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WOLVES MUST STAY DELISTED
SUPPORT FOR HB 4040 A
February 15, 2016

Senate Committee on Environment and Natural Resources

Dear Senator Chris Edwards and Senate Committee Members:

From a scientific perspective, Oregon is simply the leading edge of an expanding wolf population moving westward from the Rockies. As such, the state's wolf packs are ready to be delisted so the state wildlife management agency can keep moving towards Phase III and careful management of this species.

A 2009 U.S. Fish and Wildlife Service report states there were between 60,000 and 70,000 wolves in North America at that time, including at least 1,645 in the northern Rocky Mountains recovery area, which is recognized as a southern extension of the large Canadian population. As of 2014, 770 wolves were estimated in Idaho in 104 packs, and this estimate follows six years of regulated hunting and trapping of wolves in that state. Idaho has been, and continues to be, the source population, through dispersal, for wolf re-establishment and range expansion in Oregon. Wolf dispersal capacity has far exceeded expectations, whether looking at movement from Idaho to northeast Oregon or from northeast Oregon to the southern Oregon Cascades. Wolf movements of well over 500 miles have been documented using GPS collars in Oregon.

Our state anticipated an inevitable wolf movement coming from Idaho, and by 2005 had produced and adopted a Wolf Management Plan. This three-phased approach called for evaluating an option for delisting once the criteria were met for Phase II. The criteria state: four breeding packs to successfully rear two or more pups for three successive years.

By 2014, these criteria had been exceeded with nine known successful breeding pairs of wolves in Oregon, including eight packs in northeast Oregon and one in the southern Cascade Mountains. In recent weeks, there have been three new wolf activity areas identified in Southern Oregon. The minimum population is estimated at 81, not counting this year's pups (13 of the 16 documented pairs had litters this year).

Contrary to some claims, delisting does not remove protections for wolves in Oregon. Delisting will, however, allow the Oregon Department of Fish and Wildlife more options for management moving forward. Oregon developed an effective management plan with detailed criteria to recover wolves in this state, while also protecting other wildlife species and agriculture. Following through on the promises made to Oregon's agricultural community will also foster better tolerance of wolves and maintain the credibility of Oregon's Wolf Plan.

It’s vital that we follow the direction of the wolf plan, which was developed with buy-in from many diverse stakeholders, including wolf advocates – some of which have now filed a lawsuit. The Oregon Hunters Association is in support of HB 4040 which ratifies the decision of the state Fish and Wildlife Commission to remove Canis lupus from the state endangered species list.

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# Elk and Predation in Idaho: Does One Size Fit All?

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## Introduction

Predation and predator-prey dynamics are particularly interesting and intriguing aspects of wildlife biology. Though predation is an integral part of population dynamics, the effect of predation on prey populations is less clear, largely because the interaction is complex. For example, the large-ungulate prey base in Idaho includes elk ( *Cervus elaphus*), mule deer ( *Odocoileus hemionus*), white-tailed deer (*O. virginianus*), moose (*Alces alces*), bighorn sheep ( *Ovis canadensis*), mountain goats ( *Oreamnos americanus*) and pronghorn (*Antilocapra americana*). The suite of large predators includes black bears ( *Ursus americanus*), cougars ( *Puma concolor*), coyotes ( *Canis latrans*), bobcats (*Felis rufus*), wolves (*Canis lupus*), and a few grizzly bears (*Ursus arctos*). Furthermore, the dynamics of individual predator and prey species vary across spatial and temporal scales, as do the interactions among those species.

Changing habitats, management philosophies, and social values also cloud our understanding of predator-prey dynamics (Schwartz et al. 2003). Messier (1991) points out that the emphasis on the limiting effects of predation has likely obscured identification and interpretation of other factors that may ultimately regulate prey populations. Consequently, describing and understanding the effect of predators on prey populations is a significant challenge.

To illustrate this, we have assembled relevant data sets for elk in Idaho. The data were collected as part of several Idaho Department of Fish and Game (IDFG) research efforts aimed at understanding bull-elk mortality, elk recruitment and population processes across large spatial scales. The data are from generally comparable telemetry-based projects with objectives related to survival and cause-specific mortality.

Our objective is to review and discuss these data sets within the context of predator-prey dynamics.

## Background

Elk are Idaho's premier big-game animal. The statewide population has increased steadily since the mid-1970s, when hunting for antlerless elk was eliminated throughout most of the state. Idaho elk populations are near all-time highs and are at or near management objectives (Compton 1999). Today, about 125,000 elk are distributed throughout the state from the sagebrush-dominated deserts in southern Idaho to dense, cedar-hemlock forests of the north.

Managing elk populations and their habitats for a sustainable yield is a high priority for management agencies. Habitat-effectiveness models are the primary elk-habitat management tool in the northern Rocky Mountains (Lyon 1979), and harvest is the primary population management tool.

Idaho also supports viable populations of black bears, cougars, coyotes and bobcats. Small populations of grizzly bears occur near the Greater Yellowstone Ecosystem and in the Selkirk and Purcell mountains in northern Idaho. Wolves were reintroduced during 1995 to 1996. The population has grown from 35 to an estimated 512 wolves in 59 packs (Sime and Bangs 2006) distributed across the state.

Approximately 25,000 black bears occur throughout forested habitats in Idaho. Hunter harvest is about 2,000 animals annually, and the populations in most game management unites (GMUs) are considered stable-to-increasing (Nadeau 2005a). Harvest has generally increased since 1994, and management criteria suggest that harvest is "moderate" (Beecham and Rohlman 1994).

Cougars are found throughout Idaho, but they are difficult to monitor because they are secretive, and they occur at low densities. The statewide harvest increased through the late 1990s, peaking in 1997 when 798 animals were reported, then declined to 423 in 2005 (Nadeau 2005b). This suggests that the cougar population has likewise declined over the past decade.

The data sets that we present are derived from localized concern over declining bull-to-cow ratios or poor recruitment and from a general interest in ungulate ecology. Declining bull-to-cow ratios in north and northcentral Idaho in the late 1970s and early 1980s lead to a research effort designed to link elk-population processes with the landscape (Unsworth et al. 1993, Hayes et al. 2002). Hughbanks (1993) conducted a small-scale investigation in southeastern Idaho, and Montgomery (2005) used the combined data to address statewide bull-ecology questions.

Furthermore, concerns related to chronically low or declining calf-to-cow ratios led to two major investigations into the underlying reasons for poor recruitment (Schlegel 1986; Gratson, unpublished report 1992; Zager and White 2003).

More recently, the reintroduction of wolves into Idaho has resulted in renewed interest in broad, ungulate-population ecology and predatory-prey dynamics. In response, the IDFG launched an ambitious research effort in 2005 that includes GMUs (Figure 1) across the state. We provide some preliminary data from that research.

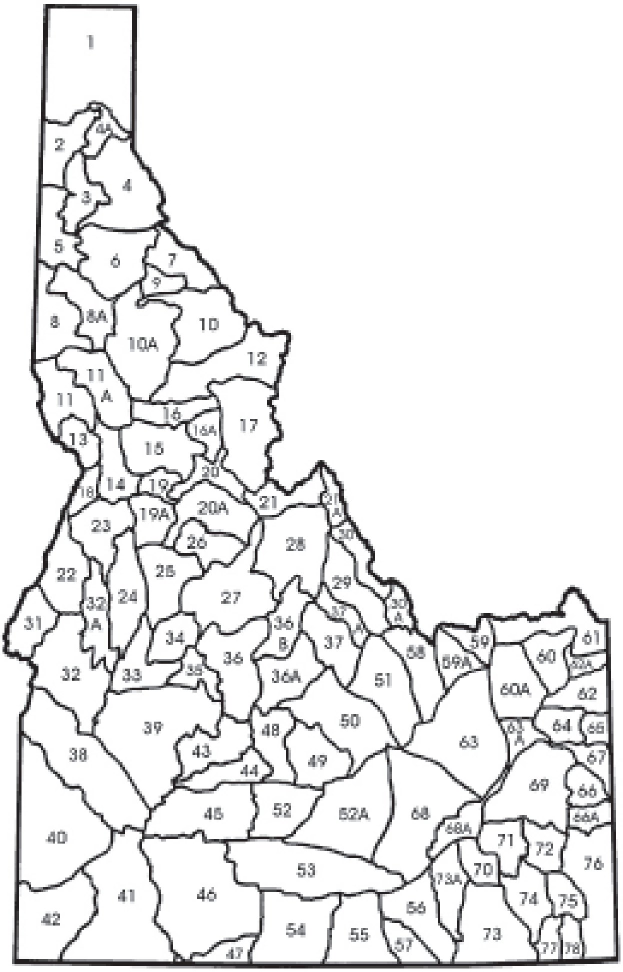
## Results and Data Sets

### *Bulls*

Elk-population growth and expansion was uneven across the state. Also, declining bull-to-cow ratios and quality of bulls in the harvest were evident in northern and northcentral Idaho GMUs by the mid-1980s. In response, IDFG launched projects during 1986 to 1995 in 3 in contrasting study areas (Lochsa study area, GMU 12; Coeur d'Alene study area, GMU 4; Sand Creek study area, GMU 60A) to identify the reasons behind this decline.

Across the 3 study areas, bull survival ranged from 0.54 to 0.69, and more than 80 percent of the mortality was related to hunting (Table 1). Therefore, intensive monitoring was limited to just before, during and immediately after the hunting seasons. Mortalities occurring during other seasons were often not promptly investigated, so determining cause of death was problematic. Other causes of death (less than 10 percent of the total mortality) included, but were not

Figure 1. GMUs as delineated by the Idaho Department of Fish and Game.




limited to, predation. Therefore, predation accounted for less than 10 percent of the annual bull elk mortality on these three study areas during this period.

Furthermore, bull survival on the Lochsa study area was modeled using road density, hunter density and an index of topographic roughness as predictive variables (Unsworth et al. 1993). Survival on the Coeur d'Alene study was predicted by total road density and season timing (Hayes et al. 2002). Predation rate was not an important predictor of bull mortality.

However, the reintroduction of wolves during 1995 to 1996 may alter this dynamic. Smith (2005) reported that wolves in Yellowstone National Park prey

Table 1. Adult male elk annual survival rates and cause-specific mortality in Idaho. The time periods are indicated.

| | | | | | Cause-specific mortality[1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | N[2] | Malnutrition | | | | | | Un- | Total |
| GMU | N[2] | Survival | SE | deaths | disease | Harvest | Other | Bear | Cougar | Wolf | known | predation |
| Panhandle | | | | | | | | | | | | |
| GMU 4 (1988–1990) | 63 | 0.549 | 0.063 | 28 | 0 | 96.4 | 3.6 | | | | | |
| GMU 4 (1991–1994) | 128 | 0.691 | 0.041 | 39 | | 92.3 | 7.7 | | | | | |
| Clearwater | | | | | | | | | | | | |
| GMU 12 (1986–1990) | 169 | 0.600 | 0.063 | 64 | 0 | 90.7 | 9.3 | | | | | |
| GMU 12 (1991–1995) | 231 | 0.634 | 0.065 | 80 | | 98.8 | 1.2 | | | | | |
| Upper Snake | | | | | | | | | | | | |
| GMU 60A (1981–1988) | 66 | 0.543 | 0.116 | 40 | 17.5 | 80 | 2.5 | | | | | |

[1] in percent

[2] N indicates mortalities that were investigated; it does not include censored animals.

upon adult bull elk in proportion to their availability. We currently have no data with which to address this question.

***Cows***

Since 1975, Idaho has managed antlerless elk conservatively, generally resulting in increasing populations and in little interest in data pertaining to survival and to cause-specific mortality of adult female elk. Furthermore, Unsworth et al. (1993) and Leptich et al. (1995) reported adult female elk annual survival rates greater than 0.85 (Table 2). Legal harvest was the primary mortality factor. No predation was documented, but it may have been undetected and reported in the "other" category. Because overall survival was considered adequate, determining mortality factors was a low priority.

More recently, elk populations in several southeastern Idaho GMUs have exceeded management objectives, so harvest goals have been adjusted to reduce the population. The reintroduction of wolves has also created renewed interest in elk population and predator-prey dynamics, and it coincided with IDFG interest in investigating ungulate population dynamics across the range of habitats in Idaho.

Recognizing that ungulate population dynamics likely vary with factors, such as habitat, landscape features, and predator and prey density, multiple study areas were selected to encompass that variability. During the first full year of monitoring (March 2005 to February 2006), preliminary data indicate that adult cow-elk survival ranged from 0.797 to 0.962. Predation (by cougar and wolf) and harvest were the primary proximate mortality factors (Table 2).

Adult-cow survival was less that 80 percent in GMUs 43 and 44, in 10 and 12, and in 60A (Table 2). Coincident with relatively low survival, these populations declined since about 2000 (Compton 2005).

Predation, primarily by wolves, was an important mortality factor in GMUs 43 and 44 (33 percent of the mortality). However, the radio-collared portion of the elk population in GMUs 43 and 44 was concentrated around permanent winter feeding stations, presumably predisposing these animals to predation.

Though predation is the dominant mortality factor for adult cows in GMU 10 and 12, the population decline began in the mid-to-late 1980s, suggesting that factors other than predation initiated the decline.

Body-condition scores (Gerhart et al. 1996; Cook et al. 2001a, 2001b) likely reflect either habitat quality or population density. Because the Lochsa

Table 2. Adult female elk annual survival rates and cause-specific mortality in Idaho. Unless indicated otherwise, the survival period is March 2005-February 2006, cause-specific mortality is derived from March 2005-February 2007.

| | | | | | Cause-specific mortality[1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GMU | N[2] | Survival | SE | N[2] deaths | Malnutrition disease | Harvest[3] | Other[4] | Bear | Cougar | Wolf | Un-known[5] | Total predation |
| Panhandle | | | | | | | | | | | | |
| GMU 4 (1988–1994) | 169 | 0.855 | 0.018 | 23 | | 82.5 | 17.4 | | | | | 0 |
| Clearwater | | | | | | | | | | | | |
| GMU 12 (1986–1990) | 46 | 0.886 | 0.094 | 5 | | 40 | 60 | | | | | 0 |
| GMU 10/12 (2005–2006) | 44 | 0.797 | | 25 | | | 4 | | 4 | 80.2 | 12 | 96 |
| GMU 15 | 33 | 0.878 | | 5 | | | | | 60 | 40 | | 100 |
| GMU 23 | 26 | 0.962 | | 7 | | 42.9 | 57.1 | | | | | 0 |
| Southwestern Idaho | | | | | | | | | | | | |
| GMU 32/32A | 29 | 0.931 | | 7 | | 85.7 | 14.3 | | | | | 0 |
| GMU 39 | 27 | 0.926 | | 6 | | 67 | | | 33 | | | 33 |
| GMU 43/44 | 24 | 0.740 | | 6 | | | 33 | | 16.7 | 33 | 16.7 | 67 |
| Salmon | | | | | | | | | | | | |
| GMU 28 | 28 | 0.893 | | 14 | 7.1 | 57.1 | | | 28.6 | 7.1 | | 35.7 |
| GMU 36A | 31 | 0.806 | | 9 | | 44.4 | | | 33.3 | 11.1 | 11.1 | 55.6 |
| GMU 36B | 31 | 0.839 | | 14 | | 35.7 | 14.3 | | 28.6 | 21.4 | | 50 |
| GMU 50 | 30 | 0.833 | | 5 | | 60 | | | 40 | | | 40 |
| GMU 60A (1981–1988) | 53 | 0.553 | 0.044 | 35 | | 74.3 | 25.7 | | | | | |
| GMU 60A (1981–1988) | 30 | 0.733 | | 6 | 16.7 | 66.7 | | | 16.7 | | | 16.7 |

[1] in percent
[2] N = number of elk years; deaths indicates number of elk that died during the period.
[3] Harvest includes legal harvest, wounding loss and poaching.
[4] Other includes, e.g., vehicle collision, disease ore accident.
[5] Unknown predation includes animals that were killed by a predator, but the species of predator could not be determined with reasonable certainty.

population declined dramatically over the last 20 years, it is more likely that body-condition scores reflect habitat quality in this case.

Body-condition scores for adult female elk were lower in GMUs 10 and 12 than in the other study areas in March 2005 and were lower than GMU 15 in previous sample years pregnancy rates have been variable (Zager and White 2003). If body condition scores reflect habitat quality, it suggests that Lochsa habitats are not as productive as the other study areas, which can result in reduced fecundity, declining recruitment and increased vulnerability to starvation or predation. In fact, Lochsa habitats have changed dramatically during recent decades (U.S. Forest Service 1999). Wildfires in the early 1900s created extensive shrubfields and other early seral habitats used by elk. As these habitats have matured, they became less suitable for elk (Skovlin et al. 2002). Though 96 percent of the mortality is linked to predation, it appears that habitat is contributing indirectly to the elk-population decline in the Lochsa study area.

The elk population in GMU 60A exceeded management objectives. Therefore, the management direction is to increase harvest to bring the population to objective. Lower survival is anticipated and desired under these circumstances.

Cow survival was greater than 80 percent (according to 2005 to 2006 preliminary survival data), and populations were stable-to-increasing since 2000 in the other study areas where recent aerial-survey data are available. Hunter harvest and predation were the primary mortality factors in most of these GMUs. Each of these areas supported viable cougar populations, and wolves were well established by 2000. Predation accounted for approximately 50 percent of the mortality.

### *Calves*

Though elk populations generally increased throughout Idaho after 1975, recruitment remained chronically low in several northcentral Idaho GMUs. Concern over poor recruitment lead to two major investigations into neonatal calf survival and cause-specific mortality in GMUs 10 and 12, the Lochsa study area (Schlegel 1986; Gratson, unpublished report 1992; Zager and White 2003).

