MOUNTAIN LION DATA ANALYSIS UNIT L-24
MANAGEMENT PLAN

GAME MANAGEMENT UNITS
72 & 73
Cortez-Mancos Area
Southwest Region

Prepared for:
Colorado Division of Wildlife

By:
Scott Wait
Terrestrial Wildlife Biologist

August, 2004

Components of a Puma Management Plan

DAUs are assemblages of Game Management Units (GMUs) within which puma occupancy has been mapped. Each DAU has a brief management plan with objectives for hunter harvest, game damage, and human-puma conflict, and objectives are stated as the maximum level on a three-year running average.

I. Biological Basis and Framework for Management in Colorado

Puma Population Estimation (Static)

Colorado does not regularly inventory puma populations because no reliable, cost effective sample based population estimation technique currently exists. Population projections have been made based on densities reported in literature for intensively studied populations. Low and high densities were selected from study areas that had habitat types most similar to Colorado. Densities were then applied by biologists to areas of puma habitat within DAUs. Areas not considered puma habitat, such as extreme high elevations, intensively farmed land, cities, highways, or reservoirs, were first deleted. Biologists were allowed to apply more constrained densities based upon their knowledge of prey abundance or relative puma abundance. Finally, biologists were asked to pinpoint the puma density most applicable to DAUs within their management responsibility.

Puma densities are driven by two main factors, abundance of available primary prey and quality of habitat for puma hunting behaviors. Given the temporal and spatial variability of these two factors, complicated time and space models for predicting puma densities have yet to be developed. Therefore, a population estimation method at this time should be static (I.e.: a snapshot in time) and should bracket the population between probable high and low numbers. Therefore, Colorado will use ranges reported from credible scientific literature for intensive mark and recapture studies on puma. When low densities for puma are reported in the literature it is usually from study areas of relatively low productivity in terms of primary prey. Conversely, high densities for puma are reported from study areas that are relatively rich in available primary prey and are relatively densely vegetated and/or have high topographic relief. These characteristics of high prey populations and productivity in productive and diverse habitats are supportive of the primary factors that drive puma densities.

Estimating static population should consider the general make up of a population. For puma this includes adult male, adult female, subadults, and cubs. A simple algebraic equation expresses the population: static population = total adults + subadults + cubs, and total adults = male adults + female adults.

In application, a static population is derived by extrapolating density ranges reported in literature to DAU land area. Two density ranges give high and low end densities. Logan and Sweanor (2001) found density ranged from 2.0 to 4.3 puma/100 km^2 in the San Andres Mountains in New Mexico, whereas Logan, et.al. (1986) found density ranged from 3.5 to 4.6 puma/100 km^2 in the Bighorn Mountains in Wyoming. Therefore, we use a range of **2.0 to 4.6 puma/100 km^2** . Nearly all puma studies have estimated densities on winter range only (winter range of the prey species being used as a surrogate of puma winter range), so the previous density estimates should only be applied to winter range areas.

For estimating the component make up of a puma population, two intensive mark recapture studies have used similar age classifications comparable to harvest data collected in Colorado. These were both conducted in moderately hunted populations or emulation of hunting effects. The age structure of these studies were 56% adult, 10% subadult, and 34% cubs (Logan and Sweanor, 2001), and 48% adult, 19% subadult, and 34% cubs (Ross and Jalkotzy, 1992, in Alberta). The average of these yield 52% adult, 14% subadult, 34% cub, or stated as a ratio **100 adult: 26 subadult: 65 cub**. In populations that are heavily hunted, one would predict that the relative proportion of adults to be decreased. Conversely, a lightly hunted population should see a larger relative proportion of adults. It is illegal to harvest a female accompanied by kittens.

Finally, estimating sex composition of the adult population assumes a **1:1 ratio male to female**. This is based upon numerous intensive studies in scientific literature that found no significant difference between the number of adult male and female in the studied populations. Actual data almost always show slightly more females than males in the populations, however this is frequently offset by a lower number of females actually available for breeding.

