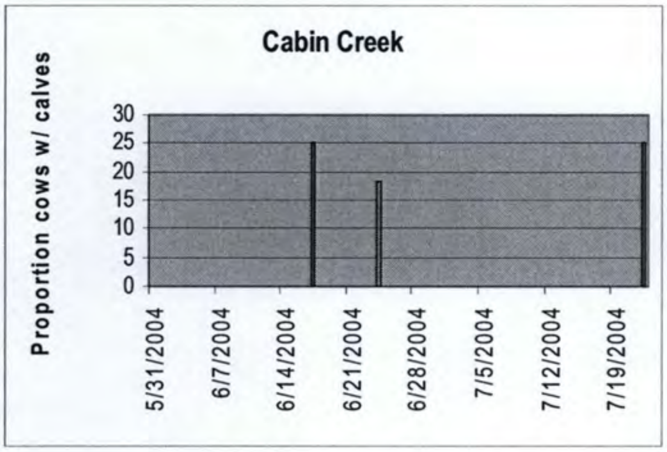
Figure 4: Proportion of cows observed with calves across the entire study area.

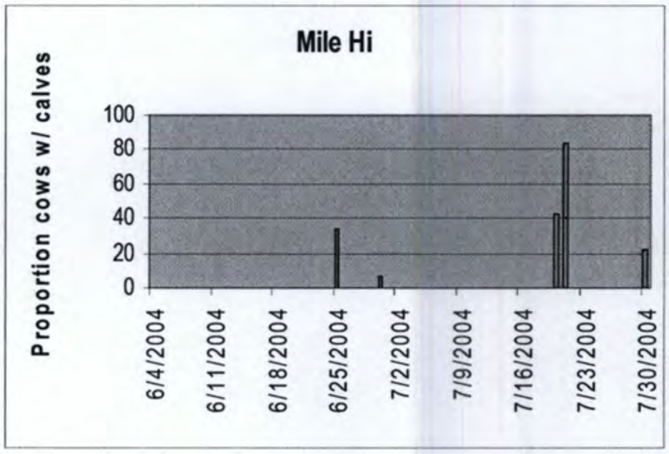


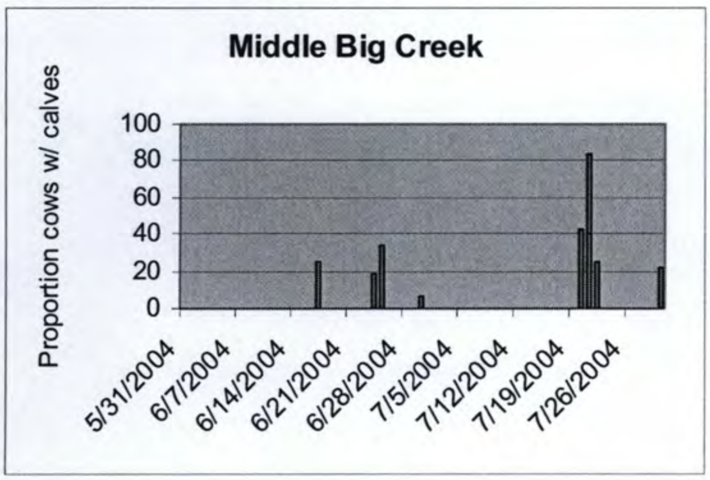
Individual subunits of the study area











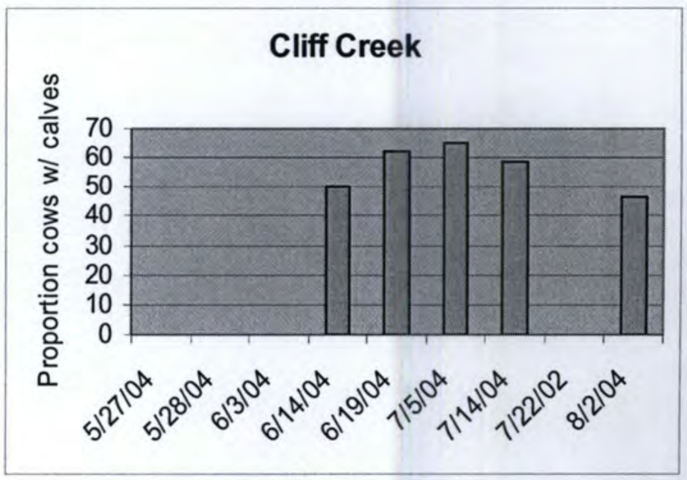
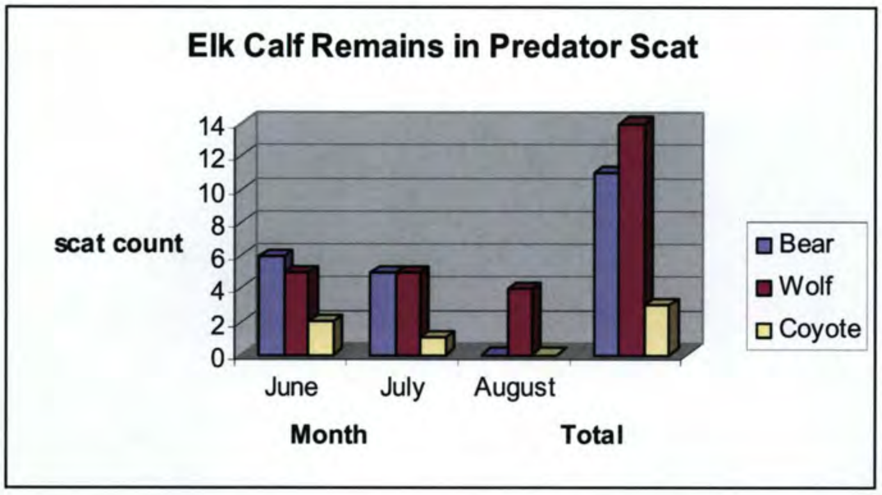


Figure 5: Scat samples containing calf remains during study period.



Neonatal calves were found mostly along the riparian corridors within 100 m of a water source. We observed 7 newborn calves that were believed to less than 1 week old based on physiology (Johnson 1951). These <1 week old calves were observed beginning on May 30 and the last observed July 11. Noticeable size/age differences between calves in nursery groups were noted throughout the summer although difficult to quantify during intermittent visits. These changes suggested that while ratios of observed calves were not changing during the early summer, it was due to new calves replacing those that had died. Some photographic evidence of this is presented in Appendix IX.

Discussion

The information presented in this report needs to be regarded in the context of long term population trends of elk in this study area. This elk population has been in a decline after reaching a historical high in the early 1990's (Rohlman 2003). It is possible that this elk population was near the ecological carrying capacity at that time. As a result low fecundity or high mortality of the calves may be a compensatory mortality in response to density dependant environmental conditions rather than a limiting additive mortality (Singer et al 1997). Figure 1 demonstrates that the calf:cow ratio for this area was declining before the reintroduction of wolves in 1995. However, the cause for concern is the continued decline with poor recruitment into the population. The high elevation units have had concentrated wolf activity due to the presence of dens and rendezvous sites during the summer, while the low elevations had less wolf presence.

Between the high and low elevation study units a significant difference was found in the proportion of cows with calves. The high elevation sites had dramatically lower ratios than the low elevation sites and the presence of calves was not detected until a much later date. The total population estimate proportion is skewed because it included early summer observations with pregnant cow groups who had not calved yet, and had a zero proportion of calves present or calves were hidden from observer view. But it does highlight the late and prolonged calving situation, especially at the Cold Meadows unit. When looking at individual subunits it appears that higher elevation sites had very low calf production and/or survival rate. While the lower elevation subunits were higher, the elk population as a whole was low in observed calf survival. This continued low elk calf recruitment could be detrimental to population growth potential.

