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## Proceedings of the Vertebrate Pest Conference

### Title

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### Permalink

<https://escholarship.org/uc/item/3q40g86f>

### Journal

Proceedings of the Vertebrate Pest Conference, 23(23)

### ISSN

0507-6773

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### Publication Date

2008

### DOI

10.5070/V423110568

# Relative Risks of Predation on Livestock Posed by Individual Wolves, Black Bears, Mountain Lions, and Coyotes in Idaho

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**ABSTRACT:** Gray wolf populations have exceeded anticipated recovery levels since they were first reintroduced to central Idaho in 1995. Although wolf predation on livestock is a relatively minor issue to the livestock industry as a whole, it can be a serious problem for some individual livestock producers who graze their stock in occupied wolf habitat. This paper compares Idaho population estimates for gray wolves with the available information on numbers of livestock killed by wolves in order to estimate numbers of livestock killed per wolf. This information is compared with similar analyses for other species most commonly implicated as predators of livestock in Idaho (coyotes, black bears, and mountain lions). Population estimates for coyotes, black bears, and mountain lions are based on review of available scientific literature and analyses in environmental assessments prepared by Wildlife Services, as well as estimates from the Idaho Department of Fish and Game. Wolf population estimates are based primarily on monitoring information provided by the Idaho Department of Fish and Game and the Nez Perce Tribe. Estimates of numbers of livestock killed by wolves, coyotes, black bears, and mountain lions are based on survey data compiled by the National Agricultural Statistics Service. Rationale for use of various data sets is provided, and limitations of the data are discussed. This analysis suggests that individual wolves are much more likely to prey on livestock than are individuals of any other predator species in Idaho.

**KEY WORDS:** black bears, *Canis latrans*, *Canis lupus*, coyote, depredation, *Puma concolor*, livestock, mountain lions, predation, *Ursus americanus*, wolves

Proc. 23<sup>rd</sup> Vertebr. Pest Conf. (R. M. Timm and M. B. Madon, Eds.)  
Published at Univ. of Calif., Davis. 2008. Pp. 129-133.

## INTRODUCTION

Gray wolves (*Canis lupus*), federally listed as endangered in the United States, were reintroduced into central Idaho and Yellowstone National Park in 1995 and 1996. Since that time, they have far surpassed their original recovery goals. The biological criterion for a fully recovered wolf population in the 3-state (Idaho/Montana/Wyoming) Northern Rockies Recovery Area was to have at least 30 breeding pair of wolves (anticipated to be at least 300 total wolves) equitably distributed among the 3 states for at least 3 consecutive years. That criterion was met by the end of 2002 (USFWS et al. 2003). The wolf population in the Northern Rockies as of December 2007 was estimated at about 1,500 wolves, with about half of those living in Idaho.

One of the most controversial aspects of wolf recovery and management has been wolf depredations on livestock. Incidents of wolf predation on livestock in Idaho have steadily increased as the wolf population has increased (USDA-WS 2008). Some wolf advocacy groups have attempted to downplay the significance of wolf predation on livestock by pointing out that, in relative terms, only a very small proportion of livestock losses (<1% for cattle and <2.5% for sheep) are typically caused by wolves, and that other predators, such as coyotes (*Canis latrans*), are responsible for many more livestock deaths than are wolves (Defenders of Wildlife 2007). While both of these are valid points, it is also important to recognize that even though predation losses due to wolves may represent a relatively minor portion of total overall death losses, these losses are not evenly distributed across the industry (Mack et al. 1992).

Most livestock producers will experience no predation by wolves, while some producers in certain areas may suffer significant losses to wolves. Coyotes, by virtue of

the fact that their population is typically many times greater and more widely distributed than the wolf population, do cause more overall predation losses. But assessing the relative likelihood of predation by individual wolves versus individuals of other commonly implicated livestock predators can provide insight as to why wolf predation is a bigger concern to some livestock producers than predation by other species. One simple approach to making this type of assessment is to contrast the estimated population of the most commonly implicated predator species, coyotes, wolves, black bears (*Ursus americanus*), and mountain lions (*Puma concolor*), with the estimated number of livestock killed by each species, thereby arriving at a relative likelihood for individuals of each species to kill livestock.