During 1973 to 1975, neonatal calf survival from birth to October 1 averaged 37.5 percent. Predation by black bears was the primary proximate cause of mortality (Table 3). In 1976, 75 black bears were removed from the study area. Calf survival increased to 67 percent, then approximated preremoval

Table 3. Survival and cause-specific mortality of elk calves captured and radio-collared as neonates in Idaho. The time periods are indicated.

| | | | | | Cause-specific mortality[1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GMU | N[2] | Survival | SE | N[2] deaths | Malnutrition/ disease | Harvest | Other | Bear | Cougar | Wolf | Un-known | Total predation |
| Lochsa (1973-1975) | 56 | 37.5 | | 35 | 2.9 | 71.4 | 14.3 | | | 11.4 | | 85.7 |
| Lochsa (1976) | 18 | 67 | | 6 | | 83.3 | | | | 16.7 | | 83.3 |
| Lochsa (1979) | 12 | 25 | | 9 | | 33.3 | 55.6 | | 11.1 | | | 100 |
| Lochsa (1997-2004) | 97 | 0.26 | | 62 | | 54.8 | 40.3 | | 1.6 | 3.2 | | 96.7 |
| Lochsa (2000-2004) | 57 | 0.55 | | 21 | 9.5 | 38.1 | 28.6 | 9.5 | 9.5 | 4.8 | | 85.7 |
| South Fork (1996-2004) | 102 | 0.68 | | 30 | 3.3 | 40 | 36.7 | | 10 | 10 | | 86.7 |
| South Fork (2000-2004) | 99 | 0.39 | | 53 | 5.7 | 47.2 | 26.4 | | 13.2 | 7.5 | | 86.8 |
| GMU 28 (2006) | 34 | 50 | | | 5.9 | 23.5 | 11.8 | 17.6 | 35.2 | 5.9 | | 88.1 |
| GMU 36B (2006) | 27 | 52 | | | | 7.7 | 15.4 | 38.5 | 30.8 | 7.7 | | 92.4 |

[1] in percent
[2] N = number of elk years; deaths indicates number of elk that died during the period.
[3] Harvest includes legal harvest, wounding loss and poaching.
[4] Other includes, e.g., vehicle collision, disease ore accident.
[5] Unknown predation includes animals that were killed by a predator, but the species of predator could not be determined with reasonable certainty.

levels 2 years later. Calf-to-cow ratios (an index of recruitment) from aerial surveys showed a similar pattern (Schlegel 1986).

Concurrently, the trend in calf-to-cow ratios was similar in surrounding GMUs, where the bear population was not reduced, compromising interpretation of these results (Schlegel 1986). Nevertheless, these data suggest that predation by black bears is additive and can be a significant factor limiting elk recruitment and population growth.

The second investigation was initiated in 1996, also in GMUs 10 and 12, but north and east of the Schlegel (1986) study. This project was designed to build upon the earlier work (Schlegel 1986) by broadening the scope and addressing some of the criticisms (Gratson, unpublished report 1992; Zager and White 2003).

This investigation contrasted elk population dynamics in a study area with poor recruitment (in the Lochsa study area, GMUs 10 and 12; there were less than 20 calves per 100 cows) and in another with adequate recruitment (South Fork study area, GMU 15; there were more than 30 calves per 100 cows).

Summer (birth to 1 August) calf survival averaged 0.26 on the Lochsa reference area during 1997 to 2004. Predation was the primary proximate cause of mortality. Black bears were implicated in most calf deaths during the first month of life, and cougars were an important mortality factor throughout the remainder of the year (Table 3).

To determine whether predator-caused calf mortality was additive or compensatory, beginning in 2000, black bear and cougar populations were reduced on a 270 square mile (699 km$^2$) portion of the Lochsa study area. The remainder of the study area served as a reference area where bear and lion populations were not manipulated.

Calf survival increased to an average of 0.55 on the treatment area, but did not change significantly on the reference area. Black bears and mountain lions continued to be the primary proximate mortality factors on both areas (Table 3). Wolves had been well established on the Lochsa study area since about 2000. They are an important source of mortality for older (more than 6-months-old) elk calves but not for younger calves (Tables 3 and 4).

Because few calves radio-collared as neonates survived more than 6 months on the Lochsa, we captured and radio-collared 6-month-old calves in December 2005 and 2006. Comparable data were collected in GMUs 28 and 36B. Among older calves on the Lochsa, wolves were the primary cause of mortality (Table 4).

Table 4. Survival and cause-specific mortality of elk calves captured and radio-collared in December 2005, when they were 6-months-old, through October 2006.

| GMU | N[2] | Survival | SE | N[2] deaths | Malnutrition disease | Harvest | Other | Bear | Cougar | Wolf | Un-known | Total predation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Cause-specific mortality[1] | | | | |
| GMU 10/12 | 33 | 70.0 | | 10 | | | 30.0 | 60.0 | | 10.0 | 90.0 | |
| GMU 28 | 36 | 61.1 | | 14 | 14.3 | | 42.9 | 7.1 | 7.1 | 28.6 | 57.1 | |
| GMU 36B | 24 | 58.3 | | 10 | 10.0 | | 10.0 | 30.0 | | 50.0 | 40.0 | |

On the GMU 15 study area, summer calf survival averaged 0.68 on the reference area during 1997 to 2004. Like the Lochsa study area, predation, mostly by black bears during June and by cougars during the remainder of the year, was the primary proximate mortality factor (Table 3).

To further investigate additive versus compensatory mortality, black bear and cougar populations were allowed to increase (harvest season closed) on a 221-square mile (574 km$^2$) portion of the area during 2000 to 2004. The remainder of the study area served as a reference.

Calf survival declined significantly on the treatment area, averaging 0.39. Predation, especially by black bears and mountain lions, continued to be the primary proximate mortality factor (Table 3).

Furthermore, White et al. (in prep.) modeled calf survival on both study areas within the context of predator management, landscape and habitat features, and biological factors. Their preliminary models include calf birth weight (index of physical condition) and habitat/landscape features as predictor variables. An index of predator density also contributed significantly to the "best" model for each area (White et al. In Press).

That calf birth weight (index of condition) is an important predictor suggests that neonatal mortality is partly compensatory. That predator density contributes suggests that additive mortality also plays a role.

## Discussion

The role of predation in ungulate-population dynamics is unclear, largely because these interactions are complex and difficult to study. Among the wildlife biologists, the traditional view is that most predation is compensatory, i.e., that predators take only those animals that are going to succumb to other factors (e.g., old age, malnutrition, disease) and prey populations respond with increased production and survival. Therefore, predation does not affect prey-population size, but it keeps the population vigorous by removing substandard animals. On the other hand, some recent research suggests that growth rates of prey populations, especially those at low densities, may be limited by predation. In this case, predation is additive because it is in addition to, rather than a substitution for, another form of mortality.

Determining the effect of predators on ungulate populations is difficult because it is a moving target. Predator-prey interactions occur within a matrix of prey species, and several species of predator are distributed across a diverse landscape with changing habitats. Furthermore, the biology of each species is unique and segments (e.g., neonates, juveniles) of populations respond uniquely to the biological setting (Coulson et al. 1997, 1999). In addition, each segment of a population plays a different role in shaping the dynamics of a particular population (Gaillard et al. 1998, 2000).

Evaluating the vital rates (e.g., birth rate, survival rates) of ungulate populations is the best way to assess the effect of predation on an ungulate population. Populations are most sensitive to changes in adult-female survival, followed by reproductive rates of prime-aged adults, age at first reproduction and juvenile survival (Gaillard et al. 1998, Eberhardt 2002).

### *Cows*

We found that adult-female survival was consistently high through time and across the state, and most populations are at or near management objective (Compton 1999). These study areas also support viable populations of black bears, cougars and wolves. Legal harvest and predation were the primary proximate mortality factors. Harvest, assumed to represent additive mortality, was used to reduce cow survival and to maintain those populations within objectives.

Exceptions to this were the Lochsa, GMUs 43 and 44, and the GMU 60A study areas, where survival was less than 80 percent. The elk population in GMUs

43 and 44 is compromised by the presence of permanent winter feeding stations where elk concentrate, presumably making them more vulnerable to predation. The feeding stations were originally established to alleviate excessive winter loss. It is unclear whether they met that objective. Whether survival would improve in the absence of such elk concentrations is also unknown.

The Lochsa elk population decline began in the mid-1980s. Though data establishing cause and effect are not available, this long-term decline may be a result of interactions among factors, including poor or declining habitat; poor or declining calf survival and recruitment; poor adult female body condition; increasing black bear, cougar and wolf populations; and significant mortality associated with the 1996-97 winter. It is not likely that the declining Lochsa elk population is solely a result of predation

The sum of the evidence suggests that inverse density dependence may operate on the Lochsa study area, wherein the elk population has declined to a low level (due to a variety of factors), and predation is maintaining the population at that level. If this is the case, Gasaway (1992) suggested that a regulated predator control may release the ungulate population, and a new predator-prey equilibrium could establish at a higher prey density. The Lochsa study area would provide an interesting test of this hypothesis.

***Calves***

Our data illustrate the variability in neonatal calf survival across four contrasting study areas. Summer survival was low where the overall population was performing poorly (Lochsa study area). Whereas it was at least 50 percent where populations were stable-to-increasing.

Predation was the primary proximate mortality factor in each area. Bears were important factors in June but not thereafter. Additional data may be required to clarify the relative roles of black bears, cougars and wolves in these areas.

As predicted, summer calf survival increased when bear and cougar populations were reduced on the Lochsa study area and declined when those populations were allowed to increase on the GMU 15 experimental areas. This suggests that calf mortality due to predation was largely additive on these study areas during this investigation. Taken out of context, this implies that predator control is warranted. Though poor calf survival contributes to the Lochsa population decline, addressing adult-female survival should be the first priority (Gaillard et al. 1998, Eberhardt 2002).

Furthermore, advocating predator control is risky. It may be effective over the short term if the ungulate population is below carrying capacity, if predation is additive and if the predator population can be reduced significantly. Generally, increased harvest of predators by sportsmen and sportswomen is not an effective tool for increasing ungulate populations because those efforts are typically spatially and temporally restricted (Stewart et al. 1985). Thus, agency intervention or extreme measures are necessary to reduce predator populations significantly (e.g., Ballard 1991, Boertje et al. 1991, Zager and White 2003). The effectiveness of such measures is temporary and can be costly.

### *The Future*

With the reintroduction of wolves in 1995 to 1996, the predator-prey dynamic in Idaho is in transition, and it may be decades before an equilibrium is achieved (Coulson et al. 2004; White and Garrott 2005a, 2005b). It is unlikely that the data we presented represent that equilibrium because they are limited spatially and temporally. The data should be viewed within the context of larger scale and longer term ecosystem dynamics. Defining and identifying the equilibrium will require long-term research and monitoring of the predator and prey populations, of their habitats and of relevant human influences. For instance, we found little evidence of predation on adult-bull elk in hunted populations. However, these data were collected before wolves were an important component of the community. We expect this dynamic will change because wolves select adult bulls in proportion to their availability in the Greater Yellowstone Ecosystem (Smith 2005).

Furthermore, ecosystems are dynamic, and habitats change as part of the natural process. The dynamics of predator and prey populations undoubtedly change concurrently (e.g. Schwartz and Franzmann 1991), even without human intervention. This argues for using the historical range of variability (Morgan et al. 1994) within an ecosystem as a starting point for conservation and management activities. Such an approach will provide a more reasonable framework for decision making and for temper expectations.

## Research Needs

Important questions need to be answered before we can fully understand the effect of predation on ungulates. The first step is to clearly differentiate between the fact of predation and the effect of predation. Further, if we are to advance our understanding, research should focus on pertinent concepts such as ultimate versus proximate factors, compensatory versus additive mortality, density dependence versus density independence versus inverse density dependence, and predation rates.

Significant recent research in Alaska (e.g., Gasaway et al. 1992, Keech et al. 2000, Bertram and Vivion 2002) has provided important insights and offers a sound basis for developing hypotheses and appropriate experimental designs. Additional work in other ecosystems will also provide important insights.

This research will be difficult because understanding predation is expensive and time consuming. Furthermore, some fundamental management and research tools are missing. It is difficult to estimate ungulate population size and even more difficult to estimate predator numbers. Population estimates form the backbone of population dynamics research. Inaccurate or imprecise population estimates hamper interpretation of the data and may lead to incorrect conclusions.

The universal nature of the questions, the difficult logistics, and expense of such investigations argue for an adaptive management approach (Walters 1986) and collaboration across jurisdictions. This approach can be used to test hypotheses and experimentally investigate important questions and, if conducted thoughtfully and properly, will bridge the gap between research and management.

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“The Gray Wolf is the largest living member of the family Canidae. The largest members of this family tend to be found in the northern forests of North America, with weights of 175 lbs. having been recorded. A weight of 100-125 lbs. is much more typical, however. Gray wolves from the hotter, drier, parts of the world rarely exceed 50 lbs. In general there is a wide size range within the various races, or “sub-species” of the gray wolf. Their color also ranges vastly between the sub-species.”

# (Case Study) Wolf Habituation as a Conservation Conundrum

By Diane K. Boyd, *Corvallis, Montana*

On April 26, 2000 a healthy, wild wolf attacked a 6-year-old boy in Icy Bay, Alaska. The wolf was killed and the boy received stitches and recovered fully. The Alaskan incident was so unusual that it was reported in newspapers across the U.S. Every year a few humans are injured, sometimes fatally, by wild coyotes, black bears, grizzly bears, mountain lions, deer, elk, and moose. Although wolves often kill formidable prey as large as moose, wolf attacks on humans are very rare. However, the frequency of such encounters in North America has increased in the past three decades. Wolf conservationists are concerned because an increase in human–wolf interaction may result in harm to humans, exaggerated fear of wolves, and, ultimately, increased wolf mortality. Here, I examine the causes of these increasing incidents and discuss the effects of this conflict on wolf conservation efforts.

The expanding wolf distribution has caused an increase in wolf–human encounters and generated concerns among wolf managers and conservationists. Only two accounts of wolf–human encounters that resulted in injurious contact between a wolf and humans were published in the scientific literature between 1900 and 1985 (Peterson 1947; Jenness 1985). However, since 1985 several apparently deliberate, injurious wolf attacks on humans were documented in Alaska (Icy Bay incident described earlier), Vargas Island (British Columbia), Algonquin Park (Ontario, five separate attacks), and India. The attacks in India were the most dramatic and severe: In Uttar Pradesh during a 2-year period (1996–1997), a wolf or wolves killed or seriously injured 74 humans, mostly children under the age of 10 years (Mech 1998). This may sound like a tabloid headline, but the attacks were well documented by wolf authorities. Several factors may have led to the attacks including a lack of available wild prey, domestic livestock that were well protected, and many small children playing in the vicinity of the wolves.

The common factor among nearly all reported wolf attacks was that wolves had become increasingly bold around humans (perhaps because of food scarcity, or possibly as a new strategy to exploit resources brought by humans into wilderness areas). North American wolves involved in recent attacks were repeatedly seen stealing articles of clothing, gear, exploring campsites, and sometimes obtaining food items—behaviors nearly identical to those reported by early frontiersmen. The wolves of Algonquin and Vargas Island exhibited bold behavior for weeks or months before the attacks occurred. Therefore, those injuries would probably have been preventable if humans had perceived the wolf as a wild predator rather than a thrilling campsite visitor.

13 Dec 2008, 10:06am
Deer, Elk, Bison Population Dynamics Predators Wildlife Management
by admin

## Effects of Wolf Predation on North Central Idaho Elk Populations

Idaho Department of Fish and Game, April 4, 2006, **Effects of Wolf Predation on North Central Idaho Elk Populations**

Full text [here] (2.3 MB)

**EXECUTIVE SUMMARY**

Gray wolves (Canis lupus) were reintroduced into Idaho in 1995 and listed as an experimental nonessential population under Section 10(j) of the Endangered Species Act (ESA). Thirty-five wolves were reintroduced and by 2005, an estimated 512 wolves (59 resident packs and 36 breeding pairs) were well distributed from the Panhandle to southeast Idaho. In February 2005, the U.S Fish and Wildlife Service (USFWS) modified the 10(j) rule which details State options for management of wolves impacting domestic livestock and wild ungulates (Endangered and Threatened Wildlife and Plants; Regulation for Nonessential Experimental Populations of the Western Distinct Population Segment of the Gray Wolf [50 CFR Part 17]).

The provisions of the 10(j) rule fall short of allowing the states' preferred management tool of regulated hunting. However, under Section (v): "If gray wolf predation is having an unacceptable impact on wild ungulate populations (deer, elk, moose, bighorn sheep, mountain goats, antelope, or bison) as determined by the respective State and Tribe (on reservations), the State or Tribe may lethally remove wolves in question. In order for the provision to apply, the States or Tribes must prepare a science-based document that: 1) describes what data indicate that ungulate herd is below management objectives, what data indicate there are impacts by wolf predation on the ungulate population, why wolf removal is a warranted solution to help restore the ungulate herd to State or Tribal management objectives, the level and duration of wolf removal being proposed, and how ungulate population response to wolf removal will be measured; 2) identifies possible remedies or conservation measures in addition to wolf removal; and 3) provides an opportunity for peer review and public comment on their proposal prior to submitting it to the Service for written concurrence."

This document supports the State's determination that gray wolf predation is having an unacceptable impact on a wild ungulate population. Specifically, this document reviews the Idaho Department of Fish and Game (IDFG) evaluation of the effect of wolf predation on an elk population below state management objectives. The document includes a review of elk population data, the cause-specific mortality research being conducted on elk, the wolf population data, and the modeling conducted to simulate impacts of wolf predation on elk using known population parameters. Additionally, this report identifies remedies and conservation measures that have already been attempted to reduce impacts of the multiple factors influencing the current elk population status, and identifies management actions and objectives to improve and monitor elk populations in the Lolo Zone.

This evaluation addresses the criteria outlined under 10J SEC. (v) and provides detailed information on the following topics:

1. What is the elk management objective?

Management objectives for elk in the Lolo Zone (Game Management Units [GMU] 10 and 12) is to maintain an elk population consisting of 6,100 – 9,100 cows and 1,300 – 1,900 bulls. Individual GMU objectives for the Lolo Zone are: 4,200 – 6,200 cows and 900 – 1,300 bulls in GMU 10; and 1,900 – 2,900 cows and 400 – 600 bulls in GMU 12. Population objectives for GMU 17 are 2,400 – 3,600 cows and 650 – 975 bulls. Objectives are based on the Department's best estimate of elk habitat carrying capacity and acknowledge a reduction in habitat potential from the conditions observed in the 1980s. In 1989, the Department estimated 16,500 elk in the Lolo Zone. Current cow and bull objectives (7,400) are 60% of the 1989 estimate of 12,378 cow and bull elk. In 2006, the Department estimated 4,233 cow and bull elk in the Lolo Zone.

2. Data used to evaluate populations in relation to management objective.

IDFG biologists use aerial surveys to monitor elk populations throughout the state, including GMUs 10, 12, and 17. Surveys are designed to provide a statistically and biologically sound sampling framework. Biologists generate estimates (and confidence intervals) of population size, age ratios (e.g., calves:100 cows) and sex ratios (e.g., bulls:100 cows) from the survey data. Current status of elk populations are: 2,276 cows and 504 bulls in GMU 10; 978 cows and 475 bulls in GMU 12; and 2,076 cows and 486 bulls in GMU 17.