Observer bias in sampling methods may influence the results found. An assumption of accuracy in counts when herds were located is reasonably high, but the issue of not documenting groups of animals could influence the ratios. Cows with young calves would be the most likely to not be seen. The irregularity in locating herds and being limited in the area covered could place additional bias in actual versus observed population ratios. Data from the Yellowstone ecosystem (Mech et al. 2001) and

Manitoba, Canada (Hebblewhite and Pletscher 2002) suggests that group sizes of elk herds are either larger or smaller in the presence of wolves than they were prior to wolf pack presence and this may be happening in the Salmon River Mountains as well in response. As a result small groups may hide in dense cover avoiding predator detection as well as observers of this study. Later they aggregate to create much larger herds that were easily observed and showed the increase in calf ratios later in the summer. During the middle of the study we emphasized observing these small nursery groups with each cow having a calf, thus causing a 100% proportion during that time period. This was not indicative of the entire study population.

In the predator scat sampling the wolves were likely a higher proportion of collections because of their behavior to mark trails with excrement, whereas cougars were absent from the sample. Other predators likely were somewhere between those two extremes. These detection levels were only based on detected occurrences, which could be biased because of species behavior and relative densities. We did not assume that because an animal consumed an elk calf that it was responsible for killing that animal. Scavenging from several predator species, or multiple members of the same species, could occur on a single calf regardless of cause of death. Although in the case of these large predators it is likely that species responsible for mortality will consume the carcass.

The timing of calving appears to be an important issue that has impacted the recruitment of calves into the elk population of the study area. We observed a prolonged calving period. There is an apparent rightward shift in the date of the highest observed calf ratios later in the season, which would not be expected in normal population trends where most calves were born near the same time. Corresponding to this was the presence of elk calf remains in bear scats through the month of July, suggesting the presence of small calves born that late into the summer. This information of when cow elk are bred and the calves born may have the most important management implications for this population.

The reduced calving synchrony could be related to the low bull ratio and the age structure of the bulls present (White 2001, Noyes et al. 1996), or the older age structure of cow elk (Akenson and Akenson 2002), or poor cow elk nutritional condition (Cook et al. 2001). The recent fires have caused a reduction in the amount of available cover during calving and early development when the calves are most vulnerable to predation. Most of the young calves observed were found in the limited cover near riparian zones. With limited cover and an extended calving period the elk calves could become a readily available and easily located prey for predators. Predators could concentrate in areas with dense cover where the young calves are hidden by cows. Under these circumstances normal predator swamping effect would be lost. In such a situation a limited quantity of quality habitat could be turned into a population sink that provides a "buffet table" for predators that learn where to look for calves throughout the summer and repeatedly kill young calves in the same locations. This could lead to a higher summer predation rate and reduced survival of calves.

The study area appears to be an ecosystem in transition with the reintroduction of a top predator and the recent fire events. If feasible, predator control policies may be a short term way to improve calf survival, but past research would suggest the deeper problems are related to habitat availability and the sex ratios of adults in this elk population. Changing hunter harvest to improve bull ratios to management objectives, and reducing harassment during the fall rut could improve calf ratios and survival the following year.

At the conclusion of this research we documented a low summer elk calf ratio in the study area, especially in the higher elevation subunits. Corresponding to this was an extended calving season that could be contributing to low survivorship. I suggest further research to identify the causes of these observed phenomenon. Specifically looking at habitat quality and use versus availability of potential habitat by both ungulates and predators. Further investigations into the causes of low bull ratios and age structure impacts on calving synchrony could reveal a less obvious cause. The age structure, nutritional healthy, and fecundity of the cow elk population needs to be investigated to determine their impacts on calf recruitment. With the increased understanding of the causes to low calf recruitment managers can better manage the elk population in a sustainable manner for the future.