## PREDATOR POPULATION ESTIMATES

### Wolves

Of the 4 predator species being considered in this analysis, the population estimates available for wolves in Idaho are probably the closest to representing the actual number of individuals in the population. Because the criterion for delisting wolves as an endangered species require accurate population data, intensive monitoring of Idaho's wolf population has been conducted annually since wolves were first reintroduced in 1995. This monitoring has included regularly-occurring surveys conducted both from the ground and from the air, facilitated by the fact that many of the wolf packs in Idaho contain one or more radio-collared animals. Additionally, the Idaho Department of Fish and Game (IDFG) maintains an online reporting system that allows members of the public to routinely report any wolf sightings, and these reports can subsequently be followed up to facilitate monitoring efforts. Idaho's wolf population has increased steadily since wolves were first reintroduced (Figure 1), and the

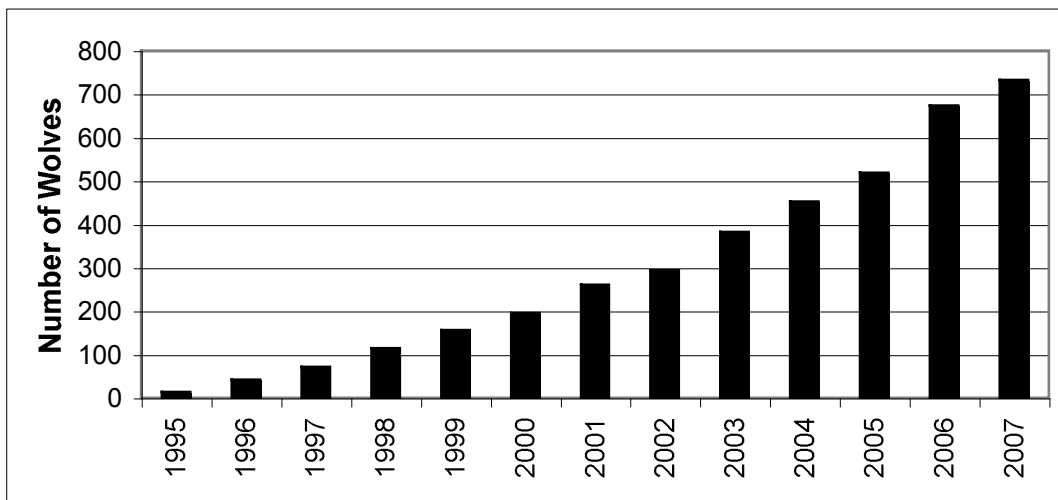


Figure 1. Estimated number of wolves in Idaho, 1995-2007.

estimated population for calendar years 2005-2007 was 518, 673, and 732 individuals, respectively (Nadeau et al. 2007, 2008).

#### Mountain Lions and Black Bears

Mountain lions and black bears in Idaho are game species managed by the IDFG to maintain stable populations, and populations of both species are currently believed to be relatively stable. Based on harvest estimates, known reproductive capabilities, and age structure of the harvest, IDFG estimates there are currently about 2,500 mountain lions and 20,000 black bears in the state of Idaho (Steve Nadeau, pers. commun.).

#### Coyotes

The IDFG has never attempted to estimate coyote populations in the state of Idaho, but the Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program developed coyote population estimates in conjunction with the preparation of several different environmental assessments (USDA-ADC 1996a,b; USDA-WS 2002). Idaho's coyote population was estimated in these analyses by considering the most relevant available scientific information on coyote densities, then extrapolating a conservative density estimate to the total land area of Idaho. Density estimates ranged from a low of 0.63/mi<sup>2</sup> (Clark 1972) to a high of 5-6/mi<sup>2</sup> (Knowlton 1972), and the lower end of this range was applied to the total area of Idaho to arrive at a conservative statewide coyote population estimate of about 50,000 animals.

#### ESTIMATES OF NUMBERS OF LIVESTOCK KILLED BY EACH SPECIES

The Idaho office of the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS) conducts an annual statewide survey of sheep producers to determine death losses due to all causes, and cattle producers have been surveyed every 5 years regarding their total death losses. NASS survey procedures ensure that all sheep and cattle producers, regardless of the size of their operation, have a chance to be included in these surveys, but larger operations are sampled more heavily than

smaller operations. All loss estimates are rounded to the nearest 100 head.