3. Data that demonstrate the impact of wolf predation.

Elk survival rates were estimated using radio-collared animals. A total of 64 adult cow elk were captured, radio-collared, and monitored in GMUs 10 and 12 in 2002-2004 (90 elk-years). Combining samples across areas and years produced point estimates of annual elk survival (includes all mortality sources) ranging from 75% to 89%, with a 3-year weighted average of 83%. More recently, survival from March 2005 through February 2006 was 77%.
Nine of 25 (36%) mortalities among adult cow elk from January 2002 through March 2006 were

attributed to wolves. Wolf-caused mortality was not detected during 2002 or 2003; whereas 1 death was attributed to wolf predation in 2004 and 8 through 1 March 2006. Three additional losses resulted from predation, but species of predator could not be determined; 4 were attributed to mountain lions; and 9 were attributed to factors other than predation (e.g., hit by a vehicle, harvested, disease) or cause of death could not be determined.

Similar survival and cause-specific mortality data for elk in GMU 17 does not exist because of logistical difficulties with capture and monitoring of elk in designated Wilderness.

IDFG used the available data and assumptions based on peer-reviewed literature to simulate the impacts of wolf predation on elk populations in north-central Idaho. All simulations revealed a lack of cow elk population growth in the presence of wolf predation. Most simulations suggest moderate to steep declines in abundance caused by wolf predation. Regardless of the approach we used to model elk populations, all simulations used suggest wolves are limiting population growth.

4. Why wolf removal is warranted.

Several factors may have contributed to the elk population decline in the Lolo Zone, including harvest management, habitat issues, and predation. The Department and collaborators have aggressively addressed each of these factors for a number of years. Nevertheless, the Lolo Zone does not meet state management objectives. Without an increase in cow elk survival, the Lolo Zone elk population is unlikely to achieve management objectives.
The available data indicate that wolf predation is, at a minimum, partly additive and likely contributes to low adult female elk survival. Based on our evaluation and analysis, the State has determined that wolf predation is having an unacceptable impact on elk populations in the Lolo Zone. This evaluation demonstrates that wolves play an important role in limiting recovery of this elk population and that wolf removal is warranted as allowed under the 10(j) rule.

Management of most big game populations is accomplished through regulated harvest by hunters. A reduction in wolf numbers in the Lolo Zone would ideally be accomplished through regulated take by sportsmen rather than by state or federal agencies, and all alternatives for removal would be explored.

5. Level and duration of wolf removal.

During year one, we propose to reduce the wolf population in the Lolo Zone by no more than 43 of the estimated 58 wolves (75% reduction) that currently occupy the zone. The first year reduction represents about 8% of the estimated 512 wolves present in Idaho in 2005. The wolf population will be maintained at 25-40% of the pre-removal wolf abundance for 5 years. Concurrently, we will monitor elk and wolf populations. After 5 years, results will be analyzed and a peer-reviewed manuscript will be prepared that evaluates the effect of fewer wolves on elk population dynamics.

6. How will ungulate response be measured?

We will monitor the performance of elk populations in GMUs 10 and 12 with ongoing statewide research efforts on elk and mule deer and within the context of Clearwater Region wildlife management activities. The information will include fecundity, age/sex-specific survival rates, and cause-specific mortality rates. We will use aerial surveys to monitor elk populations in GMUs 10, 12, and 17. In GMUs 10 and 12, complete surveys will be scheduled for 2006, 2008, and 2010. In GMU 17, complete surveys will be scheduled for 2007 and 2010. Composition surveys will be flown in intervening years. In GMUs 10 and 12, we will document elk survival rates and cause-specific mortality factors from samples of radio-marked adult cow and calf elk

8 Mar 2010, 10:23pm

Predators Wildlife Management

by admin

## Lessons from a Transboundary Wolf, Elk, Moose and Caribou System

Mark Hebblewhite. 2007. **Predator-Prey Management in the National Park Context: Lessons from a Transboundary Wolf, Elk, Moose and Caribou System**. Predator-prey Workshop: Predator-prey Management in the National Park Context, Transactions of the 72nd North American Wildlife and Natural Resources Conference.

Full text [here]

Selected excerpts:

**Introduction**

Wolves (*Canis lupus*) are recolonizing much of their former range within the lower 48 states through active recovery (Bangs and Fritts 1996) and natural dispersal (Boyd and Pletscher 1999). Wolf recovery is being touted as one of the great conservation successes of the 20th century (Mech 1995; Smith et al. 2003). In addition to being an important single-species conservation success, wolf recovery may also be one of the most important ecological restoration actions ever taken because of the pervasive ecosystem impacts of wolves (Hebblewhite et al. 2005). Wolf predation is now being restored to ecosystems that have been without the presence of major predators for 70 years or more. Whole generations of wildlife managers and biologists have come up through the ranks, trained in an ungulate- management paradigm developed in the absence of the world's most successful predator of ungulates—the wolf. Many questions are now facing wildlife managers and scientists about the role of wolf recovery in an ecosystem management context. The effects wolves will have on economically important ungulate populations is emerging as a central issue for wildlife managers. But, questions about the important ecosystem effects of wolves are also emerging as a flurry of new studies reveals the dramatic ecosystem impacts of wolves and their implications for the conservation of biodiversity (Smith et al. 2003; Fortin et al. 2005; Hebblewhite et al. 2005; Ripple and Beschta 2006; Hebblewhite and Smith 2007).

In this paper, I provide for wildlife managers and scientists in areas in the lower 48 states (where wolves are recolonizing) a window to their future by reviewing the effects of wolves on montane ecosystems in Banff National Park (BNP), Alberta. Wolves were exterminated in much of southern Alberta, similar to the lower 48 states, but they recovered through natural dispersal populations to the north in the early 1980s, between 10 and 20 years ahead of wolf recovery in the northwestern states (Gunson 1992; Paquet, et al. 1996). Through this review, I aim to answer the following questions: (1) what have the effects of wolves been on population dynamics of large-ungulate prey, including elk (*Cervus elaphus*), moose (*Alces alces*) and threatened woodland caribou (*Rangifer tarandus tarandus*), (2) what other ecosystem effects have wolves had on montane ecosytems, (3) how sensitive are wolf-prey systems to top-down and bottom-up management to achieve certain human objectives, and (4) how is this likely to be constrained in national park settings? Finally, I discuss the implications of this research in the context of ecosystem management and longterm ranges of variation in ungulate abundance. …

## Effects of Wolves on Ungulates

### Elk

In the Bow Valley, Hebblewhite et al. (2005) compared adult female elk survival and recruitment between the low and high wolf areas during 1997 to 2000. Differences in wolf-caused mortality were tested using chi-square tests. In the high wolf zone, adult survival equaled $0.62 \pm 0.06$; n equaled 22, where n represents the number of adult female elk. And, calf recruitment equaled $14.6 \pm 1.97$ percent. The combination of this survival and recruitment led to rapid population decline (Hebblewhite et al. 2005). But, in the low-wolf area, survival equaled $0.89 \pm 0.06$; n equaled 23. And, recruitment equaled $27.4 \pm 1.58$ percent, which both are high and the same as before wolf recolonization; it led to a stable or increasing population (Woods 1991; Hebblewhite and Smith 2007). The main survival difference was wolf mortality increasing from about 16 percent to 56 percent; Hebblewhite and Smith 2007) between the low and high wolf area, which was consistent with an increase in wolf-kill rate of elk in the high-wolf area (Hebblewhite et al. 2004). …

In the YHT study area, Hebblewhite et al. (2006) showed that the migratory behavior of elk changed since the 1970s in three ways. First, both the proportion and number of elk migrating into BNP declined. The ratio of migratory to resident elk declined from 13:1, in 1980, to 2.5:1, in 2004; the numbers of migrants declined from 980, in 1984, to 580, in 2004. Second, the spatial distribution of elk shifted to the winter range year round. Third, the duration of migration declined because fall migration occurred almost a month earlier. … Importantly, prescribed fires, competition with horses for winter forage, and human harvest were unrelated to changes in the ratios of migratory to resident elk.

### Moose

Hurd (1999) undertook a 4-year study (1993–1997) in BNP of competition between moose and elk to understand causes for moose declines following wolf recolonization. Hurd examined both exploitative competition for forage and apparent competition mediated by predation by wolves. The study revealed, at fine-spatial scales, that elk were exploitatively outcompeting moose because of their greater diet breadth and higher abundance. Yet, at large spatial scales, apparent competition mediated by wolves seemed the most compelling reason for moose declines. Wolves were the leading cause of moose mortality, causing 56 percent. Adult moose (male and female were the same) survival rates were very low (0.71 ± 0.03, n = 45) and were combined with low calf recruitment (23 ± 7.5 percent, most likely a result of predation but unknown). Moose populations were declining at about 8 percent per year because of wolf predation. Moose and elk in the high-wolf area had similar demography evidencing the strong top-down effect of wolf predation. In summary, Hurd found apparent competition mediated by wolves was occurring in combination with exploitative competition in a negatively additive fashion, which caused moose population declines.

### Caribou

A similar example of conservation concern is apparent competition between elk and threatened woodland caribou, which have declined during wolf recolonization (Hebblewhite et al. 2007b) in the Canadian Rocky Mountains. Elk and caribou diets differ enough to make exploitative competition an unlikely explanation for caribou declines. Instead, similar to moose, the likely mechanism for caribou declines is competition between elk and caribou mediated by wolf predation, and this hypothesis was supported by modeling work by Hebblewhite et al. (2007b) and Lessard (2005). … Consequences of this for national park management in the Parks Canada system are dramatic; with current densities of wolves and elk in BNP, the Banff caribou subpopulation will almost certainly become extirpated. …

### Evaluating Potential Management Scenarios

### Relative Sensitivity to Management Changes in Forage

There was essentially no evidence that the extensive prescribed fires (more than 77.22 square miles [200 km2] of burns) actually translated to increased elk populations in BNP. This was despite the higher forage biomass in burns (Sachro et al. 2005) and the higher forage quality for migrants in general (Hebblewhite et al. in press); migrants still declined due to wolf and grizzly predation. Furthermore, time-series modeling in both the Bow Valley and YHT area suggested that burning in areas with high-wolf density can actually reduce elk population growth rates (White et al. 2005, Hebblewhite et al. 2006). Although speculative, these studies suggest a bottom-up effect of fire on wolf numbers instead of elk mediated by rapid numeric responses of wolves. In essence, any increased elk productivity from fires translated to increased wolf productivity through a rapid numeric response. …

### Relative Sensitivity of and Management Constraints to Changing Wolf Predation

The typical conclusion of previous studies where wolves limited prey densities to low numbers was usually a recommendation to reduce predation via large-scale wolf control (Hayes et al. 2003). While there is some controversy over the success of wolf controls (Orians et al. 1997), there is some experimental evidence that wolf control—when applied consistently to reduce wolf populations by greater than 80 percent over huge areas (more than 3,861.02 square miles [10,000 km2]) for long terms (5-years) at great financial costs can be partially successful at enhancing ungulate populations (Boertje et al. 1996; Bergerud and Elliot 1998; Hayes et al. 2003; Valkenburg et al. 2004) for short periods of time.

I feel compelled to reiterate, however, that the main conclusions of the authors of perhaps, to date, the best executed wolf-control study in the Yukon (Hayes et al. 2003) pointed out the seeming futility of their wolf-control program as a longterm solution to ungulate population declines. Within 2 years of the end of wolf control, wolf densities and ungulate vital rates returned to precontrol levels. To be successful, wolf control needs to be conducted for long periods of time with greater than 70 percent of the wolf population removed from huge areas (Hayes et al. 2003). While future harvest plans for wolves once delisting occurs will undoubtedly include some wolf harvest, it remains difficult to conceive of states being able to conduct wolf control at the spatial and temporal scales required to even obtain short-term increases in ungulate populations. …

# Winter Severity and Wolf Predation on a Formerly Wolf-free Elk Herd

Excerpts from USGS study 1997 to 1998 Yellowstone National Park
Leopold, Rose Creek and Druid wolf packs observed wolf kills

Average pounds killed per wolf per month 768 lbs.
Estimated weight per each elk* 252 lbs.
**Average kill rate per wolf per month 3.05 elk killed per wolf**
total killed calves Ave
* 1997 15 2 13.3%
1998 23

*Echinococcus granulosus* has a two host life cycle with canids as the definitive host for adult worms and ungulates as the intermediate host for the larval worms. The adult worms are small, about 3-5 mm in length, and live in the small intestine of canids (dogs, wolves, foxes, dingo, and jackals). The adult worms lay eggs that are passed in the feces of the canid and are accidently ingested by ungulates (deer, elk, moose, caribou, domestic sheep, domestic cattle, etc) where the eggs hatch in the rumen and migrate to the thoracic or abdominal cavity and form sac like structures called hydatid cysts. Within the hydatid cysts, hundreds of immature tapeworms bud off the lining of the cyst. If a canid consumes a hydatid cyst, the larval tapeworms develop into adult worms in the small intestine of the canid.

*Echinococcus granulosus* has a worldwide distribution (Gottstein 1992). There are two recognized biotypes of the parasite – the northern or sylvatic biotype that circulates between canids (wolf, dog) and cervids (moose, caribou, reindeer, deer and elk) and is present above 45° latitude. The northern biotype does not appear to cross-infect domestic livestock (Rausch 1986).

The domestic biotype, comprised of at least nine different strains, circulates between dogs and domestic ungulates, especially sheep or other endemic species of wildlife (lions and sheep, dingoes and dogs and macropod marsupials, etc) (Jones and Pybus 2001). It is endemic in most sheep raising areas of the world including the southwestern United States, central and South America, the Middle East, northern Africa, and Australia (Loveless et al. 1978; Jones and Pybus 2001).

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# Study Shows Effect of Predators on Idaho Elk

In the past few years, some Idaho big game hunters have complained that they no longer see elk in places they have hunted for years. Idaho Fish and Game spends more than $2 million annually tracking the state's big game populations, and recent aerial surveys do show some elk population declines.

But elk numbers have not declined everywhere – 10 of Idaho's 29 elk zones are above management objectives for female elk, 13 zones are within objectives and six are below objectives. (See Figure 1, next page) Elk populations are affected by a number of factors, including predators.

Since the return of wolves to Idaho 15 years ago, Idaho's overall elk population has dropped by 20 percent from 125,000 to about 100,000.

To find out why, Idaho Fish and Game biologists have been looking closely at the effects of predation in general on elk herds, and wolf predation in particular. They are learning how delisted wolves will fit into state management of big game and other wildlife species.

An ongoing study in 11 elk management zones shows that predators today are the primary cause of death among female elk in five zones. The zones represent the range of habitat, hunting opportunity and predator densities found in Idaho. In at least three of those zones, wolves are the primary cause of death of female elk and calves over six months old. (See Table 1, next page.)

Elk population trends depend on the survival rates of female elk and calves.

To maintain the population, typically about 88 percent of the breeding female elk must survive, and enough calves must survive to replace the adult animals that die each year.

Elk survival depends primarily on four factors: habitat conditions, weather, predation and hunter harvest.

The influence of habitat on elk tends to be subtle. Pregnancy rates and calf survival may be 10 to 20 percent lower in poor habitat – small changes that can have important consequences over decades.

Idaho Fish and Game biologists attach a radio collar on a captured elk calf as part of an ongoing elk survival study.

In the winter of 1996-97, unusually heavy snows arrived early in much of central and northern Idaho. Elk mortality during that winter was extensive, as high as 40 percent in some herds.

In 1995 and 1996, the U.S. Fish and Wildlife Service released 35 wolves into central Idaho – reintroducing a top predator to the landscape. Today, wolves in Idaho number more than 800. (See Figure 2 next page).

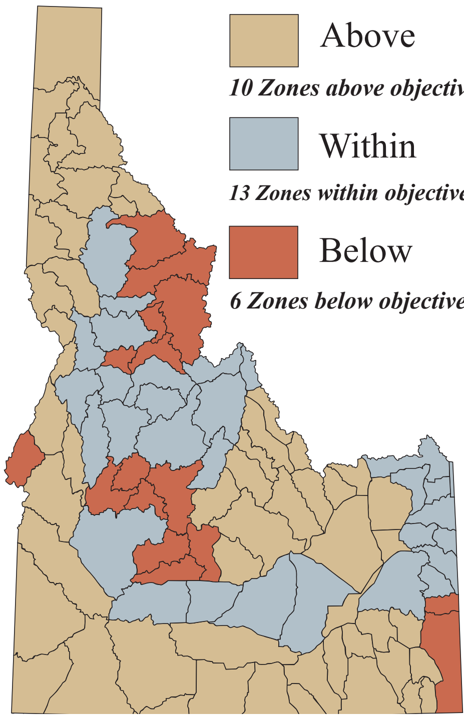


Figure 1: Because of the expense and the limited availability of resources, Fish and Game does not count elk numbers in every zone every year.

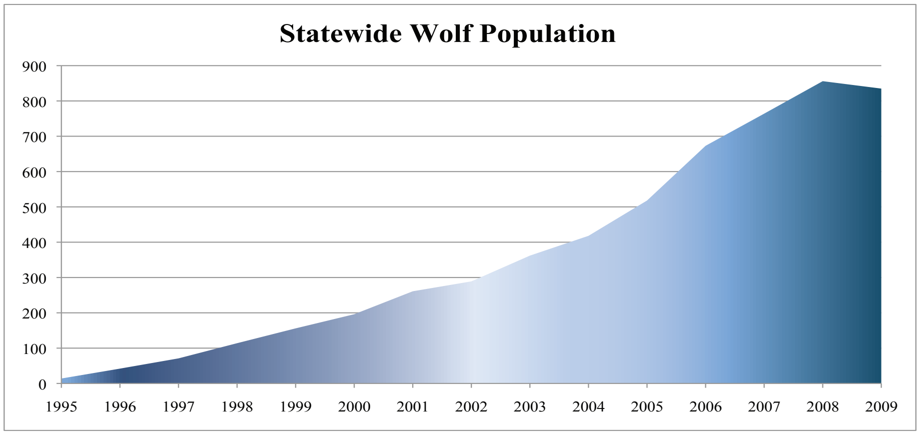


Figure 2: Estimated minimum numbers of wolves in Idaho.

**In 2005 Fish and Game** launched its elk survival study, the largest ever conducted in the state, covering 11 elk management zones (elk are managed in 29 zones, split up to allow populations to be managed on a smaller scale reflecting local conditions).

Biologists captured, radio-collared and monitored more than 500 adult female elk since the study began. They found the number of adult female elk surviving from one year to the next – survival rate – ranged from a low of 75 percent in the Lolo Zone to 89 percent in the Tex Creek and Weiser zones (See Table 2).