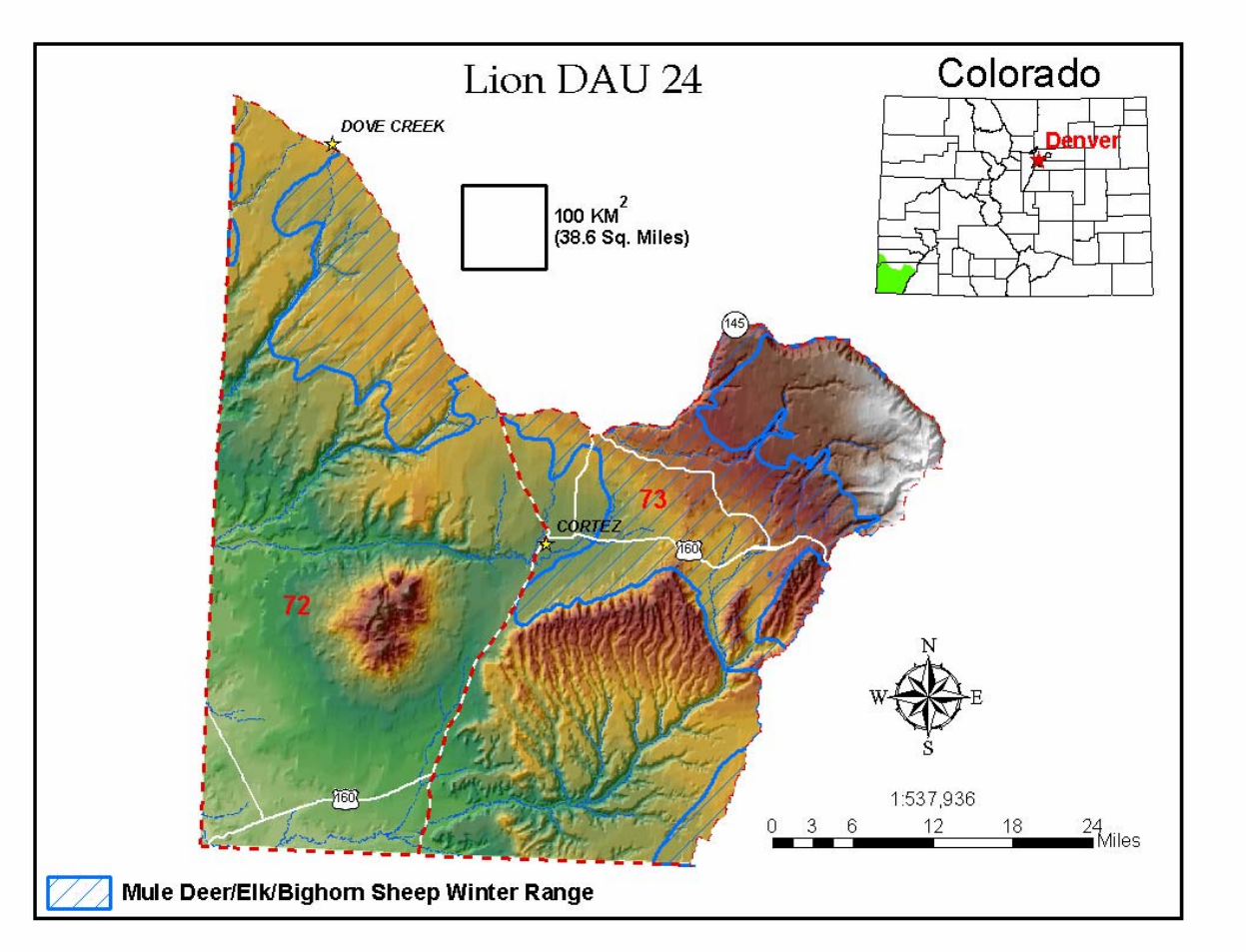
Finally, local biologists examine the estimated number of puma in DAUs and make adjustments based upon their knowledge of various qualitative habitat conditions. Conditions such as intensive agriculture, subdivision development, prairie, and relative prey density are types of factors that may influence puma populations. Consideration of these numbers in some cases help to tighten the range of the population estimation.

The CDOW does not attempt to quantify habitat quality in any numeric fashion and due to the high cost of implementing intensive mark-recapture does not implement population inventory efforts on regular basis. Information to monitor population trends is gathered via mandatory harvest checks and is analyzed on a DAU basis.

II. Data and trends for the Cortez-Mancos Puma Data Analysis Unit in Colorado

The Cortez-Mancos Puma DAU (L-24) is in southwest Colorado (Figure 1), and includes most of Montezuma County as well as a small part of Dolores County, and includes the Ute Mountain Ute Reservation and Mesa Verde National Park. The unit ranges from <6000 feet at the Utah stateline to a few peaks over 13,000 feet. Nearly all of the DAU is considered moderate or high puma density habitat, and there are significant populations of primary prey species deer and elk.

