IDAHO DEPARTMENT OF FISH AND GAME

Steven M. Huffaker, Director

Project W-160-R-32

Subproject 31

Progress Report

ELK ECOLOGY

Study IV: Factors Influencing Elk Calf Recruitment

Job No. 1: Pregnancy rates and condition of cow elk
Job No. 2: Calf mortality causes and rates
Job No. 3: Predation effects on elk calf recruitment

July 1, 2004 to June 30, 2005

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September 2005
Boise, Idaho

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JOB NO. 1: PREGNANCY RATES AND CONDITION OF COW ELK

Abstract

As part of a larger effort to determine the factors responsible for poor or declining elk recruitment, we continue to evaluate the body condition and pregnancy status of cow elk on contrasting study areas in north-central Idaho. In March 2005, we captured and evaluated 4 cow elk on the Lochsa and 4 on the North Fork study areas. Steroid metabolite levels derived from fecal samples collected from wintering free-ranging elk were also used to determine pregnancy rate. Melanie Miller, University of Idaho graduate student, presented those findings at the Society for Conservation Biology conference. We are currently testing a DNA-based approach to adjust this index to account for young bulls that occur with cow groups during January-March. Adair Muth, a student in Dr. Lisette Waitts' laboratory, is summarizing these data.

Introduction

Elk recruitment has been chronically low or has declined in many key elk management units in Idaho. This is cause for concern because recruitment replaces losses to hunting and other factors, thus allowing population stability or growth. There are a variety of factors that can influence recruitment including elk density, habitat condition, nutrition, weather, pregnancy rates, predation, breeding conditions, and calf condition. Each factor probably plays a role, but which factors are significant and how they relate to each other remains to be addressed.

We are interested in identifying ultimate factors that have a major influence on recruitment, as well as understanding the underlying mechanisms. Within the context of this project, we consider 3 broad categories of ultimate factors: (1) elk density and habitat, (2) predation, and (3) age structure of bulls as being potentially important to elk in Idaho. This report addresses elk density and habitat and several closely related factors. A literature review is provided in Gratson and Zager (1997) and Zager and Gratson (2001).

Study Area

We selected 2 contrasting study areas, the Lochsa River/North Fork of the Clearwater River and the South Fork of the Clearwater River, to investigate mechanisms potentially affecting elk recruitment. The Lochsa/North Fork study area includes portions of Game Management Units (GMU) 10 and 12 in north-central Idaho. It is bounded on the north, west, south, and east by Pierce, Orofino, Kooskia, and Castle Butte, respectively. The primary landowners are the Clearwater National Forest, Potlatch Corporation, and Idaho Department of Lands, with scattered private parcels. Topography ranges from a rolling patchwork of timbered parcels on the western private lands to large and rugged drainages on forested land in the central and eastern portions. Elevations range from 425 m at Syringa to 2,030 m at Castle Butte.

The Lochsa/North Fork is characterized by poor elk recruitment, moderate access, possibly stagnant habitats, and apparently high predator densities.

The South Fork study area (GMU 15) is also in north-central Idaho. The majority of the area is under public ownership administered by the Nez Perce National Forest. Elevations range from 1,200 m at the western end of the winter range to 2,000 m at the peaks in the eastern portion of the GMU.

More complete study area descriptions are provided in Gratson and Zager (1997) and Zager and Gratson (2001).

Methods

During March 2005, we used a helicopter to capture 4 adult cow elk on the Lochsa and 4 on the North Fork study area winter ranges. We did not capture elk on the South Fork study area in 2005 because sample size was already adequate to meet objectives. Lochsa and North Fork animals were darted and immobilized with approximately 4 mg of Carfentanil, then reversed with Naltrexone.

We used a body condition score (BCS) (Gerhart et al. 1996, Cook et al. 2001, Cook and Cook pers. comm.) to index physical condition of each elk. We measured chest girth and converted it to mass (Millspaugh and Brundige 1996, Cook et al. 2003). A blood sample was taken and processed according to standard protocols (Gratson and Zager 1998). The Analytical Sciences Laboratory at the University of Idaho evaluated serum trace element levels and whole blood selenium levels.

Animals were placed in 1 of 5 age categories based on dentition eruption and wear patterns (Quimby and Gaab 1957). Animals were ear-tagged, radio-collared, and released. Beginning in April 2005, they were monitored approximately weekly to evaluate survival and general seasonal movements. Pregnancy was determined from PSPB levels in serum samples (Sasser et al. 1986, Noyes et al. 1997).

Department biologists routinely take blood from elk captured elsewhere in Idaho. We are attempting to coordinate collection of serum and blood samples from these animals to begin building a statewide database.

Results

Largely because of a mild 2004-2005 winter, animals were dispersed and capture conditions were poor. In the interest of animal safety and fiscal considerations, we aborted the capture operation after capturing 4 adult cows on the Lochsa and 4 on the North Fork study areas. We plan to mount another capture effort during December 2005 to supplement the currently-marked sample.

Because few animals were captured and evaluated during the March 2005 capture effort, comparisons with previous years are compromised. Nonetheless, the data are presented in Tables 1-3.

Discussion

Elk recruitment is inadequate in several important GMUs in Idaho. As a result, several key elk populations have declined over the past decade. Predation is often cited as the primary cause of this decline, but a variety of factors may affect recruitment. We have chosen to take a broader view of the recruitment question by considering factors in addition to predation, such as:

1. Habitat quality and structure as it affects:
    a. Cow condition
    b. Pregnancy rates
    c. Calf condition
    d. Calf vulnerability
    e. Predator efficiency

2. Bull:cow ratios
3. Bull and cow age structures
4. Road access and success rates of bear and lion hunters

Because pregnancy is such an important piece of information, we initiated an effort to assess pregnancy non-invasively by collecting fresh fecal pellets from cow elk during February and March. Fecal steroid metabolite levels were evaluated to estimate the pregnancy rate (Stoops et al. 1999). For this approach to work, one must be able to differentiate samples from male vs. non-pregnant females. Otherwise some of the "non-pregnant" samples may actually represent bulls rather than cows, skewing the results.

In collaboration with Dr. Steven Monfort's lab, we investigated the use of hormone profiles in fecal samples to determine sex. This approach is appealing because it is much less costly than DNA-based evaluations. However, using P_4, T, and the P_4/T ratio, we were unable to distinguish between samples from non-pregnant females and male elk. Pregnant animals were readily identified using the same parameters.

An alternative, though more expensive, approach is to use a DNA-based evaluation of fecal samples to determine an animal's sex. We are working with Dr. Lisette Waits' lab at the University of Idaho on such an approach.

Trace element levels and other serum parameters have proven difficult to interpret (DelGiudice et al. 1990, DelGiudice et al. 1991, Cook et al. 2001). Nevertheless, where differences occur among our study areas, the Lochsa and/or North Fork are generally "deficient". This may reflect habitat and environmental differences among the study areas. We expected marked differences in pregnancy rates and physical condition of adult cows among the study areas. The pregnancy rate was 13% higher and the BCS (Gerhart et al. 1996) was significantly greater for South Fork vs. Lochsa/North Fork animals in 1997. Furthermore, following a relatively mild winter, the pregnancy rate was slightly higher and BCS significantly greater for South Fork cows in 1998 vs. 1997. In March 2002, pregnancy was essentially 100% across all study areas, but South Fork animals continued to exhibit better BCSs. South Fork cows continued to be in better condition and exhibit higher pregnancy rates in 2004 than those on the Lochsa and North Fork study areas.