During a public comment period held in conjunction with preparation of an environmental assessment regarding predator control activities (USDA-ADC 1996a), some respondents expressed concerns about the reliability of rancher-supplied data on death losses, and they suggested that ranchers might be inflating their estimates of losses to justify more predator control. However, these data are believed to provide the most realistic assessment available of actual losses. Schaefer et al. (1981) employed several different methods to survey sheep producers regarding predation losses, and based on their own field necropsies, concluded that producers' estimates of losses were realistic. Sheep loss survey data for the most recently available 3-year period (2005-2007) in Idaho indicates predation losses ranged from 25.3% to 32.9% and accounted for an average of about 30% of total death losses among Idaho sheep producers (NASS 2008). However, through intensive monitoring conducted during a study on 3 typical range sheep operations in southern Idaho, Nass (1977) found that predation was actually responsible for 56% of total death losses. This would suggest that attributing an average of 30% of total death losses to predation is not unrealistic, and it may even suggest that Idaho sheep producers could be underestimating their losses to predators.

NASS has been conducting their annual survey of sheep losses to predators in Idaho since 1981, and losses attributable to coyotes, black bears, and mountain lions have been tabulated separately during all that time. Losses caused by species that kill relatively few sheep, such as bobcats (*Lynx rufus*) and eagles (*Aquila chrysaetos* and *Haliaeetus leucocephalus*), have historically been lumped into a category of "other". Wolves were reintroduced to Idaho in 1995 and 1996, and beginning in 1996 the relatively few losses caused by wolves in the early years after reintroduction were first lumped into the category of losses caused by "other" predators (NASS 1997). Losses attributable to wolves continued to increase as Idaho's wolf population increased, but NASS did not begin reporting them separately until the 2005 reporting period (NASS 2008).

**Table 1. Estimated sheep (2005-2007) and cattle (2005) losses due to wolves, black bears, mountain lions, and coyotes in Idaho (NASS 2006, 2008).**

	<b>Wolves</b>	<b>Black Bears</b>	<b>Mountain Lions</b>	<b>Coyotes</b>
2005 Sheep loss	500	900	500	6,100
2006 Sheep loss	600	600	400	4,900
2007 Sheep loss	500	700	400	7,200
2005 Cattle loss	888 <sup>1</sup>	111 <sup>1</sup>	200	600

<sup>1</sup>NASS estimates of Idaho cattle losses to wolves in 2005 were combined into the “other predators” category, which included any losses attributable to wolves, grizzly bears, black bears, and vultures. Total losses reported in the “other predators” category in 2005 were 600 calves and 400 adult cattle, for a total of 1,000. The Idaho Wildlife Services program has received no reports of cattle or calf losses to vultures, and the combined 1,000 losses are believed to be primarily attributable to wolves and bears. The number of confirmed and probable calf losses documented by Idaho Wildlife Services as being bear-related was 3 animals in 2005, while the number of confirmed and probable calf losses attributed to wolves was 24 animals. The ratio of 3/27 was applied to the combined 1,000 wolf and bear losses to assign 111 of the losses to bears and 888 of the losses to wolves.

The most recent survey of death losses for Idaho cattle producers was conducted by NASS as part of a nationwide survey for calendar year 2005 (NASS 2006). At the national level, the NASS data for predation losses due to coyotes, mountain lions, bears, and wolves are tabulated separately. At the state level, losses to coyotes and mountain lions are listed separately, but the losses attributed to wolves and bears are combined in a category called “other predators”, which includes grizzly bears (*Ursus horribilis*) as well as black bears, along with any cattle losses caused by vultures (*Cathartes aura* and *Coragyps atratus*). Cattle losses to vultures are not known to occur in Idaho, and very few incidents of grizzly bear predation on cattle occur because of the very low population of grizzly bears relative to black bears. The number of calf and adult cattle losses to bears and wolves combined in Idaho for 2005 was reported by NASS (2006) as 1,000 animals. The Idaho Wildlife Services program confirms relatively few calf losses to bears as compared to the number of calves and adult cattle confirmed killed by wolves, and the majority of the 1,000 animals reported killed by wolves and bears were probably killed by wolves. In 2005, the Idaho Wildlife Services program determined that 2 calves reported killed by black bears and 1 calf reported killed by a grizzly bear were either confirmed or probable incidents of predation, whereas a total of 24 calves and adult cattle were judged to be confirmed or probable wolf kills. If this same ratio (3 Wildlife Services-verified bear kills out of 27 combined Wildlife Services-verified bear and wolf kills) were applied to the 1,000 combined calf and adult cattle losses attributed to wolves and bears in the NASS report, this would suggest about 111 of the 1,000 combined losses were attributable to bears, while about 888 of those losses were attributable to wolves. Table 1 provides a summary of the NASS data on Idaho sheep producers’ losses to predators for 2005-2007 and cattle producers’ losses for 2005.