Acknowledgments

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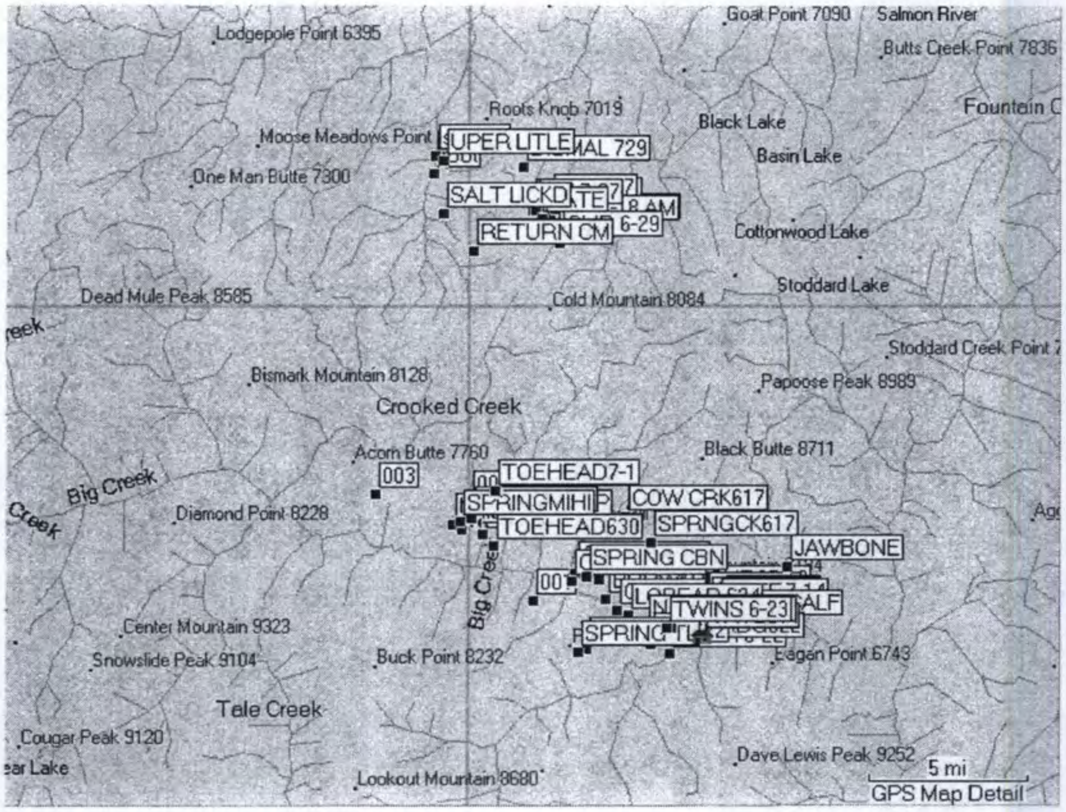
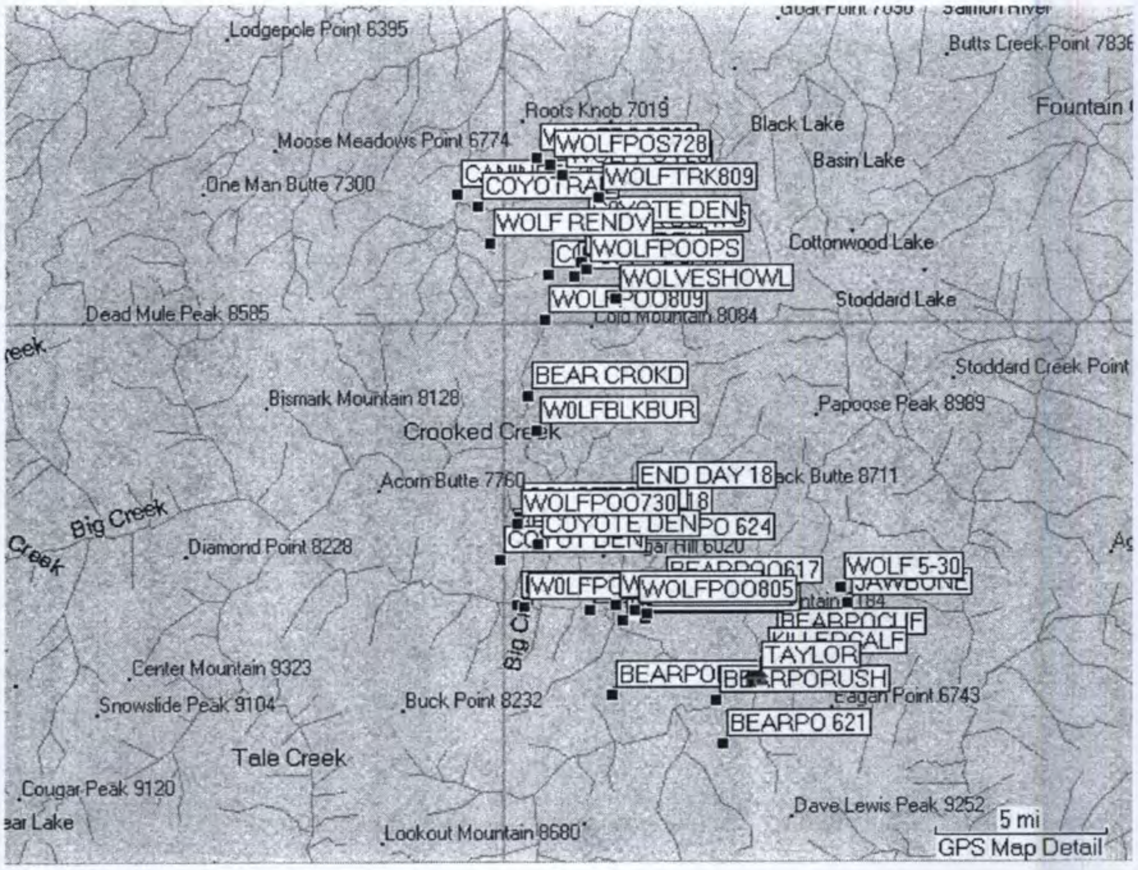
Appendix I:

Calf Locations May 30- August 10, 2004



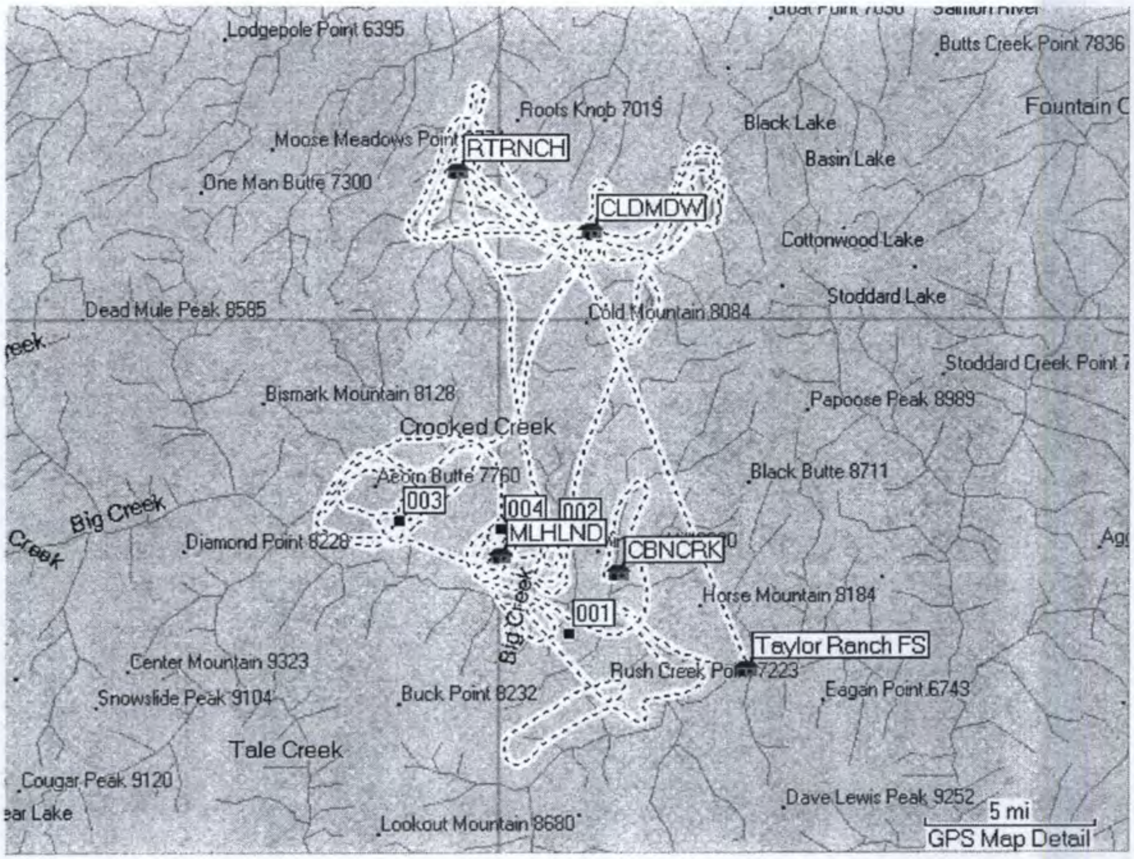
Appendix II:

Predator Presence Detected



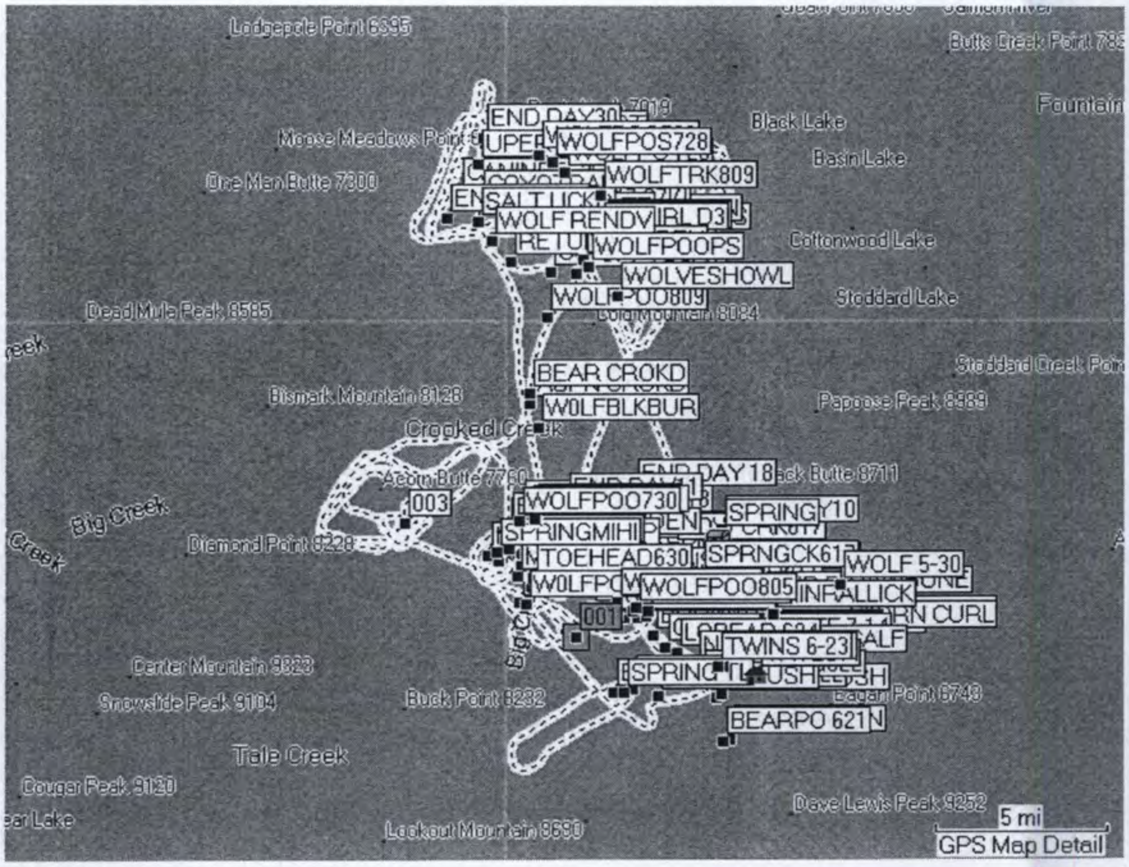
Appendix III:

Flight Pattern



Appendix IV:

All Points Plotted



Appendix V:

Elk Calf Mortality Datasheet

KILL INVESTIGATION & NECROPSY FORM ____________ **Date** ________________

Study Area: 1) Big Creek 2) Mile High 3) Cold Meadows

Field Investigators ____

Species ______________________ Sex: M F Unk Time since death ____ 1)known 2)est.