Mitchell and Brown (1974), Hamilton and Blaxter (1980), and Albon et al. (1986) reported a correlation between environmental conditions, animal condition (weight), and pregnancy rates for red deer (*Cervus elaphus*). Likewise, Gunn et al. (1969) demonstrated that domestic sheep (*Ovis aries*) in good or improving condition have a higher fertility rate than individuals in poor condition.

Over the past decade, biologists have investigated ways to measure physiological stress in wild populations. One response to such stresses is increased secretion of glucocorticoids which can be detected in fecal samples. Increased secretions are adaptive in the short-term, but chronically elevated levels can produce reproductive suppression, ulcers, muscle wasting, and immune suppression (Sapolski 1992). We suspected that 3 factors may differentially influence fecal glucocorticoid levels in elk on our study areas:

1. Winter 1996-1997 was particularly difficult in north-central Idaho. Snow-pack was 200% of normal, whereas the winters of 1997-1998 and 2001-2002 were near "normal" with snow-packs approximating the long-term average. We suspected these conditions would be reflected in elevated fecal glucocorticoid levels in 1996-1997 samples and lower levels in 1997-1998, 2001-2002, and 2002-2003 samples.

2. Lochsa winter ranges are characterized by decadent shrub-fields and deep snow. The primary South Fork winter range is Earthquake Basin – much of which burned in 1967. The South Fork habitat remains productive and available to elk because snow depths are markedly less than found on the Lochsa/North Fork winter ranges. We suspected that physiological stress and fecal glucocorticoid levels would be higher for Lochsa animals than for South Fork elk.

3. Wolves were infrequently found on each study area during the 1996-1997 and 1997-1998 collections. Wolves were a significant component of the Lochsa/North Fork ecosystem by 2001-2002. They continue to be infrequently present on the study area portion of GMU 15. We suspected that fecal glucocorticoid levels would be higher on the Lochsa/North Fork in 2002 and 2003 than in previous sample years because wolves had become established in the interim. We did not expect a similar change in the South Fork because wolves were not yet established on the study area portion of the GMU.

Fecal glucocorticoid levels were 2-3 times higher on the Lochsa than the South Fork, indicating a higher level of physiological stress for the Lochsa animals. The Lochsa values are well below those reported for elk in the Yellowstone ecosystem (Creel et al. 2002). Either there was no response to winter severity or presence of wolves, or they acted as confounding variables because the 1996-1997 fecal glucocorticoid level was not significantly different from the 2001-2002 level. Unexpectedly, the South Fork fecal glucocorticoid levels were significantly higher in 2001-2002 than in 1996-1997, but remained markedly lower than Lochsa values. Possible reasons for this are unclear.

Though the connection between fecal glucocorticoid levels and population performance is unclear, monitoring fecal glucocorticoid levels in conjunction with BCS, pregnancy rates, age structure, and so forth may provide a useful index of the physiological condition and status of an elk population (Millspaugh et al. 2001).

Our data from the Lochsa/North Fork and the South Fork (Gratson and Zager 1997, 1998, 1999, 2000; Zager and Gratson 2001; this report) suggest that the "recruitment problem" in north-central Idaho, and particularly the Lolo Zone, is more than a question of predation. Preliminary information suggests that Lochsa/North Fork cows exhibit generally lower than expected pregnancy rates and an apparently older age structure in addition to poor calf survival.

Lower pregnancy rates may be related to poor habitat quality, high population density, or other factors. Any changes in predator density or predation rate may simply exacerbate the recruitment problem.

Furthermore, more than 20 years of bulls-only hunting has resulted in a cow age structure skewed toward older animals on the Lochsa/North Fork. Because fecundity begins to decline at 8 (Greer 1966) to 12 (Bubenik 1982) years old, this age structure may also contribute to low pregnancy rates and declining recruitment.

Recommendations

GMUs that represent the full range of habitat and population variability found in Idaho should be included in efforts to collect age-specific condition and pregnancy data. These data will provide a better understanding of ungulate demographics and population processes throughout the state.

As wolf populations increase and their distribution expands in Idaho, it is important to continue monitoring adult cow survival, age structure, condition, and pregnancy rates to better understand the impacts of predation on elk populations in north-central Idaho.

JOB NO. 2: CALF MORTALITY CAUSES AND RATES

Abstract

There are a variety of factors that may influence calf survival. These can be summarized into 3 major issues (Gratson and Zager 1997): (1) the balance between elk density and habitat, (2) number and age structure of bulls, and (3) predation. Gratson and Zager (1997) provide a

literature review and discussion on the details of these issues. Importantly, these factors may simultaneously influence calf survival and interactions often occur; therefore, Job 2 has been combined with Job 3 and presented under Job 3.

JOB NO. 3: PREDATION EFFECTS ON ELK CALF RECRUITMENT

Abstract

We are investigating causes of variation in calf mortality, including the effects of predation by black bear (*Ursus americanus*) and mountain lion (*Felis concolor*). During the report period, we monitored survival and determined causes of death of radio-collared elk calves captured in 2004 in parts of GMU 15 (South Fork Clearwater) and 2005 in parts of GMU 10 (North Fork Clearwater) and GMU 12 (Lochsa). In fall 1999, the Department increased the bag limit to 2 bears and 2 lions per year on a portion of the Lochsa study area and eliminated legal harvest of bears and lions in part of the South Fork study area. The North Fork Clearwater and a portion of the South Fork serve as control areas. Annual survival rate of calves captured in 2004 was 0.52 ± 0.14 on the South Fork, 0.83 ± 0.51 (n = 6) on the North Fork, and 0.51 ± 0.09 (n = 24) on the Lochsa study areas. The survival rate of calves captured in 2005 to 1 August was 0.00 ± 0.00 on the North Fork and 0.76 ± 0.14 on the Lochsa. We did not capture calves on the South Fork study area in 2005. Predation, mostly by bears and lions, continues to be the primary proximate source of mortality. We observed 0.92 bears/flying hour on the combined North Fork and Lochsa study areas during 2005 calf capture operations. Black bear bait station surveys and a mark-recapture index indicate that the bear populations in the 2 treatment areas are responding to manipulation as anticipated. The bear population on the South Fork treatment area has increased to mirror the control area since the harvest season was closed and the population on the Lochsa treatment area has declined in relation to the North Fork control since we initiated efforts to increase bear harvest. The bear and lion harvest treatment on the South Fork was eliminated during fall 2004. During 2004-2005, we continued efforts to index mountain lion populations using harvest and mark-recapture analyses of DNA samples.

Introduction

Recruitment is chronically low or has declined in many key elk populations in Idaho (Gratson and Johnson 1995, Gratson and Zager 1997). This is cause for concern because recruitment must replace losses of adults to hunting and other factors to allow population stability or growth. In Idaho, hunting losses typically account for >85% of the annual mortality of adults (Leptich and Zager 1991, Unsworth et al. 1993). However, hunting mortality can be managed by manipulating hunter numbers and success through changes in season timing and length, sex and antler point restrictions, legal hunting equipment and techniques, road densities, cover amounts and juxtaposition, and controlled-hunts (Thomas 1991, Unsworth et al. 1993, Gratson and Whitman 2000). In contrast, information pertaining to predicting and managing elk recruitment both across geographic areas and within populations is generally lacking.

There are a number of demographic parameters that may affect elk recruitment such as pregnancy rates, birth rates, and calf survival. This study addresses calf survival rates. Elsewhere, we address elk recruitment from a statewide, broad-scale perspective, investigating patterns of calf:cow ratios (Bomar 2000) and questions of pregnancy, birth rates, and cow condition (Zager and White 2004; Job 1, this report).