Predators were the primary cause of death in five zones, and of those, wolves were the primary cause of death in three zones – the Lolo, Smoky Mountains and Sawtooth zones. In the other two zones – the Elk City, and Salmon zones – mountain lions either equaled or exceeded wolves as the primary cause of elk deaths. (See Figure 3)

Since 1995, elk populations have declined in these five zones. Elk numbers are below management objectives in the Smoky Mountains, Lolo and Sawtooth zones, and within objectives in the Elk City and Salmon zones.

Harvest was the primary known cause of death in six zones – the Pioneer, Weiser, Tex Creek, Island Park, McCall and Boise River zones. Elk populations declined in the Pioneer and Island Park zones since 1995, while increasing in the Tex Creek and Weiser zones. Elk populations in the McCall and Boise River zones have been relatively stable since 1995.

The Weiser Zone is above objectives and the other five are within objectives.

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### Causes of female elk mortality

| Elk Zone | Percent of population removed by cause: Wolf | Cougar | Harvest |
|---|---|---|---|
| Lolo | 20 | 3 | |
| Elk City | 5 | 5 | |
| McCall | | | 6 |
| Sawtooth | 4 | 2 | 3 |
| Boise River | | 3 | 5 |
| Weiser | 1 | | 8 |
| Smoky Mtns | 5 | 4 | 3 |
| Pioneer | 1 | 3 | 6 |
| Salmon | 2 | 6 | 5 |
| Tex Creek | | 1 | 8 |
| Island Park | | 1 | 17 |

**Table 1:** Leading known causes of death of female elk in the study population.

| Survival of female elk | |
|---|---|
| **Elk Zone** | **Annual Survival (%)** |
| Lolo | 75 |
| Elk City | 87 |
| McCall | 81 |
| Sawtooth | 87 |
| Boise River | 85 |
| Weiser | 89 |
| Smoky Mtns | 81 |
| Pioneer | 88 |
| Salmon | 83 |
| Tex Creek | 89 |
| Island Park | 80 |

**Table 2:** Female elk survival by zone.

**Though most of the research focused** on adult female elk, it also evaluated calf survival and mortality in the Lolo and Sawtooth zones.

Between 2005 and 2009, biologists captured and radio-collared 272 six-month-old elk calves. In both zones, calf elk survival from December through June was considerably less than normal, which is about 82 percent. (See Table 3)

In the Lolo Zone, deteriorating habitat and other factors contributed to a long population decline, dropping from about 16,000 in 1988 to fewer than 8,000 elk by 1998. Since 1998, the numbers have dropped to about 2,000 – a decline of more than 70 percent. (See Figure 4 on back page)

Survival of the radio-collared six-month-old calves was 52 percent; wolf predation took nearly one-third of the calf population (See Table 3).

Leading cause of mortality of female elk

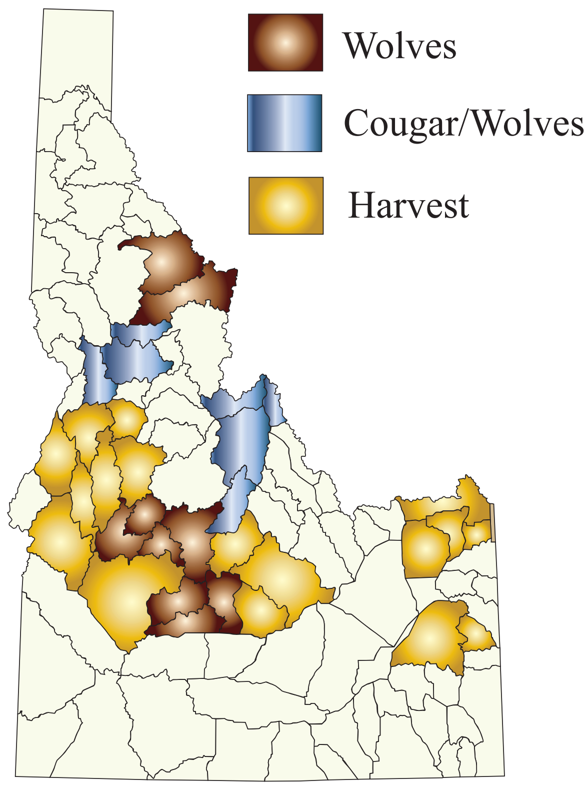


Figure 3, Leading known cause of mortality in 11 elk zones 2005-2008 (Lolo/Sawtooth through 2010)

## Causes of elk calf mortality

| Percent[4] of population removed by cause | | | | | |
|---|---|---|---|---|---|
| Elk Management Zone | Average Annual Survival[3] | Wolf Predation | Cougar Predation | Unknown Predation[1] | Other Causes[2] |
| Lolo | 52 | 32 | 7 | 2 | 7 |
| Sawtooth | 30 | 38 | 3 | 13 | 18 |

[1] Cause of death determined to be from predation, but specific predator unknown.
[2] Includes death caused by accidents, disease, malnutrition, other predator, and unknown causes.
[3] Calves monitored from December to June.
[4] Percentages may not add up to 100 because of rounding.

**Table 3:** Survival of elk calves more than six months old and leading known cause of death, 2005-2009.

In the Sawtooth Zone, elk numbers also have declined (See Figure 5). Here survival of six-month-old calves was about 30 percent during the study. Overall, predation by wolves was the leading cause of death, but malnutrition was also an important factor during the difficult winter of 2007-08. (See Table 3)

In both these zones, wolf predation was the leading cause of death of six-month-old calves. Earlier research shows that in some areas predation by black bears was the primary cause of death of calves less than six months old.

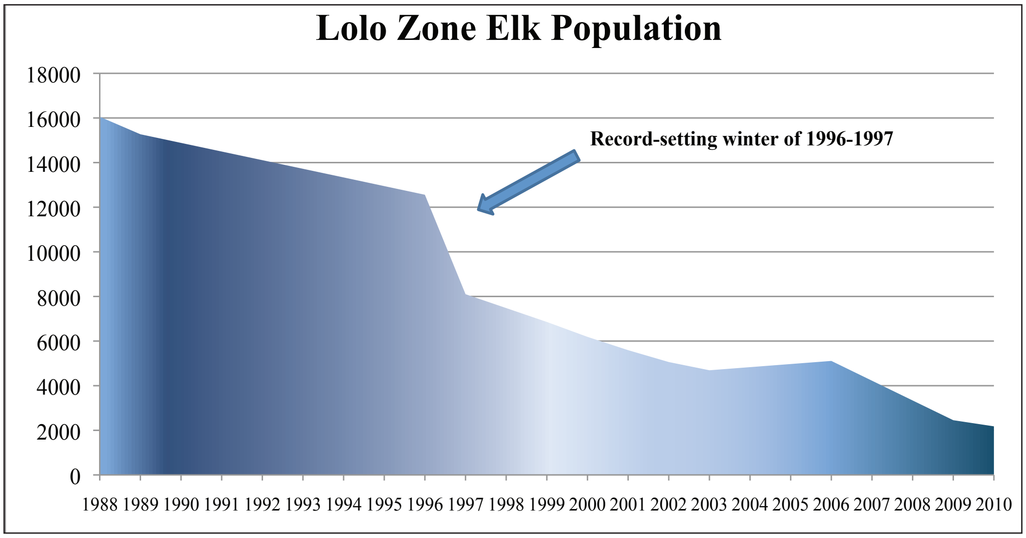


Figure 4: Elk population numbers in the Lolo zone in north Idaho's Clearwater Region.

As the elk numbers in the Lolo and Sawtooth zones have declined (See Figures 4 and 5), Fish and Game has raised limits on predators, reduced hunting opportunities and stopped female elk harvest in the Lolo Zone since 1998.

Meanwhile, in some other areas elk are so numerous they are causing trouble for landowners.

The information from this study may not apply in other parts of the state, but it may help Fish and Game biologists evaluate declines in other areas.

Wildlife managers have no control over the weather and only little control over habitat. In 2009, however, Idaho Fish and Game conducted the state's first regulated wolf hunt. Hunters harvested 188 wolves in an orderly hunt and followed the strict reporting requirements.

Recognizing that effects of predators on elk would increase as the numbers of predators increase, the Idaho Fish and Game Commission has set a wolf population goal at about 500 – the population in Idaho in 2005, the year when wolf depredations on elk herds and domestic livestock began to rise sharply.

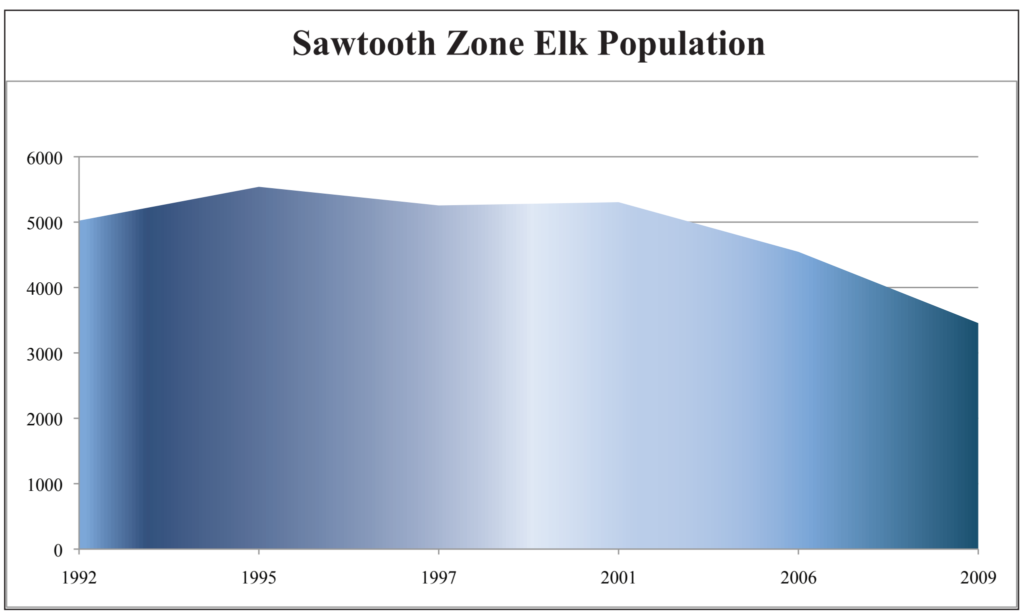


Figure 5: Elk population numbers in the Sawtooth zone in central Idaho.

Fish and Game has shown that professional wildlife managers can manipulate wildlife populations to limit their effects on each other and on people, as they have done with elk that cause damage to crops or take over habitat occupied by mule deer. They will to do the same with wolves in places, such as the Lolo – not to wipe them out, but to reduce their effects where elk herds are in trouble.



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**IDAHO DEPARTMENT OF FISH AND GAME**
600 South Walnut/P.O. Box 25
Boise, Idaho 83707

C.L. "Butch" Otter / Governor
Cal Groen / Director

December 7, 2010

TO: Cal Groen, Director

FROM: Lance Hebdon and Sharon W. Kiefer, IDFG

SUBJECT: Idaho hunting license sales and revenue changes due to wolves

The information below was submitted to the Chairman of the Senate Natural Resources Committee in February 2009. We have updated the trend information to include 2009-2010 license sales and the 2009 nonresident survey.

Sales trends.

A trend in declining nonresident license sales appeared early in 2009 (Figure 1). In an attempt to determine the reasons for declining nonresident license sales, the Department surveyed nonresident hunters who hunted in Idaho within the previous five years but had not purchased a license by May 2009. We asked them to choose the reasons for not purchasing their 2009 license. When asked to choose the single biggest reason for having not yet purchased an Idaho hunting license 28% chose “I think wolves have killed too many elk”. Respondants also noted the 2009 nonresident fee increase and the overall economic climate. We received responses from 2,550 nonresident hunters. Although not included in Figure 1. because calendar year 2010 is not completed, Table 1. is a subsample of information through mid-November of each year that demonstrates that the declining trend continues through 2010.

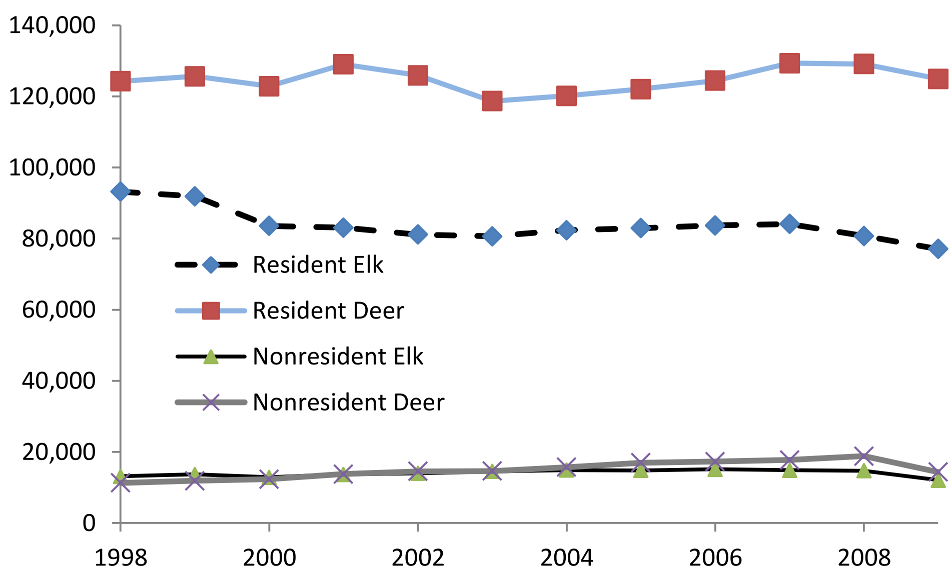


Figure 1. Trends in resident and nonresident elk and deer tag sales (by calendar year) 1998 to 2009.

Table 1. Calendar year sales through mid-November of nonresident deer and elk tags.

| | Nonresident Deer | |
|---|---|---|
| | Tags Sold | Revenue |
| 2008 | 15,830 | $4,064,352 |
| 2009 | 11,463 | $3,341,111 |
| 2010 | 9,331 | $2,799,300 |
| | **Nonresident Elk** | |
| | Tags Sold | Revenue |
| 2008 | 13,046 | $4,836,805 |
| 2009 | 10,688 | $4,274,229 |
| 2010 | 9,043 | $3,752,845 |

What economic effect have wolves had on Idaho hunting revenue?

The Department of Fish and Game has not conducted a directed economic assessment of the effect of wolves on Department or State of Idaho revenue. However, sales of nonresident hunting licenses and big game tags have a large influence on Department revenue and although the nonresident survey indicated intertwined factors, we believe hunter concern about the effect of wolves on their hunting opportunity and success, and effects on certain big game herds is a component of decreased sales. Calendar year 2009 license sales declined by 2,634 nonresident elk tags, 4,460 nonresident deer tags and 4,405 nonresident hunting licenses compared to 2008 sales. Table 1 shows continued decline in 2010.

Economic Impact Analysis of Gray Wolf Reintroduction-Statewide Assessment

The primary analysis regarding the economic effects of wolves to Idaho was the 1994 Final Environmental Impact Statement on The Reintroduction of Gray Wolves to Yellowstone National Park and Central Idaho (USFWS 1994). The EIS about wolf reintroduction estimated the impact of recovered wolf populations on the elk population in central Idaho and the "foregone benefits to hunters" from reduced antlerless elk harvest that would be expected from the recovered wolf population. The EIS used a recovered wolf population of "about 100 wolves." Using the data in the EIS and an extrapolation of the current minimum estimated wolf population we can estimate the potential economic impact from wolves. The analysis represents a snapshot of the current conditions and assumes a linear response between the metrics of elk killed by wolves and lost hunter days and adjusts the values in the 1994 EIS for 2008 dollar values using the using the US Bureau of Labor and Statistics Consumer Price Index Calculator.

At the time this information was presented to the Senate Resources and Environment Committee in 2009, the wolf population estimate for 2008 in Idaho was 824 wolves (draft minimum population estimate as of February 6, 2009). The 1994 EIS estimated the recovered wolf population (about 100 wolves) would kill 1,650 ungulates/year. Elk were estimated to make up 30% of the wolf kills with deer making up the remaining 70%. Research conducted in Idaho using radio-collared elk and deer have not supported the ratio of 30% elk 70% deer used in the 1994 EIS. Data from radio-collared ungulates in Idaho indicate elk have made up a larger portion of the ungulates killed. This analysis used wolf kill ratio of 70% elk.

For this extrapolated analysis it was estimated that the current population of 824 wolves would kill an estimated of 9,517 elk /year. The 1994 EIS considered mortality from wolf predation to be completely additive, we retain that assumption here. However, we know that predation is never totally additive or compensatory over time, but occurs along a continuum. Therefore, these calculations would be considered an estimate based on these assumptions. Actual impacts would range dramatically depending upon location and time. The 1994 EIS also recognized that "a reduction in big game animals available for harvest directly affects the available hunting opportunities. Reduced hunting opportunities translate into a reduced number of hunters and hunter days spent in the field (USFWS 1994)." The estimated economic value of a harvested elk in Idaho is $8,000 (including economic multipliers). If the 9,517 elk killed by wolves were available to hunters at a rate of 20% (estimated harvest rate of elk in Idaho), the reduced harvest of 1,903 elk represents an economic loss to Idaho of over $15 million. The value of an elk established by the Idaho Legislature for the purpose of assessing reimbursable damages (I.C. 36-1404) for illegal loss is $750/animal. In this respect, value of 9,517 elk killed would be over $7 million.

Another method to evaluate the economic impact of wolves on Idaho is to expand the value of "foregone benefits to hunters" assessed in the 1994 EIS by the current wolf population and adjust the dollar values for inflation. The annual economic values and expenditures associated with reduced hunting opportunity associated with a recovered wolf population of 100 wolves was estimated in the 1994 EIS as between $571,591 and $857,386 in 1992 dollars based on a value of elk hunting at $39.10/day (value for day of elk hunting from 1986 US Forest Service publication). Adjusted for 2008 dollars (using the US Bureau of Labor and Statistics Consumer Price Index Calculator) the values would range from $865,432 to $1,298,148. Assuming a linear relationship of reduced hunting opportunity with the current wolf population, the estimated annual reduction in economic values and expenditures associated with a population of 824 wolves would be between $7 million and $11 million. Using the most recent estimate from Cooper et al. (2002), a day of elk hunting in Idaho is worth $127.40/day for direct expenditures in 2008 dollars. The 1994 EIS estimated that between 14,619 and 21,928 hunter days would be lost due to wolf reintroductions in central Idaho. If the reduction in hunter days was linearly related to wolf populations then the loss of hunter days associated with 824 wolves would be between 120,460 and 180,686 resulting in an estimated value of the foregone benefits to hunters of between $15 million and $24 million.

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# Is science in danger of sanctifying the wolf?