Age: 1) <1 week 2) 2-3 weeks 3) 3-4weeks 4) 4-5weeks 5) yearling 6) adult 7) unk

KILL SITE DESCRIPTION:

General Location ____

Kill: UTM ______________E ______________N Elev. (m) _____

Habitat type ____________________________________ Forest canopy cover ____%

Vegetation ____

Describe kill area ____

SITE EVIDENCE AND ASSESSMENT OF CARNIVORE INVOLVEMENT:

Carnivore Sign Present: 1)wolf 2)cougar 3)coyote 4)bobcat 5)black bear 6)none 7)other _______

Carnivore present: Y N ____

Fresh tracks _______ Old tracks ______ Beds ______ Hair ______ Scats ___________ # scats ___ Tree scratching _____ Scrapes ______ # scrapes ___ Urine marking _______

Mortality Site: Carcass located: 1)under tree/shrub 2)in open _______________

Carcass covered: Y N Cover material ______________________ Prey slid/moved: Y N ?

How far (m) ______ Carcass moved postmortem: Y N ? Distance dragged (m) _____

Signs of struggle or chase: Y N ________________________________

Scavengers present: Y N # observed: 1)wolf __ 2)cougar __ 3)coyote __ 4)bobcat __ 5)bl bear __ 6)raven ___ 7)golden eagle ___ 8)bald eagle ___ 9)magpie ___ 10)other ____________

CARCASS DESCRIPTION, UTILIZATION, AND CONDITION:

Canine punctures: Y N Distance between canines (mm): upper _______ lower ______

Location on body: ____

Bones crushed: Y N Which bones ____

Hair plucked: Y N ? Hide peeled: Y N Hide torn/shredded: Y N Nasal area eaten: Y N

SubQ hemorrhage: at base of skull Y N ? at throat Y N ? at other site ___________

Point of first feeding: ____

Blood on carcass or ground: Y N ? ______________________ Aspirated blood: Y N ?

Probable kill method: 1) choke 2) bite to skull 3) broken neck 4) unknown 5) other __________

Describe kill/carcass: ____

____

Utilization

1) 76-100% No soft tissue; hide usually present; generally disarticulated
2) 51-75% All organs consumed, all/most of quarters consumed; some head/neck present; partial/slight disarticulation.
3) 26-50% Organs usually consumed, major portions of several quarters consumed; head/neck mostly intact; usually articulated.
4) 0-25% Some organs consumed; most muscle tissue intact; skeleton articulated.

Bones found & #: 1)all 2)skull 3)jaw 4)vertebra ___ 5)ribs ___ 6)scapula ___ 7)humerus ___ 8)radius/ulna ___ 9)metacarpus ___ 10)pelvis 11)femur ___ 12)tibia ___ 13)metatarsus ___

SAMPLES COLLECTED:

Carnivore ____________: 1) scats: #___ 2) hair 3) other ________ Photo #s______

Appendix VI:

Predator Presence Datasheet

Carnivore Presence Datasheet

Date:	Observer:	Habitat Type:	
Beginning UTM Coordinates:		Ending UTM Coordinates:	
Elevation:		Elevation:	
No Carnivore Sign Observed:			
Observed Sign	UTM Coordinates #	Type of Sign	Comments
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Total Distance traveled along survey route:

Comments:

Appendix VII:

Elk Composition Datasheet

Elk Observation datasheet

Date:	Time:	Observer(s):			
Temperature:	Weather:	Picture #(s):			
UTM Coordinates N:	E:	Elevation:	Aspect:	GPS point	
Vegetation Type:		Distance from cover:			
Total # animals:	Cows:	Calves:	Bulls:	Branch antler:	Yearlings:
Behavior observations:					
Additional Comments:					

Map on back

Appendix VIII:

Aerial Survey Datasheet

Elk Inventory Survey Description Form Summer 2004

Pilot: Craft: Speed: Weather condition:

Date: Start time: End time: % Cloud cover

Surveyors :

Survey Study Areas

Study Area Name	**Herd UTM**			**# elk**	**habitat type**	**Location Description**

Comments:

Appendix IX

Photograph

Note the size/age difference of calves at center.