The objectives of this study are to determine:

1. Factors influencing variation in calf survival rates and causes of mortality.

2. Effects of predation by black bears and mountain lions on recruitment rates.

We are also attempting to develop methods to index black bear and mountain lion population status and trends.

Study Areas and Methods

The Lochsa/North Fork study area includes the south-central portion of GMU 10 and the north-central portion of GMU 12. Calf:cow ratios are low in GMUs 10 and 12 and have been declining since the early 1990s. Recruitment is inadequate to replace losses of adults. Further details of this area are provided in Gratson and Zager (1998).

Beginning in fall 1999, we implemented a predator reduction "treatment" on the Lochsa portion of the study area. A bag limit of 2 bears and 2 lions per year was available for hunters within the 699 km^2 treatment area. To further affect this treatment, beginning with the spring 2001 season, the Department offered non-resident reduced bear and mountain lion tags valid in the Lolo, Selway, and Middle Fork zones. Non-resident hunters could purchase up to 2 bear and 2 mountain lion tags, valid only for these zones, at a significantly reduced cost.

In contrast, a bag limit of 1 bear and 1 lion per year was maintained within the 1,333 km^2 North Fork control area. Bear seasons were further extended in Unit 10 and 12 from 1 April to 30 June and 30 August to 3 November. Lion seasons extended from 30 August to 31 March.

The main South Fork study area consists generally of the northern half of GMU 15. Calf:cow ratios are stable and have averaged 30-35 since the early 1990s. Recruitment is adequate to replace losses of adults. Further details of the main South Fork study area are presented in Gratson and Zager (1998).

Beginning in fall 1999, we implemented a predator increase "treatment" on the north side of the South Fork study area. Legal harvest of bear and lion was eliminated within the 574 km^2 treatment area. In contrast, the traditional bag limit of 1 bear and 1 lion per year was maintained on the south side of the South Fork (1,357 km^2 control area). Bear seasons extended from 15 April to 15 May and 30 August to 31 October. Lion seasons extended from 15 September to 31 March. The bear and lion take season on the treatment area in GMU 15 was restored to pre-treatment levels during fall 2004.

Elk Capture and Monitoring

Details of capture and monitoring neonate elk calves are provided in Gratson and Zager (1998). Because use of Johnson's (1951) aging criteria alone can result in uncertain calf ages, we are developing an aging technique in collaboration with others (Montgomery et al. 2003) using known-aged calves from captive elk herds near LaGrande, Oregon, and Moscow, Idaho (Gratson and Zager 1999).

Predators

Black Bears

We continue to use harvest data, bait station surveys, a mark-recapture index, and an index based on observations during calf capture to monitor black bear population status and trend. Methods are detailed in previous reports (Gratson and Zager 1999, Zager and Gratson 2001).

Mountain Lions

We initiated a mountain lion population survey in 1999 on the Lochsa/North Fork study area using network sampling methodology (Becker et al. 1998) rather than linear transects (Becker 1991, Van Sickle and Lindzey 1991). That approach and those data are presented in Gratson and Zager (1999). That effort was not repeated.

We renewed efforts to index mountain lion populations during 2001-2002. Methods and approximate cost of DNA analysis are detailed in previous reports (Zager et al. 2002, Zager and White 2003). Modifications to the rub station methods were initiated during the 2004 summer field season and are described elsewhere (Zager and White 2004).

Elk and Alternate Prey Numbers

In February 2002 and January and February 2003, regional wildlife personnel conducted population surveys of elk in GMUs 10, 12, and 15 using traditional sampling and sightability methods (Unsworth et al. 1994). They also conducted "composition surveys" (using a modified, less intensive survey protocol) in these GMUs during 2004 and 2005. Poor weather (an exceptionally mild winter) precluded a meaningful aerial survey in GMU 15 during winter 2004-2005. Deer survey data have been collected on the main South Fork study area using traditional sampling and sightability methods in January 1998 and 2000.

Results and Discussion

In 2005, we captured and radio-collared 7 calves (4 male, 3 female) on the North Fork control area and 21 calves (7 male, 12 female, 2 unknown) on the Lochsa treatment area. Calves were captured from 1-10 June. We did not capture calves on the South Fork study area in 2005.

In 2004, we captured and radio-collared 19 calves (9 male, 10 female) on the South Fork treatment area, 11 calves (7 male, 4 female) on the South Fork control area, 6 calves (3 male, 3 female) on the North Fork control area, and 27 calves (15 male, 12 female) on the Lochsa treatment area (Zager and White 2004).

Age and Condition

The precise age of wild calves at capture is unknown. Montgomery (2005) developed aging criteria for wild calves using known-aged calves from captive herds in Moscow, Idaho, and LaGrande, Oregon. Known-aged calf data include approximately 676 captures during which incisor eruption and hoof growth line were recorded, 334 captures during which leg and foot measurements were additionally recorded, and 50 captures during which navel, umbilical cord, dewclaw, hoof, stability, and stature characteristics were also recorded.

Characterizing condition of calves depends on knowing capture age of calves. Thus, we have not predicted day-old weights of calves captured during 1999-2004. That analysis will occur over the next year.

In addition to birth weight or weight adjusted to body frame size, blood constituents may provide information on overall body condition of calves. For wild calves captured in 2001, trace mineral and serum parameters are presented in Tables 5 and 6. Calves from a captive herd in Moscow, Idaho, are presented for comparison. Blood parameter values may be influenced by age at capture as well as nutrition and condition of the calves, and few standards exist for elk related to age, nutrition, or condition. To reduce handling time and resultant stress on calves, we stopped collecting blood samples in 2001.

Survival and Causes of Mortality

Survival of neonate radio-collared calves captured in 2005 between capture and 1 August was 0.00 ± 0.00 ($n = 7$) for the North Fork control and 0.70 ± 0.14 ($n = 21$) for the Lochsa treatment (Table 7). Previous years are also presented for comparison.

Annual survival of calves captured in 2004 was 0.52 ± 0.14 on the South Fork, 0.83 ± 0.17 for North Fork calves, and 0.51 ± 0.09 for Lochsa calves (Table 8).

Proximate causes of mortality of calves captured on the North Fork study area in 2005 through 1 August include black bears (66.7%, $n = 4$), wolves (16.7%, $n = 1$), and non-predator (16.7%, $n = 1$) related. Proximate causes of death for Lochsa calves during the same period were black bears (50%, $n = 2$), lions (25%, $n = 1$), and non-predator (25%, $n = 1$) related (Table 9). Annual survival data from previous years are also presented for comparison (Table 10).

Predator Numbers

Black Bears - We saw 61 black bears on the combined North Fork and Lochsa study area during 66.3 hours of flying (Table 11) during calf capture operations (0.92 bears/hour). Black bear bait station results for 2004 are presented and discussed in Zager and White (2004). The 2005 data are not yet compiled.

Mountain Lions - Beginning in 1999, mountain lion populations were manipulated in the Lochsa/North Fork and South Fork study areas by increased, decreased, or stable harvest pressure from sportsmen. Also in 1999, a lion population survey was initiated on the Lochsa/North Fork study area (Gratson and Zager 1999). That effort has not been repeated. Our objective is to develop a monitoring program that would index mountain lion populations in our study areas and could potentially estimate population size.