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ABSTRACT

Historically the wolf (*Canis lupus*) was hated and extirpated from most of the contiguous United States. The federal Endangered Species Act fostered wolf protection and reintroduction which improved the species' image. Wolf populations reached biological recovery in the Northern Rocky Mountains and upper Midwest, and the animal has been delisted from the Endangered Species List in those areas. Numerous studies in National Parks suggest that wolves, through trophic cascades, have caused ecosystems to change in ways many people consider positive. Several studies have been conducted in Yellowstone National Park where wolf interactions with their prey, primarily elk (*Cervus elaphus*), are thought to have caused reduction of numbers or changes in movements and behavior. Some workers consider the latter changes to have led to a behaviorally-mediated trophic cascade. Either the elk reduction or the behavioral changes are hypothesized to have fostered growth in browse, primarily willows (*Salix* spp.) and aspen (*Populus* spp.), and that growth has resulted in increased beavers (*Castor Canadensis*), songbirds, and hydrologic changes. The wolf's image thus has gained an iconic cachet. However, later research challenges several earlier studies' findings such that earlier conclusions are now controversial, especially those related to causes of browse regrowth. In any case, any such cascading effects of wolves found in National Parks would have little relevance to most of the wolf range because of overriding anthropogenic influences there on wolves, prey, vegetation, and other parts of the food web. The wolf is neither a saint nor a sinner except to those who want to make it so.

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## 1. Introduction

"The only good wolf is a dead wolf." This and many similar slogans typified public attitudes toward wolves (*Canis lupus*) in the United States before the late 1960s. Leaders, too, agreed with this attitude. Teddy Roosevelt, for example called the wolf, "The beast of waste and desolation."

Even some of the pioneering environmentalists, naturalists, and wildlife biologists vilified wolves. Naturalist Ernest Thompson Seton poisoned them. William Hornaday stated "of all the wild creatures of North America, none are more despicable than wolves. There is no depth of meanness, treachery or cruelty to which they do not cheerfully descend." In the first comprehensive book about wolves, Young and Goldman (1944, p. 1), senior biologists of the US Fish and Wildlife Service on page 1 called the wolf "a menace to human life." Even Aldo Leopold, well-known for his conclusions that the removal of large carnivores fostered increased herbivores and overbrowsing, shot wolves and in 1946, long after he experienced the famous "fierce green fire," he recommended wolves be bountied to increase abundance of big game populations (Mech, 2002).

Now the tables have turned. The Satan wolf has become a saint in the minds of most of the general public. Ever since the wolf was placed on the federal Endangered Species List in 1967, it became one of the main symbols of endangered species, featured in posters, tee shirts, documentaries, and magazines. Numerous books have since been written about wolves. (I count over 30 on my bookshelf.) Some 27 non-governmental organizations have been formed to promote wolf preservation. Except for some local areas where wolves have recovered and anti-wolf sentiment is increasing again, wolves are now considered by the general public primarily in a positive light (Williams et al., 2002).

The legal protection that the Endangered Species Act of 1973 afforded the wolf, as well as the reintroduction of wolves into Yellowstone National Park and Idaho, allowed wolf populations to thrive in the Upper Midwest and Northern Rocky Mountains to the point where years ago they reached official biological recovery levels (USFWS, 2011a,b). Along with their recovery came numerous studies of wolf ecology and reported effects of wolves on ecosystems, not only in Yellowstone but in other parks as well, where wolves had also been recovering. Wolves have now been credited by both the scientific literature, and especially the popular media, with everything from increasing populations of beetles and birds to replenishing ground water (Table 1). These diverse reported effects of wolves are attributed to trophic cascades, which

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**Table 1**
Claims made by popular media and websites about ecological effects of wolves.

| The basis for these claims in the scientific literature are discussed in the text. |
|---|
| Reducing prey numbers and changing their movements[a,b,c,d,e,f] |
| Regenerating aspen, willows[a,b,c,f,h,j,k] |
| Improving habitat for beavers, songbirds, fish, small mammals, moose, amphibians, insects and waterfowl[a,c–g,i,k] |
| Promoting streambank recovery[a,c,d,e,k] |
| Reducing coyote density[a,d,e,k] |
| Providing food for scavengers[a,c,k] |
| Selecting old, weak, sick prey and maintaining healthy herd[a] |
| Reducing disease transmission[a] |
| Increasing bison[d] |
| Increasing raptors[e,k] |
| Improving water quality[a] |
| Replenishing ground water[a] |
| Cooling water[a,c,e,k] |
| Increasing pronghorns[e] |

[a] Jackson Hole Conservation Alliance (www.jhalliance.org/).
[b] Pickrell, 2003. Wolves' leftovers are Yellowstone's gain, study says. National Geographic News, December 4, 2003.
[c] Robbins, 2005. Hunting habits of wolves change ecological balance in Yellowstone. New York Times, October 18, 2005.
[d] Chadwick, 2010. Wolf wars. National Geographic Magazine, March, 2010.
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have long been postulated for various systems (Hairston et al., 1960; Carpenter et al., 1985; Estes et al., 2011) resulting from either large carnivore reduction of prey numbers (direct effects) or from causing prey to change their movements and/or behavior (indirect effects). These changes are then hypothesized to reduce or better scatter the prey's effects on vegetation such as willow (*Salix* spp.) and aspen (*Populus* spp.). Increased willow and aspen growth in turn fosters other species such as songbirds and beavers (*Castor canadensis*) that rely on the vegetation. Those species, especially beavers, are then said to cause another cascade of effects on waterways, leading to such effects as raising the water table and the consequent effects of that (Table 1). That trophic cascades exist is well documented (Beschta and Ripple, 2009; Terborgh and Estes, 2010). Whether recently restored wolves have already wrought the cascading effects attributed to them is the question here.

As was the case with the historical anti-wolf reports of devastating effects on prey, the new reports of wolf benefits by both lay people and scientists also may be exaggerated compared to the scientific evidence. As one reviewer of this article put it, "ecologists (and particularly conservation biologists) do seem obsessed to the point of blindness with predator-induced trophic cascades." This article examines some key reported wolf benefits, mostly based on studies in Northern Yellowstone because that area has been a strong focus of recent research. It attempts to place these findings in the perspective of what we really know about the ecosystem impacts of wolves. True, some of the more extreme claims are found more in the popular media, but most of them have at least some basis in scientific articles summarized by Hebblewhite and Smith (2010) and Eisenberg (2010). With wolf recovery has come an increased polarization between those laypeople who revere the animal and those who revile it. Establishing a more-accurate public and scientific image of the wolf is important so that authorities can better manage the species and promote accurate public understanding about the rationale for various kinds of wolf management.

It is not that scientists failed early on to warn about overstating or overgeneralizing wolf effects on ecosystems. After reviewing several such reported effects, Mech and Boitani (2003, p. 160) concluded "we do not claim to know whether the wolf's effects are positive or negative, what its net effect is, or whether the effects are of any great consequence ecologically." Smith et al. (2003, p. 339) warned that "the danger we perceive is that all changes to the [Yellowstone] system, now and in the future, will be attributed solely to the restoration of the wolf." Similarly Garrott et al. (2005) cautioned about generalizing wolf effects, and Ray et al. (2005, p. 426) warned that "... scientists will likely never be able to reliably predict cascading impacts on elements of biodiversity other than prey."

Hebblewhite and Smith (2010) explored the various complexities of trying to determine possible cascading effects of wolves on ecosystems. They concluded that across three systems, Banff, Isle Royale, and Yellowstone National Parks, trophic effects of wolves were quite variable and depended on time since wolf recolonization, ecological complexity of the community, and unknown factors that regulated the top-down strength of predation (Melis et al., 2009; Vucetich et al., 2011). Unfortunately the review by Hebblewhite and Smith (2010) was completed before some of the more recent findings discussed below were available.

## 2. Reports about wolf effects

The reports about wolf effects on the ecosystem fall into three main categories: (1) direct effects on coyotes (*Canis latrans*), (2) benefits to scavengers, and (3) cascading effects of wolf interactions with prey to other species in the wolf food chain.

### 2.1. Reduction of coyotes

Much has been made of the initial report that reintroduced wolves have reduced coyote numbers in Yellowstone National Park (Crabtree and Sheldon, 1999), a finding in accord with earlier work (Mech, 1966), and several other studies confirm that wolves kill coyotes and tend to reduce their numbers (summarized by Ballard et al. (2003)). What has grabbed the imagination of researchers and the public about a reduction in coyotes in Yellowstone is the possibility that it might lead to both increased coyote prey (Buskirk, 1999) that then fosters a "mesopredator release," that is, an increase in smaller predators such as raptors, foxes (*Vulpes vulpes*), and badgers (*Taxidea taxus*) (Terborgh and Winter, 1980). Such a release has not been documented in Yellowstone, however. Furthermore the number of coyote packs in the part of Yellowstone where they were at first reduced has returned to pre-wolf levels although the packs may be smaller (Crabtree and Sheldon, unpublished, in Hebblewhite and Smith, 2010). Thus any wolf release of mesopredators in Yellowstone is yet to demonstrated.

### 2.2. Benefits to scavengers

Effects upon a second value reported for wolves is that they benefit scavengers, every creature from bears to beetles, and ravens (*Corvus corax*) to eagles (Wilmers et al., 2003; Sikes, 1994). In Banff National Park some 20 species were recorded feeding on wolf kills (Hebblewhite and Smith, 2010). Furthermore, some researchers have suggested that wolf predation might reduce global warming effects on scavengers by providing a more regular carrion supply (Wilmers and Getz, 2005). Certainly many species do feed on wolf kills, as they do on any carrion. However wolf kills are temporally and spatially distributed more evenly than starvation die-offs, for example. Nevertheless whether wolf predation increases scavenger reproduction and survival more than other types of mortality has not been measured. Hebblewhite and Smith (2010) recognized one offsetting factor when stating that if wolves do reduce prey numbers, they also reduce total prey biomass, which would then be detrimental to scavengers.

Another important factor that neither Hebblewhite and Smith (2010) nor the authors of scavenger studies have recognized is that in most areas wolves reduce the available biomass of individual prey carcasses by 75–100% (Peterson and Ciucci, 2003), although not yet as much in Yellowstone. That is, when wolves kill a prey animal, they almost always eat most of it; the scavengers take the leftovers. However, if wolves had not killed the animal, and it had died on its own, scavengers would have had 7–10 times the amount of food as on a wolf-eaten carcass.

It is true that generally when ungulates perish without predation, that mortality tends to occur more in seasonal bursts, whereas predation tends to distribute carrion more uniformly through the year (Mech, 1970; Wilmers et al., 2003). Nevertheless many scavengers cache surplus food they obtain during bursts of ungulate mortality so as to compensate for temporal fluctuations in food (Smith and Reichman, 1984). Furthermore, much carrion from seasonal bursts of mortality lingers for many months. Whether the more-uniform distribution of much-less biomass is more beneficial to scavengers (increases reproduction and survival) than the much-greater biomass available in total without predation is a fair question that is not yet answered.

### 2.3. Cascading effects of wolves

Although the above topics have garnered considerable interest, it is the possible cascading effects of wolf interactions with prey that have drawn most of the attention from scientists and the public alike (Table 1). Cascading effects have been attributed to both wolf reductions of prey numbers and to changes in prey behavior due to fear of wolves, or to "the landscape of fear" (Brown et al., 1999). Within only a few years of wolf reintroduction to Yellowstone National Park, Ripple et al. (2001) and the National Research Council (2002) suggested that wolf predation might reduce elk (*Cervus elaphus*) browsing and release vegetational growth. Yellowstone wolves do prey primarily on elk, and science has long known that elk had been controlling aspen recruitment (Singer, 1996; Kay, 2001). Furthermore, elk numbers have declined drastically since wolf reintroduction (Eberhardt et al., 2007).

#### 2.3.1. Effects of wolf predation

What has not been clear, however, is the extent to which wolves have contributed to the decline of the main Yellowstone elk herd, that is, the Northern Range herd. Various studies have reached various conclusions about the extent to which wolves have contributed to a recent decline in the main Yellowstone elk herd (Vucetich et al., 2005; White and Garrott, 2005; Varley and Boyce, 2006), and there still is no consensus about that. The YNP elk population is affected by drought, winter severity, and human hunting as well as being preyed upon by cougars (*Felis concolor*), coyotes (Singer et al., 1997), black bears (*Ursus americanus*) and grizzly bears (*Ursus arctos horribilis*) (Barber-Meyer et al., 2008). In many areas bears are important contributors to limiting ungulate numbers (NRC, 1997). Ferreting out the role of each of these factors in the YNP elk decline is a complex task that has yet to be accomplished.

Certainly under some conditions wolves can seriously reduce prey herds (Mech and Peterson, 2003). However, such a wolf effect occurs primarily when other conditions, usually adverse weather, is also affecting the prey (Mech et al., 1971; Peterson and Allen, 1974; Mech and Karns, 1977; Hebblewhite et al., 2005; Hebblewhite, 2005) or when populations are small and isolated (Peterson et al., 1998; Klein, 1995; Garrott et al., 2009).

#### 2.3.2. Indirect effects of wolves

However, even if wolf predation contributed little to the elk decline, the "landscape of fear" looms large in the scientific literature about indirect cascading wolf effects. And there is some evidence that since wolf reintroduction to Yellowstone, elk have changed their foraging behavior (Laundre et al., 2001; Lung and Childress, 2007; Liley and Creel, 2007) and movements (Creel et al., 2005; Fortin et al., 2005; Gude et al., 2006). Thus several researchers have reported that wolves have benefitted aspen via a behaviorally-mediated trophic cascade (Abrams, 1984), in which aspen are recovering where risk of wolf predation on elk is high (Ripple et al., 2001; Ripple and Beschta, 2004, 2007; Beschta, 2007; Fortin et al., 2005). Similarly other researchers have produced evidence of increases in willow (Ripple and Beschta, 2004; Beyer et al., 2007) and cottonwood (Beschta, 2003) which they attribute to behaviorally-mediated-trophic cascades. That elk avoid aspen in risky sites because of their fear of wolves has been given considerable notice by scientists (Soule et al., 2003; Soule et al., 2005; Donlan et al., 2006; Morrell, 2007), as well as in the popular press (Table 1).

## 3. Accuracy of wolf-effect reports

The only trouble is it may well be that not all of this is correct. Science is self-correcting, and researchers who follow up on others', or even their own, work have the distinct advantage of scrutinizing the data and methods of their predecessors and thus improving on them (Ripple and Beschta, 2012). This process has now brought sharper focus on much of the early Yellowstone behaviorally-mediated-trophic-cascade research. The result is that, at the very least, scientists now disagree about whether wolf-related behaviorally-mediated-trophic cascades in Yellowstone are really occurring or at least whether that hypothesis has been rigorously tested (Kauffman et al., 2010).

At most, that well-publicized claim may not be correct at all. For example, the whole question of possible willow increase in Yellowstone after wolf restoration is rife with controversy. After Ripple and Beschta (2004) published photographs purporting to document willow increase on the only stream potentially influenced by beavers that anyone had studied, Bilyeu et al. (2008) published photos purporting to refute the increase. Creel and Christianson (2009, p. 2465), also found that "because the presence of wolves is associated with an increase [emphasis mine] in willow consumption, our data tend not to support the narrow hypothesis of willow release through a behaviorally mediated trophic cascade."

Similarly, with aspen, Kauffman et al. (2010, p. 2742) stated that "our estimates of relative survivorship of young browsable aspen indicate that aspen are not currently recovering in Yellowstone, even in the presence of a large wolf population. Finally, in an experimental test of the BMTC [behaviorally-mediated-trophic-cascade] hypothesis we found that the impacts of elk browsing on aspen demography are not diminished in sites where elk are at higher risk of predation by wolves." Further, contrary to reports by Ripple and Beschta (2004, 2006) about behaviorally-mediated-trophic cascades explaining increased willow height, Johnston et al. (2011) explained the same increased height more parsimoniously by the greater access to groundwater that taller willows have.

But what about the earlier studies that seemed to evince that wolf effect on elk behavior must be causing trophic cascades? When those studies are examined closely and critically, some understanding can be reached of how study conclusions can mislead. Many of the Yellowstone studies (e.g. Ripple and Beschta, 2004; Beyer et al., 2007) compared pre- and post-wolf reintroduction vegetation with the assumption that changes measured after wolf reintroduction were related to wolf restoration, contrary to the admonition by Smith et al. (2003, p. 339) cited earlier. However, other changes that could have affected the amount of elk browsing on willows during the post-wolf period of the Beyer et al. (2007) study were worse winter conditions, drought, human harvest of elk (Vucetich et al., 2005), increased grizzly bear numbers (Schwartz et al., 2006), and long-term reduction in moose (*Alces alces*) numbers since widespread fire in 1988 (Tyers, 2006). Furthermore, the highly relevant fact was overlooked that the growing season in Yellowstone has increased by about 27 days coincident with wolf restoration, and that could account for increased willow growth (Despain, 2005 and Renkin and Despain, Yellowstone Center for Resources, pers. comm.).

## 4. Issues related to wolf-effects

It still could be true that the actual reduction of Yellowstone National Park elk numbers is causing a trophic cascade. In Banff National Park, for example, Hebblewhite et al. (2005) thoroughly documented such a cascade. In fact that study stands out as the only one that has provided seemingly irrefutable evidence of a true trophic cascade from wolves through prey, vegetation and song birds.

There are three concerns with the claim of a wolf-predation-based explanation for trophic cascades in Yellowstone. First, elk numbers were still three to four times higher around 1998 when willow release reportedly occurred than in the 1950s when willow remained suppressed (Hebblewhite and Smith, 2010). Second, as mentioned above, there is not scientific agreement on whether wolves are actually the primary agent of the recent Yellowstone-elk-population decline. For that matter, even if they are, then presumably where other agents are more causative of elk declines, for example, human hunting, there is no reason to think a similar trophic cascade would not result there. In other words, trophic cascades caused by wolf predation would be no more unusual than those caused by other mortality agents. Third, it would be difficult to sort out the reported effects of wolves on vegetation from that of increased growing season mentioned above.

The role of beavers in the reported trophic cascade also bears further discussion. Beavers occupy a special place in the wolf-mediated trophic cascade in Yellowstone because of the many local ecological changes beaver ponds can bring (Naiman et al., 1986). Beavers depend primarily on willows in Yellowstone, and at the time of wolf reintroduction (1995) there were no actual beavers on the Northern Range (Smith et al. 2003). Willow regrowth in some areas during the past several years reportedly has increased, because of wolf effects on elk, which feed on willows. Beaver repopulation of Yellowstone, including its Northern Range has also begun (Smith et al., 2003), often attributed indirectly to wolves (Robbins, 2004; Ripple and Beschta, 2004; Chadwick, 2010). What has had little publicity, however, was that "the rapid re-occupation of the Northern Range with persistent beaver colonies, especially along Slough Creek, occurred because Tyers of the Gallatin National Forest released 129 beavers in drainages north of the park" (Smith and Tyers, 2008, p. 11). In any case, the assumption that beaver increase in Yellowstone and all the subsequent effects is a result of wolf restoration overlooks the possibility that the willow increase resulted from the raising of the water table by beavers and/or an increased growing season (Despain, 2005).