Figure 1. Location and mapped attributes of L-24, the Cortez-Mancos Puma DAU. This DAU is not completely mapped by the CDOW because of the Indian Reservation and National Park. The cross-hatched area is mapped as deer and elk winter range, and therefore high density for pumas, as well as all other areas at similar elevation and habitat coverage. Areas above deer and elk winter range up to 11,000 feet elevation are mapped as moderate density for pumas.



A. Harvest and mortality data and trends

The sport harvest quota has remained the same at 14 since 1994, while the harvest has decreased from 10-15 in the 1990's to an average of 6 in the last 5 years (Figure 2). Concurrently, the female proportion of the harvest has generally been below 50% throughout the period, except in the period of high harvest in the early to mid 1990's (Figure 3). The age data for these females is unreliable, but high harvest of females, and specifically adult age females, could be used as an indicator that the reproductive segment of the population is being impacted, and therefore the population is being suppressed. Even if the age structure of the harvested females was largely sub-adult, non-breeding females, the recruitment of breeding females is being suppressed.

Mortality due to control of depredating puma (Figure 2) has been relatively low (< 10% of harvest) throughout the period, with the exception of 4 killed in 2001, and 6 killed in 1992. Likewise, the proportion of females killed in control actions has generally been <50%. Mortality

due to factors other than harvest and control actions (roadkills mostly, Figure 2) has not been a significant factor in this DAU throughout the period of analysis.

Figure 2. Lion mortality and sport harvest in L-24, Cortez-Mancos area of Colorado.

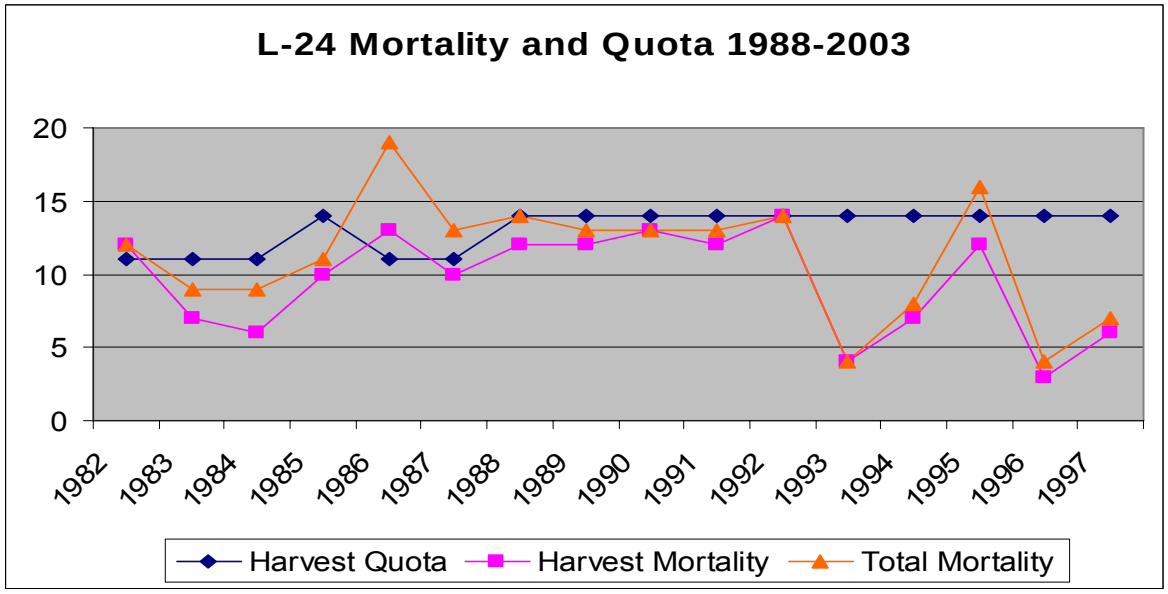
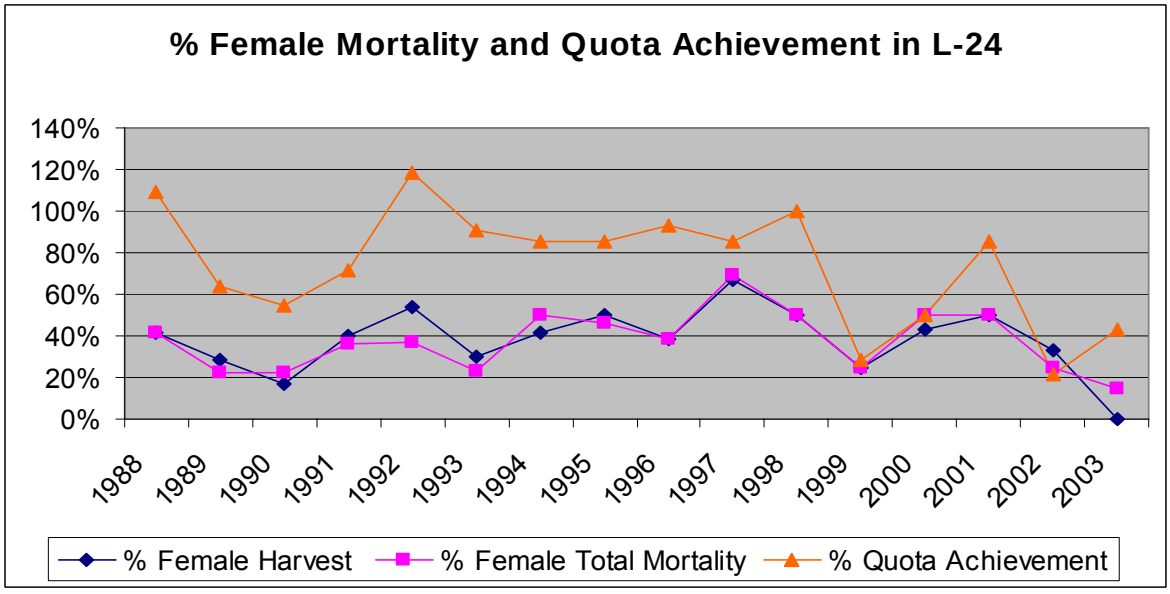