Darting - During 2003-2004, we deployed 2 hired houndsmen to "tree" lions and collect DNA samples. They also provided a track/mile index. After preliminary analysis of the data (Zager and White 2004), we decided against continuing this effort largely because it wasn't cost effective and didn't provide the necessary data. The scope of the project needs to be expanded considerably to produce potentially meaningful data.

Harvest - During the 2003-2004 harvest season, 82% of Big Game Mortality Reports (BGMR) submitted (32 of 39) by vendors for lions harvested in GMUs 10, 12, and 15 were accompanied by tissue samples. During the 2002-2003 season, vendors returned 74% of the BGMRs with a tissue sample.

Known legal harvest of mountain lions was slightly higher overall in the study areas during the 2003-2004 (n = 24) season compared to 2002-2003 (n = 21). Since the predator reduction was implemented in 1999-2000, the average harvest in the Lochsa treatment area has increased compared to the 5 years of harvest prior (Table 16). The harvest in the Lochsa/North Fork control area and the South Fork control area declined since the 1999-2000 season. The South Fork treatment area has remained closed.

Rub stations - We also used rub stations in an attempt to index lion populations during the 2003 and 2004 summer field seasons (Zager and White 2004). The method remains unproven and many variables (e.g., choice of lure, individual lion behavior, time of year) may play a role on whether a lion finds, visits, and leaves hair at a rub station. Our attempts to use rub stations as a lion population index were unsuccessful because they provided little useable data. Therefore, they were not continued in 2005.

Elk and Alternate Prey Numbers

Aerial surveys of elk were conducted in GMUs 10, 12, and/or 15 in January and February 2002, 2003, 2004, and 2005 (Table 18). Some of the surveys were conducted to collect trend data only and estimate age composition. Aerial surveys of deer were conducted in GMU 15 in January 1998 and 2000 (Table 19). Use of the mule deer sightability model for white-tailed deer has not been investigated, so bias and precision of the deer abundance index, although less biased and more precise than simple counts, are unknown.

Recommendations

Replicates of predator reduction and predator increase "treatments" should be pursued to avoid the confounding effects of simple geographic area differences rather than predator effects. Less intensive or intrusive methods may be necessary to achieve this and should be explored. If replicates cannot be secured, a "before-during-after control treatment" study design may have to be used. This approach requires estimates of calf survival, cause-specific mortality, calf condition, alternate prey, and predator abundance before, during, and after predator reduction and predator increase "treatments." Alternatively, a cross-over design could be used to address these concerns.

Secondly, bear and lion population indices must be established to verify substantial "treatments" are actually implemented. Work should continue toward a useful index of bear and lion population status and trend.

With the establishment of wolves in these ecosystems, it is important to continue monitoring neo-natal calves. Work in the Yellowstone Ecosystem indicates that wolves have a significant impact on elk calves and, therefore, population trajectories.

Finally, although substantial time and effort has gone into investigating condition of calves at capture as it relates to subsequent survival and cause-specific mortality, it might be argued that nutrition "*well after*" birth may better explain differences between study areas in survival of calves after most of the bear predation is over. Data regarding condition of calves during late summer/early fall are needed to address this question. Those data will be difficult and expensive to develop.

ACKNOWLEDGMENTS

Financial support was provided by the Idaho Department of Fish and Game with funds from the Federal Aid in Wildlife Restoration Program (Project W-160-R-32), the Rocky Mountain Elk Foundation, and Safari Club International. We thank members of our crew that included Jeff Lonneker, Nathan Borg, Craig Holmberg, Jeremy Smith, Josh Vale, Mackenzie Shardlow, Karen Fowler, Troy Hinck, and Cody McKee; members of the Department staff in the Clearwater Region for their help conducting black bear bait-station routes; Tim Craig (Boulder Creek Outfitters), Rick Armiger (Cayuse Outfitters), and Robin Kohl (Kohl's Outfitters) for use of cabin facilities; and the U.S. Forest Service, Clearwater, and Nez Perce national forests, for administrative access and use of the Wilderness Gateway camping facilities, Kelly Creek Ranger Station, and Weitas Guard Station. We also acknowledge the cooperation and assistance of Louie Turcott, Joseph Peterson, Gerald Cross, DeLoss Aldrich, Don Haukedahl, Dan Baldwin, Bob Jackson, Sherri Nygaard, Barb and Harlan Updahl, and Al Lance. Fecal steroid analyses were conducted by Dr. Steve Monfort's lab at the Conservation and Research Center at Front Royal, VA. The Holm Lab at the University of Idaho processed livers and certain blood samples. Bio-tracking, Inc., Moscow, analyzed PSPB concentrations in cow serum samples. Dr. Lisette Waits' lab processed hair and fecal DNA samples.

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Table 1. Body condition score (BCS), average weight, pregnancy rate, average age, blood selenium level, and fecal glucocorticoid (FG) levels for adult cow elk (>2 years old) captured on the Lochsa, North Fork, and South Fork study areas during March 1997, 1998, 2002, 2003, 2004, and 2005. Standard deviations are in parentheses.

Study area Year	BCS[a]	BCS[b]	Average weight[c] (kg)	Pregnancy rate (%)	Average age (years)	Se level (µg/gm)	FG[d] (ng/gm)	No. of animals
Lochsa								
1997	6.1 (1.92)		252 (20.94)	71	10.8 (4.44)	0.026 (0.017)	92.58 (40.91)	17
2002	7.2 (1.32)	2.3 (0.46)	220 (65.40)	100	12.1 (3.93)	0.090 (0.027)	101.02 (38.65)	10
2004	8.9 (1.72)	3.2 (0.68)	251 (16.95)	79	11.5 (5.94)	0.045 (0.033)		24
2005		2.4 (0.43)	225 (9.89)	100	Ad	0.106 (0.07)		4
North Fork								
2002	7.9 (0.99)	2.6 (0.53)	247 (8.37)	100	9.4 (2.88)	0.100 (0.029)	32.84 (4.47)	8
2004	8.9 (1.93)	3.2 (0.74)	259 (9.09)	77	11.4 (5.11)	0.120 (0.137)		22
2005		2.5 (0.35)	210 (20.67)	100	Ad	0.079 (0.012)		4
South Fork								
1997	8.9 (1.16)		250 (17.50)	89	7.6 (3.75)	0.130 (0.042)	35.12 (8.22)	18
1998	9.8 (1.20)	2.5 (0.81)	254 (24.82)	93	7.8 (2.77)	0.190 (0.125)	43.00 (19.34)	13
2002	9.2 (1.56)	3.4 (0.80)	246 (28.37)	100	5.25 (2.15)	0.120 (0.037)	55.46 (21.57)	16
2003	10.1 (1.96)	3.7 (0.88)	253 (17.10)	79	7.3 (3.95)	0.140 (0.14)	29.80 (13.67)	15
2004	9.9 (1.95)	3.4 (1.09)	265 (22.81)	100	7.3 (3.35)	0.170 (0.098)	[d] [d]	7

[a] After Gerhart et al. 1996.
[c] After Cook et al. (2003), corrected to represent a sternally recumbent animal.
[d] After Millspaugh et al. 2001.
[b] Rump measure only (after Cook and Cook pers. comm.), so not comparable to BCS from previous years.

Table 2. Serum parameters for adult cow elk captured on the Lochsa and South Fork study areas during March 1998 and 2002. Standard deviations are in parentheses. March 2003, 2004, and 2005 samples have been archived.