NASS estimates of predator losses to wolves, bears, lions, and coyotes are typically much higher than the number of losses actually documented as predator losses by the Wildlife Services program, but there are several reasons for this difference. In the case of losses reported to be caused by wolves, black bears, or mountain lions, Wildlife Services field employees make every effort to investigate these reports promptly in an attempt to determine the cause of death. Compensation programs exist to reimburse livestock operators for damage caused by all 3 of these spe-

cies, but compensation is contingent on Wildlife Services being able to verify that predation by one of those species was actually the cause of death. Reports of wolf predation are classified as “confirmed” incidents when there is reasonable physical evidence that the animal was actually killed by a wolf. Typical evidence used in confirming wolf predation would include the presence of wolf-sized bite marks and associated sub-cutaneous hemorrhaging and tissue damage, indicating the victim was attacked while still alive, as opposed to cases where wolves had simply fed on an already-dead animal.

In many cases, however, wolves may have been responsible for the death of a rancher’s livestock, but there was insufficient evidence remaining to confirm wolf predation. In some cases, those portions of the livestock carcass that might have contained the evidence of predation may already have been totally consumed or carried off. Some of these incidents might be classified as “probable” predation, depending on other evidence that might still remain. But in many cases, there may be little or no evidence of predation, other than the fact that wolves are known to be in the area and some livestock have seemingly just disappeared. Oakleaf (2002) conducted a study on wolf-caused predation losses to cattle on U.S. Forest Service summer grazing allotments in the Salmon, ID area, and concluded that for every calf found and confirmed to have been killed by wolves, there were probably as many as 8 other calves killed by wolves but not found by the producer. Bjorge and Gunson (1985) likewise were able to recover only 1 out of every 6.7 missing cattle during their study, and suggested that wolf-caused mortalities were difficult to detect.

#### **RELATIVE LIKELIHOOD OF PREDATION ON LIVESTOCK BY EACH SPECIES**

Table 2 provides a summary of the 2005 NASS data on sheep and cattle losses to wolves, bears, mountain lions, and coyotes in Idaho, along with the 2005 population estimate for each of these species. The estimated number of livestock killed by each species is divided by the estimated population for each species to arrive at the estimated number of livestock reported killed by each individual of those four species. In considering the combined total number of sheep and cattle reported killed by each species, each wolf in Idaho killed, on average in 2005, 2.68 head of livestock. The next-highest number of livestock killed per individual predator was for mountain lions, at 0.28 head of livestock. Dividing the 2.68 wolf figure by the 0.28 moun-

**Table 2. Estimated average number of livestock killed per individual of each species most commonly implicated in livestock predation in Idaho in 2005.**

	<b>Wolves</b>	<b>Black Bears</b>	<b>Mountain Lions</b>	<b>Coyotes</b>
2005 combined sheep and cattle losses due to each species	500 + 888 = 1,388	900 + 111 = 1,011	500 + 200 = 700	6,100 + 600 = 6,700
2005 estimated population of each species	518	20,000	2,500	50,000
Estimated number of <b>sheep and cattle</b> killed per individual present	2.68	0.05	0.28	0.13
Estimated number of <b>just sheep</b> killed per individual present	0.96	0.05	0.20	0.12
Estimated number of <b>just cattle</b> killed per individual present	1.71	0.01	0.08	0.01

**Table 3. Estimated average number of sheep killed per individual of each species most commonly implicated in livestock predation in Idaho in 2005-2007.**