It should be clear from the above examples that sweeping, definitive claims about wolf effects on ecosystems are premature whether made by the public or by scientists. Some of the claims made to date might eventually be proven valid. More likely, some might be valid for specific times or places (e.g. Hebblewhite et al., 2005). Meanwhile it would be wise for all who are interested in wolves to remember the admonition of Ray et al. (2005, p. 426) cited earlier that "... scientists will likely never be able to reliably predict cascading impacts on bio-diversity other than prey." These authors reached this conclusion after synthesizing 19 chapters of reviews relating to the ecological role of large carnivores.

## 5. Well-documented wolf effects

With some of the more obvious aspects of wolf interactions with their environment it is becoming increasingly clear what the nature of that interaction generally is. For example, under certain circumstances, usually adverse weather or in company with other large carnivores, wolves can definitely contribute to prey reductions (summarized by Mech and Peterson 2003). To the extent that wolves do reduce prey numbers, that would help release the vegetation those prey feed on, an effect known for decades (Leopold et al., 1947). Furthermore, it is well documented that wolves tend to cull out older, debilitated members of their prey (Mech and Peterson, 2003). How beneficial this culling is to prey herds, however, is still open to debate and conjecture.

## 6. Reasons for wolf-effect reports

But what explains the rash of recent research purporting to show beneficial effects of wolves beyond releasing vegetation? With wolf lay advocates it is just natural to want to promote their favorite animal and to try to counter the known negative effects of wolves and the claims fostered by people who vilify wolves, an increasing lot as wolves recover and proliferate. Thus wolf advocates eagerly seize on any study they consider favorable to wolves. The media become complicit by immediately publicizing such studies (Table 1) because of the controversial nature of the wolf. And all this publicity reverberates on the internet. Seldom, however, do studies contradicting the sensational early results receive similar publicity. The public is then left with a new image of the wolf that may be just as erroneous of the animal's public image a century ago.

Yet science is not totally blameless in all this. Not long before wolves were reintroduced into Yellowstone and wolf populations in many other areas were recovering, ecologists began uncovering cascading effects in aquatic systems (Carpenter et al., 1985; Estes and Duggins, 1995). This discovery led researchers dealing with terrestrial systems to seek similar effects in those systems. Along came the recovering wolf populations, and soon researchers began to find what they considered to be evidence of trophic cascades in wolf-dominated systems (Hebblewhite et al., 2005). Only 3 years after wolf reintroduction into Yellowstone such findings turned up there (Ripple et al., 2001). McLaren and Peterson (1994, p. 1556) had already asserted a trophic cascade on Isle Royale; "The Isle Royale food chain [wolf/moose/vegetation] appears to be a tightly linked, three-trophic-level system dominated by top-down control," although new evidence later indicated "... that top-down processes are not the primary influences of inter annual variation in moose dynamics" in this same system (Vucetich and Peterson, 2004). Once findings claiming wolf-caused trophic cascades were published, scientists competed to find more. Teams from several universities and agencies swarmed National Parks and churned out masses of papers, most of them drawing conclusions that wolf advocates considered positive toward the wolf (Table 1).

Aided by the popular media and the internet, a strong pro-wolf sentiment began to develop. Some of the sentiment might even have influenced scientists. Although most biologists try to resist making value judgments, not all have managed. For example, two scientists highly active in conservation biology wrote that wolves "may also have had top-down positive effects on the abundance of certain prey, such as pronghorn antelope." But who is to say whether more or less pronghorns are "positive?" If more pronghorns are a positive development, what about more elk or bison? Are more or fewer coyotes positive? Fewer coyotes might release more mesocarnivores (see above), but the mesocarnivores might kill more birds. Is this positive or negative?

Most scientists do refrain from making value judgments. However, subtle biases could creep into their science, for example, simply by the choice of study they do. Since wolf reintroduction into Yellowstone and central Idaho, more than 20 articles have produced findings attempting to link wolves to greater vegetational growth as above, including one where <50 wolves have lived for <10 years (Beschta and Ripple, 2010). On the other hand, few recent studies have been published and popularized about what the public might consider negative about wolves. The only such study that comes to mind is that of Oakleaf et al. (2003) who found that in central Idaho, ranchers discovered only one of eight calves that were killed by wolves. That study gained little popular press.

## 7. Wolf effects outside of National Parks

One of the most important considerations that has been overlooked by wolf advocates when it comes to publicizing all of the putative cascading effects of wolves is that most of the studies have been conducted in National Parks. Thus to whatever extent the findings are valid, they apply to National Parks and not necessarily elsewhere (Muhly, 2010; Muhly et al., unpublished data). National Parks comprise almost all of the remaining reasonably natural environments that exist in the 48 contiguous states, and wolf-mediated trophic cascades to whatever extent they exist there would certainly add to the natural character of the parks.

However, National Parks comprise less than 10% of current wolf range in the contiguous US Thus assuming wolves cause all of the ecological effects attributed to them, from helping increase beetle populations to cooling waters, these effects would pale in relation to the overwhelming anthropogenic effects that humans have already wrought over most of the wolf range. National Parks are protected from most hunting and trapping, logging, grazing, agriculture, irrigation, predator control, pest management, human habitation, and mining, all of which wreak pervasive, long-term effects on ecosystems (Vitousek et al., 1997a; Vitousek et al., 1997b; Foley et al., 2005; Dambrine et al., 2007). How significant a beneficial effect can wolves have on songbirds compared with the negative effects of logging, grazing, clearing, or farming? How important would wolf effect on trout be where trout are stocked and harvested, streams are polluted, and river banks grazed? To the extent that wolves in National Parks do influence lower trophic levels, for them to do so outside of parks, their population would have to reach natural densities for long periods. Because wolf populations will almost always be managed outside of National Parks (Mech, 1995; Fritts et al., 2003; Boitani, 2003), their densities will probably never consistently reach the densities of wolves in National Parks, however.

Wolf restoration has generated a fine assortment of interesting ecological studies and has generally improved our understanding of wolves and associated species and their interactions with each other and the environment. However, we as scientists and conservationists who deal with such a controversial species as the wolf have a special obligation to qualify our conclusions and minimize our rhetoric, knowing full well that the popular media and the internet eagerly await a chance to hype our findings. An inaccurate public image of the wolf will only do a disservice to the animal and to those charged with managing it.

The wolf, while at the top of a food chain and a restored member of the world's most famous National Park and a prominent member of others, remains as one more species in a vast complex of creatures interacting the way they always have. It is neither saint nor sinner except to those who want to make it so.

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## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.biocon.2012.03.003.

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# Predation Management Plan for the Middle Fork Elk Zone

**February 2014**

**Idaho Department of Fish and Game**

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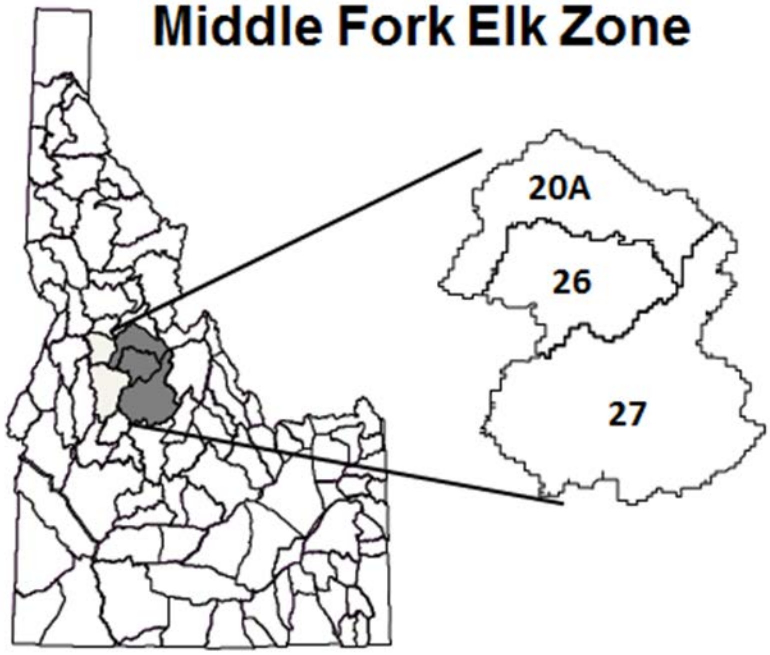


## INTRODUCTION

Consistent with the Fish and Game Commission's (Commission) "Policy for Avian and Mammalian Predation Management (IDFG 2000)," this management plan identifies actions and objectives to stabilize and recover elk populations in the Middle Fork Zone (MFZ), and identifies approaches to monitor effects of these actions on elk and predator populations. Most of the MFZ is comprised of the Frank Church River of No Return Wilderness and in federal ownership, managed by the U. S. Forest Service (USFS). Actions will be taken in consideration of congressional wilderness designation and in conjunction with state management plans for individual species (gray wolf [*Canis lupus*], black bear [*Ursus americanus*], mountain lion [*Puma concolor*], and elk [*Cervus elaphus*]) to ensure species management objectives are met.

## DEFINITION OF PROBLEM

Total elk numbers in the MFZ declined from 7,485 to 6,958 (-7%) from 2002 to 2006, and then to 4,229 by 2011 (an additional 39% for a total loss of 43% since 2002). Cow elk and bull elk numbers in the MFZ have declined 35% and 45%, respectively, between the 2006 and 2011 aerial surveys and are below population management objectives. The ratio of calves to cow elk during in the 2011 winter survey was less than 13 calves per 100 cows, suggesting further decline beyond 2011.

This low level of reproductive success is well below that needed to recover the herd, and at its current level, the elk population will continue to decline. Based on research on causes of elk mortality conducted in the elk management zones immediately adjacent to MFZ to the north

(Lolo and Selway) and to the south (Sawtooth), wolves are likely a major source of juvenile and female elk mortality especially during winter, thus reducing the recruitment of juveniles into the herd and preventing the female elk component of the population from reaching management objectives (Pauley and Zager 2011). Based on population modeling, the MFZ elk population is expected to continue to decline at 3 to 7% annually if predation rates are not reduced.

## ELK POPULATION OBJECTIVES AND CURRENT STATUS

Management objectives for elk in the MFZ call for maintaining 3,850 – 5,750 female elk and 690 - 1,030 male elk, of which 390 - 810 are adult males (defined as branched-antler bulls during winter) (IDFG 2014). The most recent survey (2011) indicated that all components of the elk population were below population objectives (Table 1, Figs. 1-2). The cow to calf ratio in the MFZ declined substantially after 1995 (Fig. 3).

Table 1. Population objectives and status of Middle Fork Zone elk 1989 – 2011 (elk sightability surveys).

| | F | M | Adult M | M:100 F | Ad M: 100 F |
|---|---|---|---|---|---|
| Objective[a] | 3,850-5,750 | 690-1030 | 390-810 | 25-29 | 14-18 |
| Year | | | | | |
| 1989 | 4,225 | 933 | 543 | 22.1 | 12.9 |
| 1992 | 5,525 | 1,217 | 691 | 22.0 | 12.5 |
| 1995 | 6,365 | 1,314 | 865 | 20.6 | 13.6 |
| 1999[b] | 6,383 | 855 | 619 | 13.4 | 9.7 |
| 2002 | 4,613 | 875 | 475 | 19.0 | 10.3 |
| 2006 | 5,137 | 834 | 450 | 16.2 | 8.8 |
| 2011 | 3,341 | 462 | 276 | 13.8 | 8.3 |

[a] Prior to the adoption of the 2014-2024 Elk Management Plan, the population objectives for males was 950-1,550 and adult males was 600-900. IDFG adjusted this objective to better reflect realistic potential for population growth during this 10-year period.
[b] Values for GMU 26 portion of this estimate based on a partial survey.

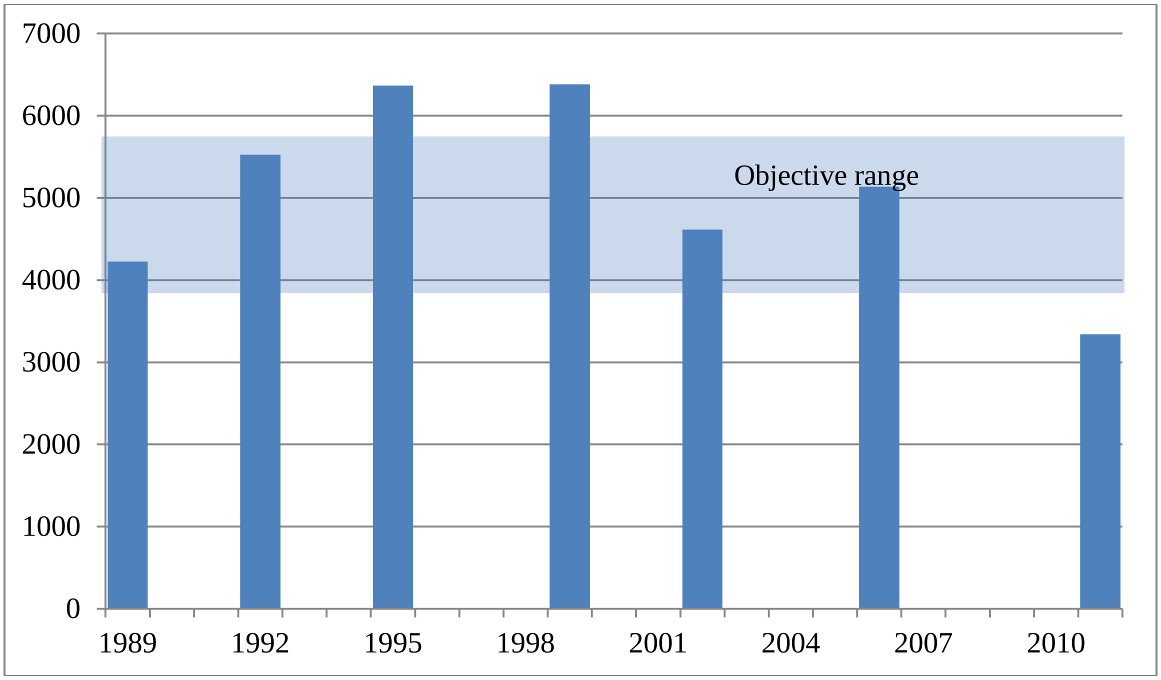


Figure 1. Total number of cow elk in the Middle Fork Zone, 1989-2011.

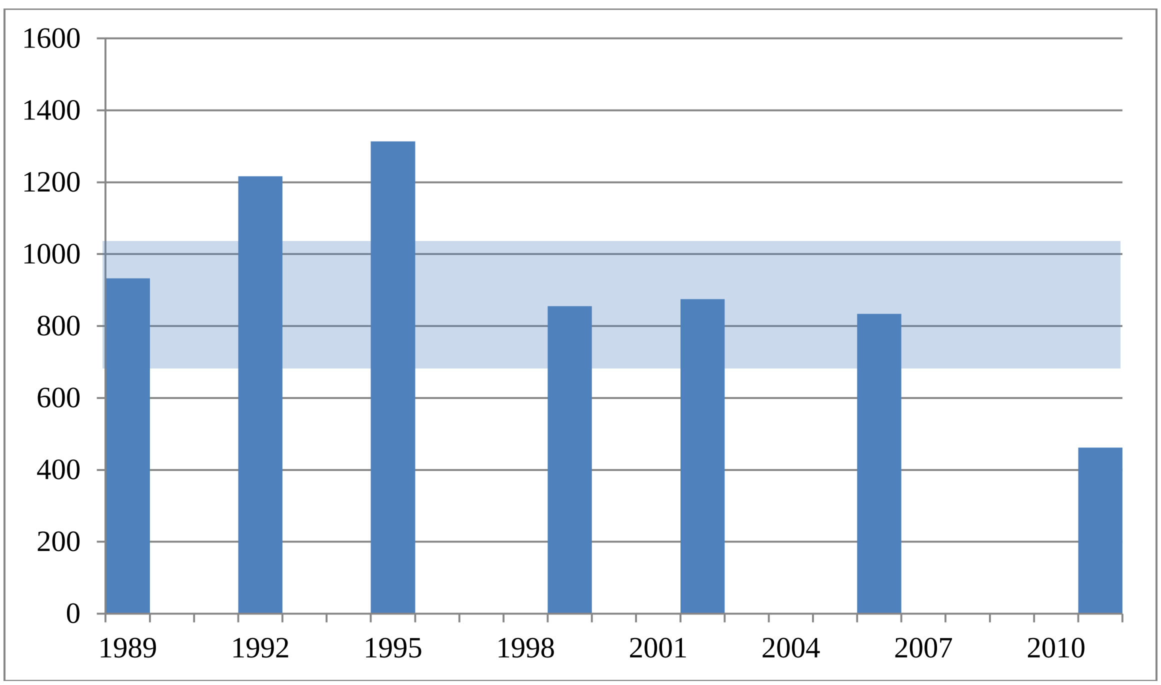


Figure 2. Total number of antlered elk in the Middle Fork Zone, 1989-2011. Prior to the adoption of the 2014-2024 Elk Management Plan, the population objectives for males was 950-1,550 and adult males was 600-900 (IDFG 1999). IDFG adjusted this objective to better reflect realistic potential for population growth over the scope of the 2014-2023 elk plan.