	Lochsa			North Fork		Lochsa & North Fork		South Fork			
Parameter	1998	2002		2002		2002		1998		2002	
Triglycerides (mg/dL)	63.00	36.60	(15.65)	50.89	(19.06)	43.37	(18.38)	83.07	(40.77)	55.05	(27.95)
Cholesterol (mg/dL)	82.00	65.40	(11.32)	70.56	(10.84)	67.84	(11.10)	75.14	(29.76)	66.60	(10.95)
Triiodothyronine (ng/dL)	71.00	62.20	(12.99)	54.78	(16.73)	58.68	(14.94)	51.57	(23.27)	53.85	(10.95)
Cortisol (µg/dL)	6.20	3.47	(0.60)	4.03	(1.32)	3.74	(1.02)	3.20	(2.19)	3.01	(0.97)
Urea Nitrogen (mg/dL)	8.00	10.30	(4.45)	11.89	(4.40)	11.05	(4.38)	15.93	(7.33)	15.10	(4.98)
Creatinine (mg/dL)	3.50	2.97	(0.44)	3.00	(0.32)	2.98	(0.38)	2.58	(0.74)	3.22	(0.40)
Total Protein (g/dL)	7.50	6.15	(0.46)	5.92	(0.39)	6.04	(0.43)	7.11	(2.16)	7.01	(0.48)
Sodium (mEq/L)	142.00	141.60	(4.38)	141.78	(3.15)	141.68	(3.74)	133.93	(3.41)	146.55	(6.17)
Potassium (mEq/L)	6.10	4.68	(0.69)	4.57	(0.58)	4.63	(0.63)	5.58	(1.37)	7.20	(1.19)
Calcium (mg/dL)	9.70	9.69	(0.35)	10.10	(0.55)	9.88	(0.49)	8.82	(2.54)	10.74	(0.90)
Phosphorus (mg/dL)	9.10	4.50	(0.41)	4.08	(0.77)	4.30	(0.63)	6.48	(2.45)	5.73	(0.80)
No. animals	1	10		9		19		14		20	

Table 3. Trace element levels in adult (>1.5 years old) cow elk sampled during winter. Standard deviations are in parentheses.

Element[a]	GMU 12[b] (n = 56)	GMU 10[c] (n = 30)	GMU 15[d] (n = 77)	GMU 62[e] (n = 11)	GMU 67[e] (n = 35)	GMU 32A[f] (n = 20)
Selenium	0.048 (0.036)	0.115 (0.115)	0.131 (0.074)	0.112 (0.038)	0.164 (0.108)	0.123 (0.117)
Calcium	102.000 (9.825)	100.700 (7.918)	107.108 (8.444)	89.860 (3.674)	87.468 (16.924)	99.800 (4.188)
Copper	0.694 (0.110)	0.720 (0.109)	0.725 (0.110)	0.801 (0.146)	0.788 (0.151)	0.743 (0.126)
Iron	1.792 (0.480)	1.510 (0.357)	1.925 (1.397)	1.373 (0.649)	1.526 (0.606)	2.070 (0.526)
Magnesium	28.500 (3.131)	28.600 (4.702)	28.405 (2.914)	20.000 (0.649)	21.625 (2.537)	28.300 (2.849)
Phosphorus	54.852 (12.950)	49.600 (8.224)	67.554 (11.767)	34.429 (10.628)	41.313 (16.912)	74.400 (10.733)
Zinc	0.652 (0.110)	0.620 (0.108)	0.607 (0.115)	0.509 (0.100)	0.480 (0.126)	0.646 (0.090)

[a] Selenium is based on whole blood, whereas all others are serum values. All units are µg/gm. Approximate adequate ranges provided by the Analytical Sciences Laboratory at the University of Idaho are as follows: Selenium 0.100-0.300 µg/gm; calcium 90-128 µg/gm; copper 0.60-1.20 µg/gm; iron 0.64-1.68 µg/gm; magnesium 18-32 µg/gm; phosphorus 55-120 µg/gm; zinc 0.70-1.50 µg/gm.
[b] GMU 12 values are based on data collected in March 1997, 2002, and 2004.
[c] GMU 10 values are based on March 2002 and 2004 captures.
[d] GMU 15 values are based on March 1997, 1998, 2002, 2003, and 2004 data.
[e] GMUs 62 and 67 values are based on data collected in 2001 and 2002.
[f] GMU 32A values are from a March 2003 capture.

Table 4. Elk pregnancy rates determined from progesterone metabolite levels in fecal samples collected during winter from 3 north-central Idaho study areas. Elk were considered pregnant if $P_4 \geq 1.4$. Sample sizes are in parentheses.

	Pregnancy rate		
Year	South Fork	Lochsa	North Fork
1999	79.6 (49)	76.1 (46)	
2000	79.7 (59)	75.0 (52)	100.0 (2)
2001	66.0 (50)	84.2 (57)	100.0 (16)
2002[a]			
2003	39.7 (58)	66.1 (62)	84.0 (50)
2004	48.0 (53)	70.0 (50)	32.0 (50)

[a] An equipment problem resulted in loss of the 2002 samples.

Table 5. Blood trace mineral levels (mean µg/g ± SD below) in elk neonates at capture (sample size in parentheses).

Year Area	Mineral level[a] Se[b]	 Zn	 P	 Fe[c]	 Mg	 Cu	 Ca
1997							
Lochsa	0.006	0.47	96.8	2.9	23.1	0.61	132.3
(23)	0.006	0.24	21.6	1.9	2.5	0.23	11.9
South Fork	0.017	0.58	92.6	2.8	22.1	0.63	129.0
(28)	0.016	0.25	15.9	1.9	2.5	0.29	12.3
1998							
Lochsa	0.010	0.45	84.9	2.5	20.2	0.66	115.3
(20)	0.009	0.29	19.1	2.3	2.9	0.36	10.4
South Fork	0.022	0.41	85.0	2.3	21.2	0.63	120.3
(26)	0.009	0.23	11.6	1.9	2.6	0.33	10.0
1999							
North Fork	0.013	0.66	98.0	3.4	21.2	0.74	119.8
(15)	0.004	0.26	17.0	1.7	2.8	0.38	11.6
Lochsa	0.015	0.94	98.4	2.7	21.1	0.59	119.9
(15)	0.009	1.40	14.4	1.8	2.7	0.22	11.7
South Fork	0.039	0.72	108.1	3.5	23.8	0.83	129.6
(20)	0.012	0.31	19.5	1.9	2.8	0.36	13.3
Moscow[d]		0.47	99.3	2.4	20.2	0.57	119.9
(9)		0.25	11.2	1.4	2.5	0.32	10.4
2000							
North Fork	0.010	0.57	95.3	2.8	21.3	0.64	118.1
(15)	0.010	0.30	21.4	1.8	2.6	0.21	10.9
Lochsa	0.044	0.51	99.3	3.2	21.3	0.66	120.7
(15)	0.018	0.28	14.4	1.9	2.7	0.20	8.1
South Fork	0.038	0.66	104.9	2.9	21.6	0.75	117.7
(18)	0.034	0.23	12.6	1.7	1.6	0.19	6.5
2001							
North Fork	0.008	0.46	94.7	2.7	21.4	0.65	108.7
(9)	0.005	0.18	19.1	2.3	2.3	0.24	5.9
Lochsa	0.022	0.44	88.8	2.9	19.2	0.62	108.3
(12)	0.009	0.21	8.9	1.4	1.9	0.19	8.9
South Fork	0.028	0.46	90.1	1.3	20.3	0.50	108.4
(30)	0.013	0.23	12.2	1.4	1.7	0.18	6.6

[a] Se = selenium; Zn = zinc; P = phosphorus; Fe = iron; Mg = magnesium; Cu = copper; and Ca = calcium.
[b] Used 0.004 µg/g for individual Se values that were below estimated detection limits (0.005 µg/g) to calculate mean and SD.
[c] Used 0.021 µg/g for individual Fe values that were below estimated detection limits (0.22 µg/g) to calculate mean and SD.
[d] Calves given Se injection shortly after birth.