	<b>Wolves</b>	<b>Black Bears</b>	<b>Mountain Lions</b>	<b>Coyotes</b>
<b>2005 Sheep loss</b>	500	900	500	6,100
<b>2005 Estimated population of each species</b>	518	20,000	2,500	50,000
<b>Estimated number of sheep killed per individual present in 2005</b>	0.96	0.05	0.20	0.12
<b>2006 Sheep loss</b>	600	600	400	4,900
<b>2006 Estimated population of each species</b>	673	20,000	2,500	50,000
<b>Estimated number of sheep killed per individual present in 2006</b>	0.89	0.03	0.16	0.10
<b>2007 Sheep loss</b>	500	700	400	7,200
<b>2007 Estimated population of each species</b>	732	20,000	2,500	50,000
<b>Estimated number of sheep killed per individual present in 2007</b>	0.68	0.04	0.16	0.14
<b>3-year average number of sheep killed per individual predator present</b>	0.83	0.04	0.17	0.12

tain lion figure suggests that individual wolves were about 10 times more likely to kill livestock than were individual mountain lions. Individual coyotes were less likely to kill livestock, at 0.13 head of livestock killed per individual coyote, which suggests that individual wolves were about 20 times more likely to kill livestock than coyotes. Black bears were the least likely to kill livestock, with just 0.05 head of livestock killed per black bear in the population, and the likelihood of an individual wolf killing livestock was more than 50 times greater than the likelihood that an individual black bear would kill livestock.

Calves and adult cattle are much more susceptible to predation by wolves than by coyotes, particularly during the summer months when cattle are grazed on forest allotments where they are more likely to be exposed to wolves. Coyote problems for the cattle industry in Idaho are primarily limited to predation on calves during the winter and early spring months when the calves are smallest, so it is of interest to note the differential likelihood of individual wolves versus individual coyotes preying on just cattle and calves, without considering sheep in the calculations. The information in the bottom row of Table 2 suggests that each individual wolf in Idaho was reported to have killed about 1.7 head of cattle in 2005, compared to only about 0.01 head of cattle killed per individual coyote or bear. Dividing the average number of cattle killed per individual wolf by the average number of cattle killed by the other three species suggests that in 2005, individual wolves were about 170 times more likely to kill cattle than were individual coyotes or bears. Individual wolves were

about 21 times more likely to kill cattle than were individual mountain lions in 2005.

Ideally, this type of simple analysis would make use of more than just a single year's data, but unfortunately, 2005 has been the only year so far for which both sheep and cattle loss data from Idaho include specific information about losses to wolves. Sheep losses to wolves are reflected in the 3 most recently available years of NASS sheep loss survey data, however, and the bottom row of Table 3 provides the 3-year average number of sheep killed by individuals of the four predator species. Dividing the average number of sheep killed per individual wolf by the average number of sheep killed per individual of each of the other species suggests that during the 2005-2007 period, individual wolves were on average about 21 times more likely to kill sheep than were individual bears, about 7 times more likely to kill sheep than were individual coyotes, and about 5 times more likely to kill sheep than were individual mountain lions.

## **DISCUSSION / CONCLUSION**

Although the livestock loss estimates and predator population estimates used in arriving at these relative likelihoods of risk are believed to be the best information available, it is important to recognize that these comparisons should be viewed as generalizations, rather than specific numbers applicable to all situations. The NASS data regarding livestock losses are subject to sampling variability and non-sampling errors such as unintentional omissions, duplications, and mistakes in reporting, recording,



and processing data. These potential errors are minimized through rigid quality controls in the data collection process and through careful review by NASS of all reported data for consistency and reasonableness (NASS 2006). Stronger inferences could be drawn if additional years of NASS data on livestock losses to wolves were available, particularly for cattle losses, where only 2005 data was available for this analysis.

Because gray wolves occupy only limited portions of the U.S., most livestock producers will never be exposed to wolf predation on their stock. But for those producers who graze stock in wolf country, this analysis suggests wolf predation may be a much bigger concern than predation by other species. In terms of prioritizing resources, wildlife damage managers should recognize that responding to wolf depredation problems may in some cases take precedence over dealing with problems caused by other predators.

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