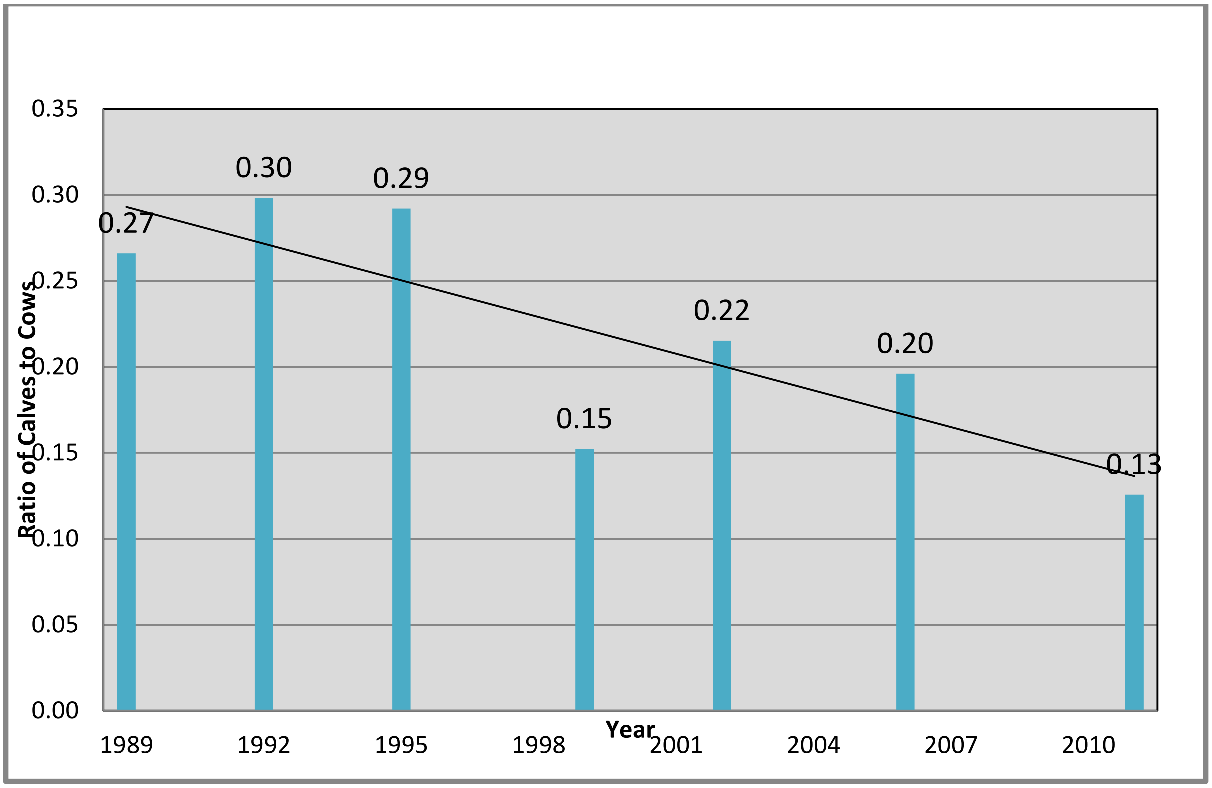


Figure 3. Juveniles:100 females in Middle Fork Elk Zone, 1989-2011.

**Background – Middle Fork Elk**

The Idaho Department of Fish and Game (IDFG) has defined some movement patterns of elk in the MFZ via radio-telemetry of elk calves. This information, combined with radio-telemetry studies of elk in the adjacent zones to the north and south of the MFZ, and historical observations within the MFZ, indicates that greater than 60% of elk in the MFZ remain resident within the zone, occupying higher elevation ranges during summer and moving to lower elevations along the Middle Fork Salmon River, main Salmon River and major tributaries during winter. Population objectives were established based on habitat potential, harvest opportunity, and moderate predation rates (IDFG 2014).

**Habitat Potential**

Pregnancy rates and body condition of females are indicators of carrying capacity (Murphy et al. 2011). In addition, forage quality and its effect on animal condition regulate elk population vital rates, and recruitment rates in particular (Cook 2002, Cook et al. 2004). Higher quality forage typically promotes higher recruitment rates, while in a habitat-limited situation, rates decline in response to lower or declining forage conditions.

Granitic and weathered volcanic formations underlying the MFZ provide fewer nutrients, and lower precipitation in the MFZ limits vegetative productivity. Similar to the situation in the Lochsa and Lolo areas (to the north), elk habitat quality in the MFZ has declined in general since the 1980s through the early 2000s due to a lack of disturbance (fires), and has been a factor contributing to population decline.

Recent fires in the MFZ have provided some relief from long-term habitat declines. Perimeters of fires occurring since 2000 encompass >400,000 acres, accounting for roughly 20% of the area. In general, large-scale wildfires promote increased forage production and forage quality, particularly on summer ranges. A significant acreage of wildfire in the MFZ has occurred on winter and transition range; however, on some winter ranges there is potential for reduced forage quantity and quantity as a consequence of increased prevalence of invasive noxious weeds and other species with lower or no nutritional value.

### Annual Survival of Elk

Elk population growth rates are sensitive to adult female survival, and populations that are stable or increasing typically exhibit female survival rates ≥90% (Eberhardt 1985). Cow survival rates averaged 81% in the nearby Lowman area, 2008-2012; and 83% in the North Fork Clearwater River drainage, 2009-2012 (Pauley et al. 2012, IDFG unpublished data 2014).

Poor juvenile survival also contributes substantially to population decline (Gaillard et al. 1998, Raithel 2005). The most recent mid-winter estimate of less than 13 calves per 100 cows is inadequate to maintain a population given observed cow elk survival rates. Female and juvenile elk survival rates appear inadequate to stabilize or provide growth of the elk population, preventing it from reaching management objectives within the MFZ.

### Cause-specific Mortality of Elk

IDFG has collected data through the use of radio-collars regarding the causes of elk mortality between 2006 and 2012 from the Sawtooth, Lolo, and Selway Zones, which are located immediately south and north of the MFZ. Legal harvest was documented as the primary cause of mortality for adult male elk, while wolf predation and malnutrition were documented as the leading causes of mortality for both females and calves ≥ six months (Pauley and Zager 2011). Neonate elk (< 6 months) are killed primarily by predation from bears and lions (Schlegel 1986, Zager and White 2003), although predation by wolves, malnutrition, and other causes can be important factors (Zager et al. 2007).

## EFFORTS TO ADDRESS MIDDLE FORK ZONE ELK DECLINE

### Changes in Elk Habitat

Most of the MFZ is comprised of the Frank Church River of No Return Wilderness and in federal ownership, managed predominately by the USFS. Habitat alteration in this area is largely in the form of natural disturbance such as wildfire. Approximately 20% of the MFZ has burned in wildfires since 2000. However, colonization of the Wilderness by invasive plant species in recent years is an important factor in the deterioration of elk habitat in some areas. IDFG will make recommendations regarding invasive plant control and other habitat-related issues to the USFS consistent with the directives of the 1980 federal wilderness designation and interagency agreements. IDFG will also continue to evaluate appropriate measures for habitat management on the relatively small acreage of parcels it owns in the MFZ.

**Changes in Elk Hunting Seasons and Harvest Strategies**

In response to declines in elk numbers, especially bull elk, IDFG implemented caps on the A and B zone tags in the MFZ in 2000 and restricted take to a smaller segment of the elk population (only bull elk with at least a brow tine) in GMU 27 in 2001. Antlerless elk hunting was reduced over time and completely eliminated in the MFZ in 2011 (Table 2).

Table 2. Middle Fork Elk Zone harvest statistics, 2003-2012.

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|
| Antlerless harvest | 110 | 73 | 78 | 119 | 78 | 42 | 67 | 57 | 0 | 0 |
| 'A' Tag | 71 | 72 | 78 | 119 | 77 | 42 | 67 | 55 | 0 | 0 |
| 'B' Tag | 39 | 1 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 |
| CH Tag | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Antlered harvest | 309 | 307 | 355 | 419 | 296 | 295 | 250 | 158 | 145 | 155 |
| 'A' Tag | 75 | 110 | 76 | 112 | 93 | 61 | 65 | 50 | 38 | 43 |
| 'B' Tag | 234 | 197 | 279 | 307 | 203 | 234 | 185 | 108 | 107 | 112 |
| CH Tag | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hunter numbers | 1,878 | 1,841 | 1,678 | 1,611 | 1,512 | 1,752 | 1,511 | 1,133 | 821 | 757 |
| 'A' Tag | 752 | 782 | 678 | 647 | 654 | 706 | 588 | 471 | 285 | 197 |
| 'B' Tag | 1,126 | 1.059 | 990 | 964 | 858 | 1,046 | 923 | 662 | 536 | 560 |
| CH Tag | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6+ points (%) | 39 | 36 | 47 | 43 | 40 | 42 | 49 | 56 | 44 | 50 |

## Black Bear and Mountain Lion Populations and Harvest

Spring and fall bear seasons in the MFZ were relatively conservative in the late 1980s and early 1990s, consisting of a standardized season of April 15 to June 15 in spring and September 15 to October 31 in fall. Lion seasons ran from September 15 to March 31. Only 1 bear and 1 lion could be taken in a calendar year.

Between fall 1999 and spring 2001, the Commission made incremental changes to bear and lion seasons and bag limits to address declining elk recruitment in the MFZ. Bear seasons were expanded to August 30 to November 18 in fall and April 1 to June 30 in spring. Lion seasons were expanded to August 30 through April 30. Extra bear and lion tags were allowed, along with discounted non-resident bear and lion tags. Non-resident deer and elk tags could also be used on bear and lions.

These changes resulted in a doubling of black bear harvest by 2002, and black bear harvest has since remained at these higher levels. The management objective for bears in the MFZ (bear data analysis unit 3B) is to increase harvest from a light to moderate harvest regime (IDFG 1998). Despite the higher harvest levels since 2002, the bear population in the MFZ continues to exhibit characteristics of a lightly harvested population.

By contrast, mountain lion harvest demonstrated an initial increase, and then a declining trend in harvest after 2000. This pattern occurred simultaneously over most of Idaho. Potential factors include a reduced lion population driven by a declining prey base for this obligate predator, and a decline in participation by hound hunters (concerns with turning dogs loose in wolf country). Although alternate prey, primarily white-tailed (*Odocoileus virginianus*) and mule deer (*O. hemionus*), are available to lions in these GMUs, whitetails are uncommon and mule deer occur at moderate densities.

The current lion harvest (average of 10 lions/year, 2011 – 2013) is below the objective described in the Idaho Mountain Lion Plan (IDFG 2002) for a harvest of 15 or more lions annually from the Warren Data Analysis Unit, which also includes GMUs 19A and 25. This DAU includes some of the oldest mountain lions in Idaho, with 55% of the male harvest constituted of lions 5 years of age or older.

## Wolf Population Size

Radio-telemetry, non-invasive genetic sampling, hunter observation and harvest information (e.g., location and number observed by hunters, location and age-class data obtained from harvested wolves) provide insight into pack activity in the MFZ. Based on this information, IDFG has documented 6 to 8 resident packs in the MFZ in recent years (2008 – 2012), and an additional 2-3 packs whose territories include significant area within the MFZ (Fig. 4). However, additional packs that have not been detected may use the MFZ, and annual minimum population estimates generated for such a vast and remote back-country area should be treated as conservative estimates.

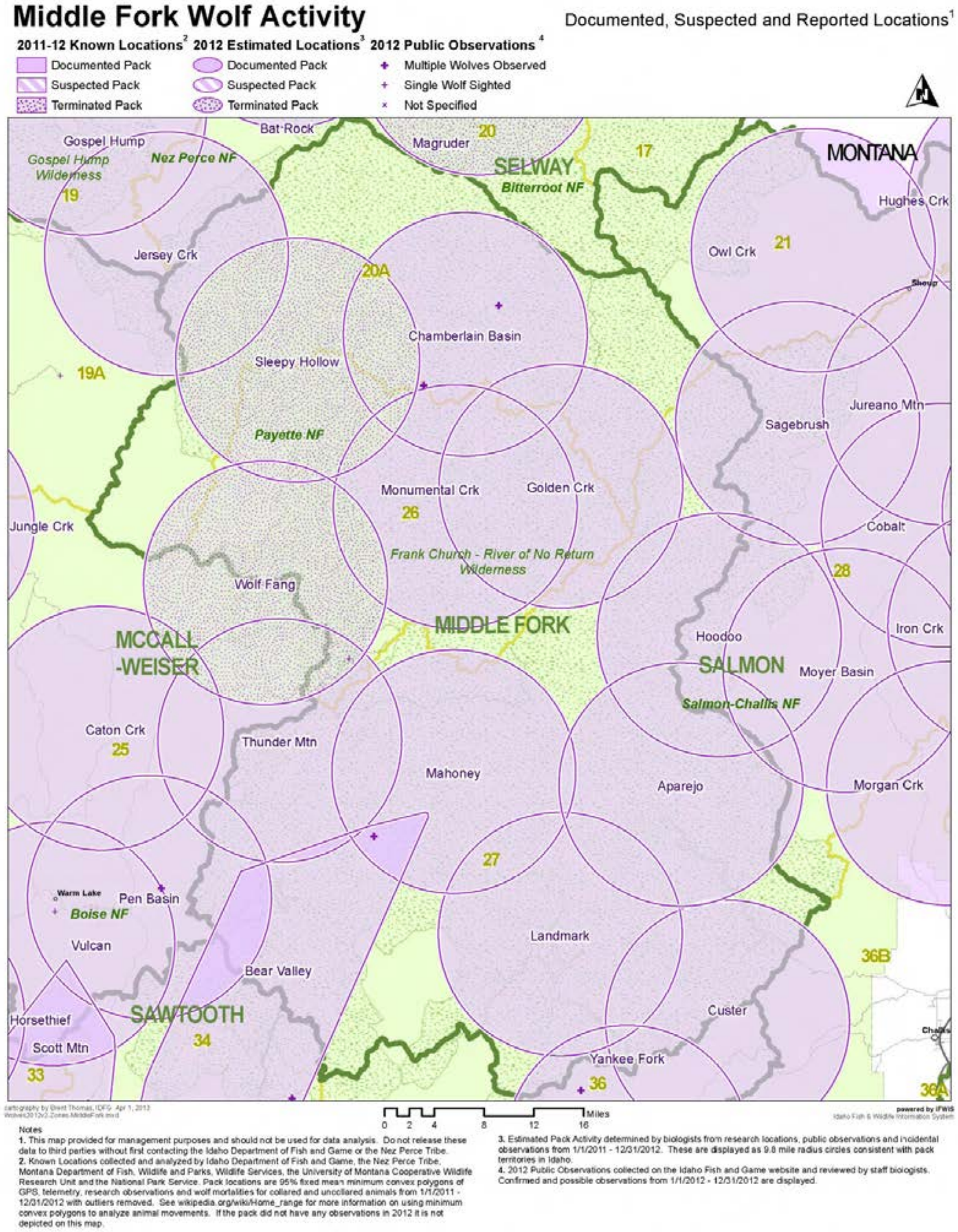


Figure 4. Approximate extent of detected wolf pack activity in the MFZ, 2011-2012.

The 2,884 $mi^2$ MFZ is large enough to accommodate approximately 12 wolf packs, based on an average territory size of 240 $mi^2$ (Ausband et al. *in review*). Given the range of 6 (minimum documented) to 12 (based on territory size) packs in the MFZ, management will initially be based upon the midpoint of 9 packs assumed present in the MFZ.

To comply with federal post-delisting monitoring requirements, IDFG develops a minimum population estimate for wolves by using information based on documented packs, estimated pack size, number of wolves documented in small groups not considered packs, and a percentage of the population expected to be lone wolves. The formula is presented as**:**

**[(# Wolves in known packs with complete counts) + (# Packs with incomplete counts *mean pack size) + (# Wolves in other documented groups)]* (lone wolf factor)**

This minimum population estimate is calculated at the end of the calendar year, during the hunting and trapping seasons. It is more useful to management, however, to calculate this estimate the following summer, after harvest has concluded and packs have demonstrated success in recruitment of pups.

Given a *summer* mean pack size of 9.2 wolves per pack (IDFG unpublished data 2012), an additional 12.5% lone wolf factor (see Holyan et al. 2013), 9 packs represent approximately 93 wolves present in the MFZ during summer.

## Wolf Harvest

The state is divided into wolf zones based on current wolf densities and distribution, elk zones and prey base, livestock conflict areas, ecological or administrative similarities, and linkage concerns. The Middle Fork Wolf Zone is identical to the Middle Fork Elk Zone.

During the first Idaho wolf hunting season in 2009, IDFG developed harvest limits for individual wolf zones as well as a statewide limit. Seasons closed in individual zones when harvest limits were met, or the end of the established season date, whichever occurred first. A harvest limit of 17 was adopted for the MFZ for the 2009-10 season (this was reached January 31, 2010); no harvest limits were deemed necessary for subsequent years. Hunting and trapping are the primary causes of human-caused mortality in the MFZ (Table 3).

Table 3. Human-caused mortality in the MFZ since 2009-2010.

| Biological Year[a] | Hunting | Trapping | Other Human-Caused Mortality[c] | Total |
|---|---|---|---|---|
| 2009-2010 | 16 | 0 | 4 | 20 |
| 2010-2011 | 0 | 0 | 0 | 0 |
| 2011-2012 | 27 | 12 | 1 | 40 |
| 2012-2013 | 6 | 10 | 0 | 16 |
| 2013 - 2014[b] | 11 | 2 | 9 | 22 |

[a] May 1 – April 30
[b] Through January 31, 2014 only
[c] Includes other legal kills, illegal kills, control actions, etc.

IDFG has incrementally increased wolf hunting and trapping opportunity under an adaptive framework consistent with Commission direction. The hunting season ran from 30 August through 31 March for the first 3 seasons and was extended to a 30 June closure beginning in 2013-14. Trapping was permitted 15 November to 31 March beginning with the 2011-12 season. Hunters and trappers can use up to 5 wolf tags in the MFZ (each method, plus hunting tags may be used for trapped wolves). Additionally, non-resident elk and deer tags may be used instead for taking a bear, lion, or wolf if that season is open.

## PREDATION MANAGEMENT PROGRAM

### PROPOSED ACTIONS

Regulated harvest by licensed hunters is IDFG's preferred tool for reducing black bears and mountain lions in the MFZ. IDFG will continue to support longer seasons and additional tags in the MFZ for managing bear and lion to improve elk survival. IDFG plans no additional actions beyond regulated harvest for bear and mountain lion management.

Regulated harvest by licensed hunters and trappers is IDFG's preferred tool for reducing wolves in the MFZ. When regulated harvest, despite changes to seasons, bag limits, and regulations, is insufficient to achieve wolf reduction in the MFZ, and consistent with the federal wilderness designation of most of the MFZ, IDFG will approach management from a "minimum tool" perspective, initially using one or more wilderness trappers on foot or horseback to remove wolves from the MFZ.

Wolf removal rates of 29% or less typically do not cause any short-term changes in wolf abundance (Adams et al. 2008). Wolf populations tend to compensate for low removal rates, potentially within a year. Where higher levels of removal occur and wolf populations decline, the wolf population would be expected to return to pre-removal levels rapidly once removals end (National Research Council 1997: Table 3.1). Consequently, after a wolf population is reduced to a desired level, it is necessary to sustain a removal level during subsequent years to maintain reduced wolf abundance. Proposed future management actions will be designed to maintain approximately 40% of the existing wolf population in the MFZ.