Table 6. Blood serum parameters (mean ± SD below) for elk neonates at capture (sample size in parentheses).

Year Area	Parameter[a]										
	TRIG	CHOL	T3	CORT	UN	CREAT	TP	NA	K	CA	P
1997											
Lochsa	48.4	44.9	381	7.48	15.68	1.15	5.47	144.0	5.32	9.9	8.8
(25)	33.9	13.8	114	4.19	6.07	0.36	0.65	3.0	0.85	0.8	2.1
South Fork	43.5	42.3	404	5.87	13.28	0.96	5.87	147.0	5.03	10.8	8.9
(29)	15.8	9.5	109	2.33	4.56	0.35	0.65	3.8	0.53	1.0	1.5
1998											
Lochsa	46.7	40.3	342	5.67	15.40	1.66	5.67	141.0	4.76	10.5	9.2
(20)	21.1	15.9	71	2.53	5.27	0.90	1.08	3.1	0.48	0.8	2.1
South Fork	41.2	41.8	371	3.96	13.36	1.23	6.07	141.0	4.46	10.4	8.9
(28)	26.4	13.1	120	1.58	3.93	0.30	0.72	4.5	0.38	0.7	1.2
1999											
North Fork	54.8	43.1	384	4.59	14.07	1.16	5.61	144.0	4.71	10.7	9.5
(15)	34.1	13.8	126	2.42	5.52	0.57	1.21	4.0	0.32	0.9	1.6
Lochsa	41.1	44.4	392	5.33	13.73	1.13	5.99	144.0	4.63	10.8	9.6
(15)	16.0	93.9	136	2.26	4.76	0.39	0.63	3.1	0.38	0.9	1.0
South Fork	37.2	40.6	348	4.31	14.30	1.17	6.02	148.0	4.77	10.8	10.1
(20)	20.5	8.7	114	1.47	3.06	0.31	0.41	3.5	0.38	0.6	1.9
Moscow	41.6	44.7	333	4.90	18.65	1.31	5.98	146.0	4.63	10.1	9.6
(17)	21.7	13.8	101	3.25	10.85	0.42	1.16	10.2	0.73	1.2	1.7
2000											
North Fork	57.6	39.0	334	3.66	15.80	1.31	5.94	148.0	4.68	11.2	8.9
(15)	32.9	11.0	52	1.73	4.61	0.61	1.01	3.3	0.42	1.1	2.0
Lochsa	51.3	43.0	380	4.40	17.60	1.14	6.21	147.0	4.91	11.3	9.2
(15)	29.8	10.0	99	2.93	4.63	0.37	0.71	3.3	0.59	0.8	1.5
South Fork	33.2	43.0	281	1.99	17.70	1.09	5.98	145.0	4.57	11.0	10.6
(18)	11.0	13.0	103	1.18	9.23	0.17	0.52	3.7	0.43	0.9	1.4

[a] TRIG = triglycerides (mg/dl); CHOL = cholesterol (mg/dl); T3 = triiodothyronine (µg/ml); CORT = cortisol (mg/dl); UN = urea nitrogen (mg/dl); CREAT = creatinine (mg/dl); TP = total protein (g/dl); NA = sodium (meq/l); K = potassium (meq/l); CA = calcium (mg/dl); P = phosphorus (mg/dl).

Table 7. Survival rates (SE in parentheses) of radio-collared elk neonates from capture to 1 August 2005.

Year	Survival rate[a]					
	North Fork		Lochsa		South Fork	
1997			0.27	(0.09)	0.73	(0.08)
n			27		31	
1998			0.27	(0.10)	0.58	(0.10)
n			20		28	
1999	0.31	(0.11)	0.45	(0.13)	0.84	(0.08)
n	16		15		22	
2000	0.59	(0.13)	0.53	(0.13)	0.75	(0.10)
n	15		15		18	
2001	0.67	(0.16)	0.40	(0.16)	0.21	(0.07)
n	9		11		30	
2002					0.38	(0.09)
n					29	
2003					0.46	(0.09)
n					33	
2004	0.83	(0.15)	0.82	(0.08)	0.65	(0.10)
n	6		25		30	
2005	0.00	(0.00)	0.70	(0.14)		
n	7		21			

[a] Excludes deaths associated with abandonment by cow presumably related to capture.

Table 8. Annual survival rates (SE in parentheses) of radio-collared elk calves.

	Survival rate[a]		
Year	North Fork	Lochsa	South Fork
1997		0.06 (0.06)	0.56 (0.14)
n		27	31
1998		0.16 (0.11)	0.43 (0.33)
n		20	28
1999	0.08 (0.08)	0.21 (0.11)	0.72 (0.11)
n	16	15	22
2000	0.13 (0.12)	0.27 (0.13)	0.29 (0.11)
n	15	15	18
2001	0.42 (0.18)	0.40 (0.18)	0.14 (0.06)
n	9	11	30
2002			0.28 (0.09)
n			29
2003			0.33 (0.10)
n			33
2004	0.83 (0.17)	0.51 (0.09)	0.52 (0.14)
n	6	24	30

[a] Excludes deaths associated with abandonment by cow presumably related to capture.

Table 9. Proximate cause of death of radio-collared elk neonates (%) from capture to 1 August 2005.

	Percent[a]		
Cause of death[b]	North Fork	Lochsa	South Fork
Bear	66.7	50.0	
Lion	0	25.0	
Wolf	16.7	0	
Unknown predator	0	0	
Unknown[c]	0	0	
Non-predation	16.7	25.0	

[a] Total number of calf mortalities = 10.
[b] Tentative identification of causes of death; excludes deaths related to abandonment by cow presumably related to capture.
[c] Unknown whether predation or not.

Table 10. Proximate cause of death of radio-collared elk calves (%) from capture to 1 June of the following year. Reported numbers may differ slightly from previous progress report numbers.

	North Fork				Lochsa						South Fork							
Cause of death[a]	1999	2000	2001	2004	1997	1998	1999	2000	2001	2004	1997	1998	1999	2000	2001	2002	2003	2004
Accident	0	0	0	0	10.0	0	0	0	0	8.3	0	8.3	0	0	0	0	0	
Disease/starvation	0	0	0	0	0	0	0	0	0	16.7	7.7	0	0	0	0	0	0	
Unknown[b]	14.3	0	33.3	0	0	0	9.1	10.0	14.3	16.7	7.7	8.3	25.0	8.3	0	11.8	5.9	
Predation																		
Bear	50.0	10.0	50.0	0	50.0	53.3	54.5	40.0	57.1	0	46.2	25.0	25.0	16.7	76.2	29.4	23.5	18.2
Lion	35.7	90.0	16.7	0	40.0	46.7	27.3	40.0	14.3	25.0	30.7	41.7	50.0	41.7	23.4	35.3	41.2	36.4
Wolf	0	0	0	0	0	0	0	0	14.3	0	0	0	0	0	0	0	0	
Bobcat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.9	
Coyote	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.1
Unknown[c]	0	0	0	100	0	0	9.1	10.0	0	33.3	0	8.3	0	16.7	0	23.4	17.6	27.3
Gunshot	0	0	0	0	0	0	0	0	0	0	7.7	8.3	0	16.7	0	0	5.9	9.1
Total mortalities	14	10	6	1	20	15	11	10	7	12	13	12	4	12	21	17	17	11

[a] Tentative identification of causes of death; excludes deaths related to abandonment by cow presumably related to capture.
[b] Cause of death unknown.
[c] Predation but unknown species.