Wolf management in the MFZ is extremely challenging considering the remote country, rugged terrain, and limited access. Consequently, hunting and trapping pressure is lower than front country areas that are easier to access and travel. Any reduction in the MFZ wolf population will likely take longer than most other zones. Management will be necessarily adaptive, relying upon monitoring to determine the appropriate management. IDFG will monitor legal harvest and adjust future efforts accordingly.

## OBJECTIVE AND MEASURES OF SUCCESS

The objective of the Predation Management Plan is to affect an increase in elk survival and elk numbers in the MFZ to move the population towards stabilization and eventual recovery. To achieve this objective, IDFG seeks to reduce predator populations without affecting their viability. IDFG will manage wolf numbers to 40% of the 2012 population, from a summer population of approximately 93 wolves to approximately 35-40 wolves. Success will be measured by comparing elk status in relation to IDFG 2014 elk plan population objectives and consistency with species management plans for black bear and mountain lion, and the Idaho Wolf Conservation and Management Plan (Idaho Legislative Wolf Oversight Committee 2002).

# MONITORING

Monitoring is a key component of any predation reduction plan and integral to adapting and refining management. Both predators and prey must be monitored to provide an adaptive framework for decisions.

## ELK

Harvest characteristics will continue to be monitored annually through a mandatory hunter report card. A zone-wide elk survey was conducted in the MFZ in 2011 and a subsequent survey is planned after 5 years, during winter 2016. Recruitment will be indexed through estimation of calf:cow ratios biennially.

## BEARS AND MOUNTAIN LIONS

IDFG will monitor black bear, mountain lion, and wolf populations through required harvest checks and Big Game Mortality Report forms. These forms are required for each successful hunter and for other discovered mortality and provide detailed information for each individual animal harvested regarding animal age, sex, location, and condition. Forms for wolves also include information regarding observation of other wolves. Harvest checks involve the extraction of a tooth for aging, collection of DNA, and attachment of an identification tag to each pelt. These data provide population trends regarding male/female ratios and age class distribution of the harvest.

## WOLVES

In addition to measures outlined above for bears and lions, IDFG will continue statewide monitoring of the wolf population to ensure compliance with post-delisting population criteria and monitoring requirements. IDFG will estimate a minimum number of wolves and breeding pairs on an annual basis from observations of unmarked and radio-collared packs, and wolf tracking and aerial surveys.

Depending on the efficacy of maintaining radio-collared animals in the MFZ, IDFG may also conduct non-invasive genetic surveys of historic and predicted rendezvous sites (Ausband et al. 2010) to assess pack presence, size, recruitment, and rate of (reported) human-caused mortality. Additional methods may include conducting howl box surveys to verify presence or absence (Ausband et al. 2011), using trail cameras to verify production, and linking harvest data to specific packs.

## BUDGET

The funds required to implement actions in this plan are available as part of larger, ongoing IDFG programs. Aerial surveys as listed are funded though statewide ungulate monitoring budgets. Funds for these efforts come from a combination of Pittman-Robertson funds, federal wolf appropriations, and IDFG license dollars. Only license funds would be used for lethal removal of wolves in the MFZ.

# RISK ASSESSMENT

## PREDATOR POPULATION

IDFG's actions under this plan will be limited to black bear, mountain lions, and wolves.

Bear season changes and associated actions that were implemented previously were intended to increase bear harvest rates to meet a "moderate" harvest goal. However, "light" harvest rates continue to be documented, and the geographic ruggedness and isolation of this area may make a moderate harvest rate unattainable even with liberal hunting seasons.

Declines in elk numbers were followed by declines in numbers of mountain lions, which in turn led to lower hunter participation and harvest rates (White 2010). Lion harvest remains low and more liberal lion seasons are unlikely to reduce lion populations substantially.

As of December 31, 2012, there were ≥117 wolf packs and ≥35 documented breeding pairs in Idaho (Holyan et al. 2013). Of the 117 packs documented in 2012, 111 documented packs were completely outside the MFZ and would not be affected by actions authorized under this predation management plan. None of the 35 breeding pairs documented during 2012 would be affected by the proposed actions. More than 600 wolves reside in areas of Idaho outside the MFZ proposed action.

Of note, the MFZ was the site of the initial 35 wolves released in Idaho during 1995 and 1996. Idaho's current wolf population is the result of these releases, dispersal from releases in Wyoming the same years, and natural colonization from established populations in Montana and Canada. A majority of introduced wolves established territories outside the MFZ, and most wolves in Idaho currently exist outside the MFZ. Potential emigration from these areas into the MFZ and wolf population resiliency in general make it very unlikely that reductions proposed under this plan would present any significant short- or long-term risk to the persistence of wolves in the Frank Church River of No Return Wilderness, MFZ, or overall wolf population viability. Wolf population reduction in the MFZ will not affect the ability to maintain Idaho's wolf population well above the recovery criteria of 15 breeding pairs and 150 wolves statewide.

In summary, these described management efforts are intended to help improve elk survival in the MFZ and will not affect the viability of the resident wolf, bear, and mountain lion populations within the MFZ nor adjacent zones.

## PREY POPULATIONS

Elk will be the primary species benefitting from the proposed actions in this plan. Mule deer, bighorn sheep, and other prey may benefit as well.

## WILDLIFE-ASSOCIATED RECREATION OPPORTUNITY

Elk have been managed for hunting and viewing by the public since the 1950s in the MFZ. The participation in hunting peaked in the 1990s as elk reached population levels that were meeting or exceeding IDFG objectives. Since that time, calf recruitment has steadily declined along with the total elk population. IDFG has substantially reduced elk hunting opportunity in the MFZ since 2000. During the past 10 years, the number of elk hunters in the MFZ declined from 2,105 to 797, a loss of 62% participation.

Implementation of actions designed to reduce impacts of predation on elk may result in a subsequent increase in opportunities for sportsmen and for other wildlife-associated recreationists whose focus is elk. The continued presence of wolves, black bear, and mountain lions in this area also provides an opportunity for hunting, trapping (in the case of wolves), and viewing (directly or indirectly), which maintains the wilderness character and values of the MFZ. These opportunities will continue in a sustainable fashion as IDFG manages predation on elk consistent with the objectives of this plan.

## MANAGEMENT ACTIONS IN FEDERALLY-DESIGNATED WILDERNESS

Most of the MFZ lies within the federally designated Frank Church River of No Return Wilderness. IDFG will consider the values underlying the Central Idaho Wilderness Act of 1980 as they apply to its actions in the Frank Church River of No Return Wilderness. IDFG will also evaluate the “minimum tool” concept for performance of additional agency actions in the Frank Church River of No Return Wilderness, should they be needed to reach population objectives under this plan.

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## Wolf Predation: More Bad News

Charles E. Kay. 2008. **Wolf Predation: More Bad News**. Muley Crazy, Sept/Oct 2008 (*posted with permission of the author*).

Full text:

As I explained in an earlier article, pro-wolf advocates are now demanding 6,000 or more wolves as one interbreeding population in every western state. Pro-wolf advocates also claim that predation, in general, and wolves in particular have no impact on prey populations. Recent research by Dr. Tom Bergerud and his colleagues, however, paints an entirely different picture and serves as a poignant example of what will happen to the West's mule deer if pro-wolf advocates have their way.

Woodland and mountain caribou have been declining throughout North America since European settlement. Many attribute the decline to the fact that caribou must feed on aboral or terrestrial lichens during winter, a food that is being destroyed by logging, forest fires, and other human activities; i.e., modern landuse practices are to blame. While others attribute the decline to predation by wolves and other carnivores. To separate between these competing hypotheses, Dr. Tom Bergerud and his co-workers designed a series of simple but elegant experiments and have now accumulated 30 years of data.

In the northern most arc of Lake Superior lie a cluster of seven major islands plus smaller islets. The Slate Islands are five miles from the mainland at their nearest point and only twice during the last 30 years has winter ice bridged that gap. Terrestrial lichens are absent, plus the islands have been both logged and burned, making them unfit for caribou according to most biologists. The Slate Islands lack wolves, black bears, whitetailed deer, and moose, but caribou are indigenous. As a companion study, Bergerud and his associates chose Pukaskwa National Park, which stretches for 50 miles along the north shore of Lake Superior. In contrast to the Slate Islands, Pukaskwa has an abundance of lichens, which are supposed to be a critical winter food for caribou, but unlike the Slate Islands, Pukaskwa is home to wolves, bears, moose, and whitetails. Woodland caribou are also present.

So we have islands that are poor caribou habitat, but which have no predators, versus a nearby national park that is excellent caribou habitat but which contains wolves. Now according to what many biologists and pro-wolf advocates would have you believe, habitat is the all important factor in maintaining healthy ungulate populations, while predation can largely be ignored. Well, nothing could be further from the truth. Habitat it turns out, is irrelevant and ecologists have been, at best, braindead for years.

Despite the supposedly “poor” habitat in the Slate Islands, Bergerud and his research team recorded the highest densities of caribou ever found anywhere in North America. Moreover, those high densities have persisted since at least 1949 when the herd was first censused. More importantly, the density of caribou in the “poor” habitat, but predator-free, Slate Islands was 100 times that in Pukaskwa National Park where predators hold sway. 100 times or 10,000% more caribou per unit area. A significant difference by any objective standard.

Then during the winter of 1993-94, a natural experiment occurred when Lake Superior froze and two wolves crossed to the Slate Islands. Within days, the two wolves proceeded to cut through the Slate Island caribou like a hot knife through butter. Because caribou, like mule deer, are exceedingly susceptible to wolf predation. Only when the two wolves disappeared did caribou numbers recover.

A second set of manipulated experiments was conducted when Bergerud and his associates transplanted Slate Island caribou to adjoining areas with and without wolves. A release to Bowman Island, where wolves and moose were present, failed due to predation. A second release to Montreal Island doubled in numbers until Lake Superior froze and wolves reached that island. A third release was to Michipicoten Island where wolves were absent but so too were lichens. Despite the “poor” habitat, those caribou increased at an average annual rate of 18% for nearly 20 years. A fourth release to Lake Superior Provincial Park on the mainland failed due to wolf predation. Thus, the data are both conclusive and overwhelming. Habitat is largely irrelevant because caribou numbers are limited by wolf predation. Bergerud goes so far as to say that managers have wasted the last 50 years measuring lichens! Remove the wolves and you have 100 times more caribou, even on supposedly “poor” ranges.

Based on his research in the Slate Islands and elsewhere, Dr. Bergerud has come to the conclusion that mountain and woodland caribou throughout the length and breath of North America are facing extinction due to increased predation, mostly from wolves, but also from bears, both black and grizzly, mountain lions, and coyotes. Caribou populations that have persisted for thousands of years will be gone in our lifetimes. But here is the kicker, it is not really a “wolf problem.” Instead it is a problem of too many moose and/or whitetails.

Historically and prehistorically moose were absent from most of western North America and eastern Canada, as well. Even in Alaska, moose were historically limited to a few, very remote areas. Since European settlement, however, moose numbers have exploded, as has the area occupied by those animals. There are more moose in North America today than at anytime in the last 12,000 years, except for the 1950’s-60’s when predator control was widespread and effective. Historically, caribou numbers were low and those animals so widely spaced that they could support only a few or no wolves. The addition of alternative prey, though, has allowed wolves to increase and the wolves then drive the more vulnerable caribou ever downward. That is to say, the addition of moose did not buffer, or reduce, predation pressure on caribou but instead increased predation on caribou, the exact opposite of what most people would predict.

That, however, is not the most intriguing part. Why were moose absent historically and prehistorically? According to Dr. Bergerud, moose, and to a lesser extent whitetails, have expanded in numbers and range due to climatic change and/or logging. In this, though, Bergerud erred. First, the expansion of moose occurred well before any global warming that may have occurred and second, based on fire-history studies, there has always been a significant amount of the browse favored by moose and whitetails. Instead, as I have explained elsewhere (see Kay, C.E. 1997. **Aboriginal Overkill and the Biogeography of Moose in Western North America**. Alces 33:141-164), native hunters extirpated moose over large areas, which allowed woodland and mountain caribou to persist. As native hunting declined, moose populations expanded, followed by wolves.

Two of the woodland caribou herds in most rapid decline lie not in Alberta’s heavily logged boreal forests, but rather in the remote wilderness of Canada’s Banff and Jasper National Parks. Why are caribou headed towards extinction in two national parks where there is no logging or other development? Wolves! that are maintained at too high a density by unnaturally large numbers of elk. Elk, that like moose, were historically kept at very low levels by native hunters. There are more elk on western ranges today than at anytime since the last glaciation.

All this has led Dr. Bergerud to conclude that there are only two ways to keep mountain and woodland caribou from going extinct. You either have to significantly reduce wolves or significantly reduce the number of moose or whitetails where the latter occur. Here we need to note that other studies have shown that wolves and bears routinely keep moose populations at only 10% or less of what the habitat would support in the absence of predation. Even at those low moose densities, though, there are still more than enough wolves to drive woodland and mountain caribou to extinction. So if we were to significantly reduce the number of wolves, we would not only save the caribou, but we would also have more moose, which is a key issue among subsistence hunters in Alaska and the far north.

As I have explained in my previous articles on predation, all this is of critical importance to mule deer and mule deer hunters because the same thing, termed apparent or predator meditated competition, occurs with elk and mule deer. By preying mostly on the elk, wolves can/will take the more vulnerable mule deer to exceedingly low levels or extinction. The wolves that were turned loose in Montana, Idaho, and Wyoming have preyed primarily on elk and there are data on how many elk each wolf kills per year — 22 elk/wolf/year — but there is little data from those states or anywhere else on the effect of wolf predation on mule deer. To put it simply, mule deer decline so rapidly there is nothing left to study!

Hunter harvest of blacktailed deer on Vancouver Island, though, gives some idea of what will happen if pro-wolf advocates have their way. Before wolves arrived, sportsmen on Vancouver Island took home around 25,000 blacktails a year. Now that wolves have overrun the island, the figure has plummeted to less than 4,000 deer a year. Moreover, blacktails are now found in reasonable abundance only where they live in suburbs or cities; i.e., the deer have moved into towns to avoid predators.

And that is not the end of the bad news. Dr. Scott Creel, a professor at Montana State University, recently published a study in Science on predation risk and elk reproductive physiology. According to that research, elk in the Yellowstone ecosystem are being harassed by wolves to such a degree that pregnant cows are aborting or reabsorbing their unborn calves. Even studies of oil and gas development on winter ranges have never shown this level of harassment. If humans chased wildlife around the way wolves do, the humans would be in jail.

Attention also needs to be drawn to a recent book by Bergerud, Luttich and Camps on **The Return of Caribou to Ungava** [here], which I reviewed at the request of the Canadian Field-Naturalist. This is simply the best book that has appeared on caribou ecology and predator-prey relationships in many years, perhaps ever. Not only do Bergerud and his co-authors discuss the woodland caribou/wolf dilemma outlined above, but they also address the age-old question of why migratory barren ground caribou are so abundant relative to sedentary woodland and mountain ecotypes. And again the answer is wolves, or more correctly, the lack thereof.

First you need to understand a little about evolution in that male and female arctic caribou have entirely different strategies to maximize their inclusive fitness. Males select habitats with large amounts of high-quality foods so that they can produce maximum body and antler growth, thereby winning breeding opportunities during the rut. Females, on the other hand, select habitats that maximize the survival of their reproductive output; i.e., calves. So in spring, pregnant caribou migrate to remote tundra locations where there are no alternative prey to support wolves or bears. The forage on those areas is of poor quality, but security for newborn young is paramount. Breeding wolves cannot follow the female caribou to the barrens because the wolves are tied to densities at treeline where there are moose. Male caribou also remain near treeline because green-up comes earlier there and the quantity and quality of forage are better.

Towards the end of summer, the bulls move north to join the cows and calves on their annual migration to distant winter ranges. After their pups can keep up with the adults, wolves abandon their territories and shadow the ever-moving caribou. This is when the wolves begin to kill the young calves. And annihilation it is, for even with the caribou's long-distance, anti-predator migrations, wolves eventually gain the upper hand and drive caribou numbers down. That is until the caribou are saved by Arctic foxes! How can Arctic foxes save caribou from wolf predation? Rabies!

Rabies is endemic in Arctic foxes and every four to five years the disease reaches epidemic proportions. And when it does, wolves become infected, wolf numbers decline by 80% to 90%, and the caribou calves and their mothers can breathe a little easier, and more importantly, a lot longer. Without Arctic foxes and rabies, the large herds of barren ground caribou would not exist. All this, though, has been ignored by the pro-wolf crowd.

To quote Dr. Bergerud, "When…biologists attempt to reduce wolf populations to increase caribou stocks, they are blamed [by pro-wolf advocates and the media] for intruding into the Balance of Nature." Earthjustice, the environmental lawfirm representing pro-wolf groups, for instance, has repeatedly cited "The Balance of Nature" in its legal briefs to federal judges. But according to Dr. Charles Elton, the father of ecology, "The Balance of Nature" though widely believed by the public "has the disadvantage of being untrue."

To again quote Dr. Bergerud,

The Balance of Nature is not a scientific hypothesis, since there is no disproof that its [advocates] will accept. [Instead] it is a closely held idea [like religion] that is not testable… Balance of Nature advocates, as a last [resort] blame imbalances between predator and prey…[on modern] man's intrusion. The most widely quoted balance of nature example… is the interaction of wolves and moose on Isle Royale…. [but] Isle Royale is a [totally] unnatural area [as there was/is] no opportunity for egress- ingress of the wolves, the major [way] they adjust their numbers, and [because] there [are] no bears on the island, a major predator of moose.

Which is exactly what I said in 1993 when I wrote my first article on predation. In short, Isle Royale is a flawed test of predator-prey ecology. The Slate Islands and Pakaskwa National Park are not.

What the world needs to learn from the Slate Islands is that wolves, not habitat, limit ungulate populations. While the take home message for mule deer hunters is that if pro-wolf advocates get their way, our already limited hunting opportunities will decline to nothingness — which unfortunately has been the goal of some all along. But letting predators decimate the game herds that sportsmen worked so hard to build over the last 70 years will destroy the fundamental framework of wildlife conservation in North America.

Just look at what has happened in Kenya. At the urging of animal rights groups, Kenya banned all consumptive use of wildlife in 1977 and as a result, Kenya's once magnificent game herds have plummeted by 80% and are predicted to be extinct in the near future. Banning hunting either by decree or by leaving predators, and especially wolves with their high reproductive rate, unchecked would be an ecological disaster. After all if there are no mule deer to help safeguard winter ranges, those areas stand a high probability of being turned into housing developments. For if wildlife is not an economic asset, it will simply disappear, as it has in Kenya. And do not let anyone fool you, wolves are not an economic asset. That too is another of the pro-wolf lies.