Table 11. Black bear observations on combined Lochsa/North Fork and South Fork study areas during aerial calf capture operations.

Year	Lochsa/North Fork (combined)	Lochsa (treatment)	North Fork (control)	South Fork
1997				
Bears/flying hour	1.68			0.09
Bear observations	94			7
1998				
Bears/flying hour	1.84			0.11
Bear observations	107			6
1999				
Bears/flying hour	1.15			0.12
Bear observations	60			7
2000				
Bears/flying hour	0.94			0.24
Bear observations	40			12
2001				
Bears/flying hour	0.85	0.62	1.14	0.09
Bear observations	46	16	30	4
2002				
Bears/flying hour				0.13
Bear observations				9
2003				
Bears/flying hour				0.05
Bear observations				3
2004				
Bears/flying hour	0.64	0.59	0.76	0.13
Bear observations	36	25	11	6
2005				
Bears/flying hour	0.92			
Bear observations	61			

Table 12. Black bear population index (bears/square km) based upon a mark-recapture analysis of the proportion of tetracycline-laced baits taken at stations distributed across each north-central Idaho study area, 1997-2004. Values should be interpreted as a population index rather than a density. Adapted from Garshelis and Visser (1997).

	South Fork		Lochsa/North Fork	
Year	Control	Treatment	Control	Treatment
1997-1998	0.26	0.61	[a]	0.55
1998-1999	0.53	0.29	[a]	0.55
1999-2000[b]	0.20	[c]	1.18	0.23
2000-2001	0.34	[c]	0.48	0.28
2001-2002	0.44	[c]	1.07	0.22
2002-2003	0.17	[c]	0.35	0.36
2003-2004				

[a] There were no recaptures; therefore, a calculated index is meaningless.
[b] Fall 1999 was the first hunting season under the population manipulation.
[c] Very few bears were in the reported harvest (3 in 1999-2000, 2 in 2000-2001, and zero in 2001-2002) because the season was closed.

Table 13. Data used to calculate a black bear population index based upon a mark-recapture evaluation of the proportion of tetracycline-laced baits taken at stations distributed across each north-central Idaho study area, 1997-2004. Adapted from Garshelis and Visser (1997).

Year	Harvest season	Potential marks	Total harvest	Number of recaptures	Percent recaptures	Population index
South Fork control area						
1997	F97-S98	94	15	4	26.7	0.26
1998	F98-S99	65	11	1	9.1	0.53
1999[a]	F99-S00	72	15	4	26.7	0.20
2000	F00-S01	65	7	1	14.3	0.34
2001	F01-S02	50	12	1	9.1	0.44
2002	F02-S03	56	12	3	25.0	0.17
2003	F03-S04	70				
South Fork treatment area						
1997	F97-S98	51	12	4	33.3	0.27
1998	F98-S99	29	12	5	41.7	0.12
1999[a]	F99-S00	27	3	2	66.7	[b]
2000	F00-S01	32	2	1	50.0	[b]
2001	F01-S02	35	1	0	0.0	[b]
2002	F02-S03	46	1	0	0.0	
2003	F03-S04	58				
Lochsa/North Fork control area						
1997	F97-S98	51	66	0	0.0	[c]
1998	F98-S99	85	70	0	0.0	[c]
1999[a]	F99-S00	63	50	2	4.0	1.18
2000[d]	F00-S01	50	38	3	7.9	0.48
2001	F01-S02	54	53	2	3.8	1.07
2002	F02-S03	64	87	12	13.8	0.35
2003	F03-S04	60				
Lochsa/North Fork treatment area						
1997	F97-S98	43	27	3	11.1	0.55
1998	F98-S99	35	44	4	9.1	0.55
1999[a]	F99-S00	22	29	4	13.8	0.23

Table 13. Continued.

Year	Harvest season	Potential marks	Total harvest	Number of recaptures	Percent recaptures	Population index
2000[d]	F00-S01	20	69	7	10.1	0.28
2001	F01-S02	18	61	7	11.5	0.22

[a] Fall 1999 was the first hunting season under the population manipulation.
[b] Very few bears were in the reported harvest (3 in 1999-2000 and 2 in 2000-2001) because the season was closed.
[c] There were no recaptures; therefore, a calculated index is meaningless.
[d] Spring 2001 included reduced non-resident tag fees and increased outfitter assistance.

Table 14. Percent visitation (sample size in parentheses) of tetracycline-laced bait routes by black bears in portions of GMUs 10, 12, and 15 during 1997-2004.

	Lochsa/North Fork Routes			South Fork Routes		
1997	Control	Treatment	Difference	Control	Treatment	Difference
Trails	75 (12)	89 (9)	-14	67 (6)	100 (2)	
Closed roads	0 (0)	0 (0)		100 (6)	100 (4)	0
Open roads	53 (15)	78 (9)	-25	80 (35)	76 (21)	4
1998						
Trails	81 (21)	83 (6)	-2	100 (5)	0 (0)	
Closed roads	100 (2)	0 (0)		80 (5)	100 (1)	-20
Open roads	63 (16)	80 (15)	-17	70 (33)	54 (28)	16
1999						
Trails	86 (14)	86 (7)	0	80 (5)	0 (0)	
Closed roads	0 (0)	0 (0)		100 (5)	75 (4)	25
Open roads	72 (18)	50 (8)	22	69 (29)	54 (22)	15
2000						
Trails	76 (21)	71 (7)	5	67 (3)	100 (1)	
Closed roads	0 (0)	0 (0)		100 (7)	67 (3)	33
Open roads	53 (18)	46 (13)	7	66 (32)	57 (23)	9
2001						
Trails	75 (20)	63 (8)	12	100 (2)	0 (0)	
Closed roads	0 (0)	0 (0)		100 (5)	100 (5)	0
Open roads	57 (21)	41 (17)	16	52 (31)	57 (21)	-5
2002						
Trails	85 (15)	80 (5)	5	0 (1)	0 (0)	
Closed roads	0 (0)	0 (0)		100 (1)	100 (4)	0
Open roads	78 (18)	60 (15)	18	82 (34)	84 (19)	-2
2003						
Trails	72 (18)	86 (7)	-14	100 (2)	0 (0)	100
Closed roads	100 (1)	0 (0)	100	75 (4)	100 (5)	-25
Open roads	68 (22)	(19)	31	74 (31)	77 (22)	-3
2004						
Trails	88 (18)	100 (6)	-14	100 (1)	0 (0)	
Closed roads	0 (0)	0 (0)		83 (6)	100 (3)	-17
Open roads	60 (20)	63 (16)	-3	68 (31)	56 (25)	

Table 15. Mountain lion tracking and treeing results across each north-central Idaho study area during the 2002-2003 and 2003-2004 winter seasons.

Year	Tracks[a]	Miles searched	Tracks/ mile	Chases	Treeing occurrences[b]	Lions treed[c]	Males treed	Females treed	Sex unidentified	Kittens treed	DNA samples obtained
South Fork Control											
2002-2003	23	1,586	0.015	10	8	9	1	5	3	0	5
2003-2004	26	890	0.029	5	2	2	0	1	0	1	1
South Fork Treatment											
2002-2003	26	1,627	0.016	7	5	5	0	5	0	0	4
2003-2004	19	957	0.020	1	1	1	0	0	0	1	0
North Fork Control											
2002-2003	15	544	0.028	4	3	5	1	1	1	2	2
2003-2004	6	563	0.011	3	3	3	1	2	0	0	3
Lochsa Treatment											
2002-2003	22	219	0.100	10	7	9	3	2	1	3	4
2003-2004	6	67	0.089	0	0	0	0	0	0	0	0

[a] Tracks were only counted if <3 days old.
[b] A treeing occurrence is defined as an event in which the hounds treed a lion after a chase.
[c] Includes lions that were possibly captured twice.

Table 16. Average harvest of mountain lions 5 years prior and 5 years after the 1999 regulation increased the bag limit from 1 to 2 lions in the Lochsa treatment portion of the north-central Idaho study areas, 1994-2003.

	South Fork		Lochsa/North Fork	
Seasons averaged	Control	Treatment	Control	Treatment
1994-1998	22	13	10	6
1999-2003	13	0[a]	8	9
Percent Change	-41	-100	-20	50

[a] Area has remained closed to harvest.

Table 17. Visits to rub stations in the Lochsa/North Fork and South Fork study areas during 2002-2004. Rub station density and placement pattern was spatially different in 2004 compared to previous years, so results should be compared with caution.

	Lochsa/North Fork rub stations			South Fork rub stations		
	2002 (n = 25)	2003 (n = 52)	2004 (n = 350)[a]	2002 (n = 27)	2003 (n = 45)	2004 (n = 380)[b]
Rub stations visited	15	25	55	11	29	12
Total visits[c]	28	35	56	12	42	13
Lion	2	0	0	1	1	4
Bear	5	8	22	2	9	3
Possible Lion	2	5	1	2	2	0
Possible Bear	0	1	0	2	3	4
Possible Lion or bear	0	1	0	0	4	0
Unknown	19	18	32	4	23	2
Other	0	1	2	1	0	0
Total DNA samples	10	19	30	5	17	7

[a] Rub stations were distributed on 35 routes; each route had 10 paired rub stations.
[b] Rub stations were distributed on 38 routes; each route had10 paired rub stations.
[c] Represents all visits at rub stations over multiple sampling periods; 2004 had only 1 sampling period.

Table 18. Elk calf:cow ratios for GMUs 10, 12, and 15 during February 2002, January and February 2003, 2004 and 2005.

GMU	Year	Calves:100 cows (estimate)
10	2002[a]	14.9
	2003	20.3
	2004[a]	25.7
	2005[a]	23.4
12	2002	26.8
	2003[a]	30.4
	2004[a]	28.1
	2005[a]	13.9
15	2002[a]	34.8
	2003[a]	27.4
	2004[a]	29.5

[a] During these years, trend surveys were completed to estimate age composition only.

Table 19. Deer index for South Fork study area (GMU 15) in January 1998 and 2000.

Year	Estimate	90% confidence interval
1998	1,554	229
2000	1,223	359

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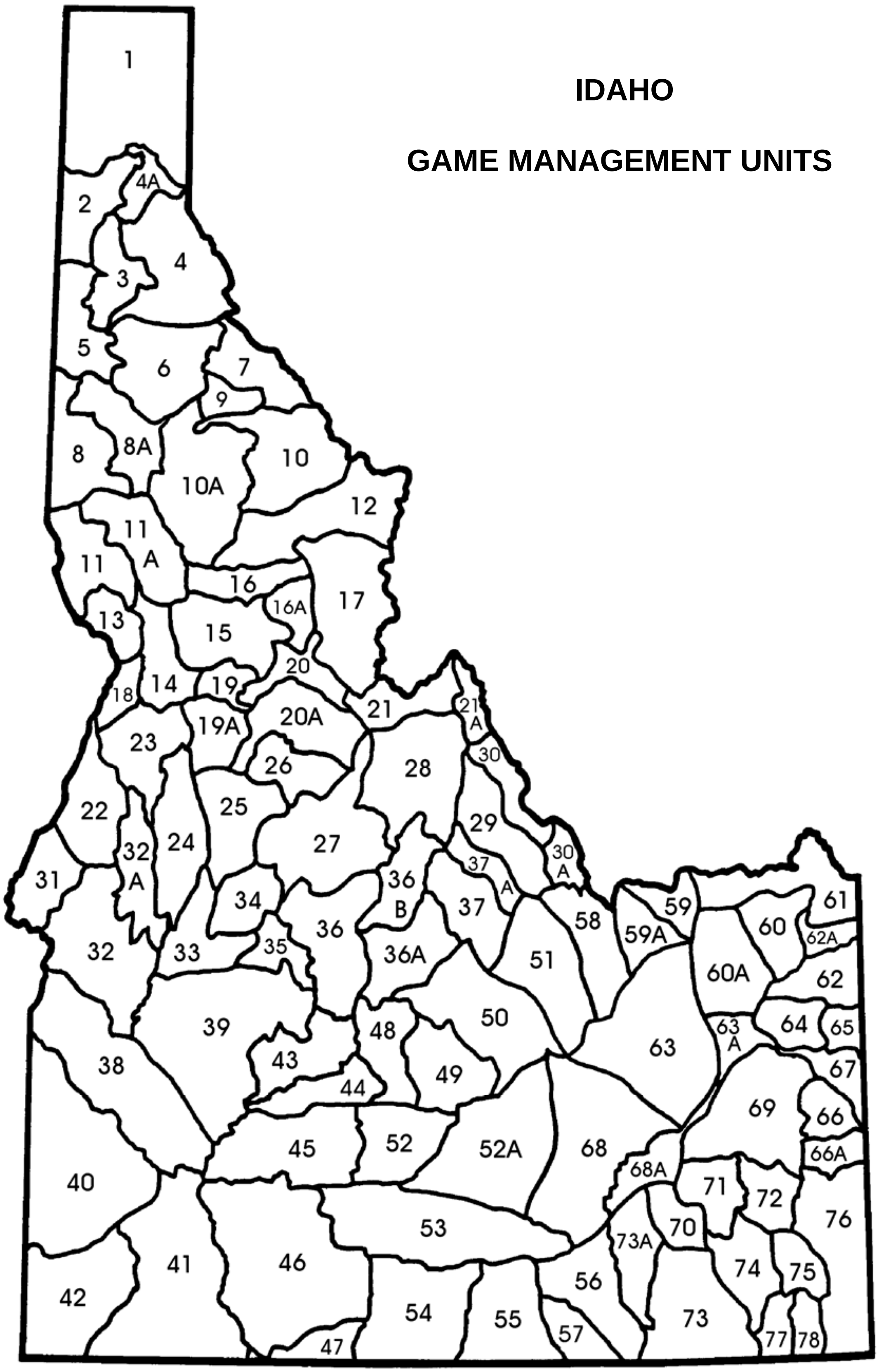
GAME MANAGEMENT UNITS



FEDERAL AID IN WILDLIFE RESTORATION

The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sale of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program then allots the funds back to states through a formula based on each state's geographic area and the number of paid hunting license holders in the state. The Idaho Department of Fish and Game uses the funds to help restore, conserve, manage, and enhance wild birds and mammals for the public benefit. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes necessary to be responsible, ethical hunters. Seventy-five percent of the funds for this project are from Federal Aid. The other 25% comes from license-generated funds.