Figure 3. Female mortality as a proportion of total mortality and quota achievement rates in L-24, Cortez-Mancos area.



B. Evaluating the DAU in terms of habitat quality/population density, estimation of puma population

For the purposes of estimating a static puma population in this DAU, we use the density estimates discussed previously, which are derived by averaging the density estimates from surrounding states where intensive studies have been completed. Until information is available from the new study in Colorado, this is the best information available. The range of puma density from these states is 2.0/100 km^2 in low density to 4.6/100 km^2 in a high density. This DAU is relatively good habitat for puma (as compared to the broad spectrum of habitats occupied by puma throughout their range), therefore the actual population (density) would be expected to be near the upper density seen in other good habitat areas. Portions of the DAU, however, have been altered or naturally would be expected to have a lower density (Table 1). These areas are assigned a reduced habitat effectiveness, resulting in a lower puma density. These breakdowns are very general, and their reduction in habitat effectiveness is only approximate. Until more specific information becomes available, these should be viewed as very coarse approximations. Pumas have very large territories, that incorporate a wide variety of habitats and human developments. This procedure results in static population estimates ranging from 94-216 puma in the DAU.

To generate point estimates for the population, rather than the range developed previously, deer and elk winter ranges below 11,000 were mapped as "high density puma habitat (4.6/100km^2)" and all other areas were mapped as "moderate density puma habitat (3.0/100km^2)". This results in an estimate of 55 puma in deer and elk winter ranges and 109 puma elsewhere, totaling 164 puma. This approach only deals with areas mapped by the CDOW as deer and elk winter range, which in this DAU neglects the role that the Ute Mountain Ute Reservation (which does have some limited puma hunting) and Mesa Verde National Park (with no hunting) play in metapopulation management. Because pumas have much larger territories than deer and elk, these areas allow for immigration and emigration of pumas. In order to more accurately reflect this, these areas were mapped as high density for pumas, except for the upper elevations of the Sleeping Ute Mountain, which was moderate density. This results in a population estimate of a total of 214 pumas. These three methods result in estimates of 94-216 pumas based only on land area, up to 214 pumas incorporating deer and elk winter range and a subjective evaluation of puma habitat quality in unmapped areas.

Given this range in density projections for the DAU, then that number can be further broken down into approximate numbers of adults, sub-adults, and cubs. This once again uses average proportions derived from various studies conducted in other states and various habitats. These studies have found that adults are 52% of the population, sub-adults 14%, and cubs 34% (Table 2). Therefore, the puma population in this DAU should be comprised of 49-112 adults, 13-30 sub-adults, and 32-73 cubs. Because the point estimate is over 95% of the upper estimate of the range, the actual population might be expected to be in the upper 25% of these ranges, therefore most likely the demographic breakdown might be 42-56 adult males and females, 22-30 sub-adults, and 55-73 cubs.

Finally, based on the long term research conducted in New Mexico through increase and decline phases of puma population and prey densities, Logan and Sweanor (2001) have suggested several guidelines of acceptable mortality for managing for stable, increasing or decreasing puma populations (Table 3). Some of their guidelines have been modified for application in Colorado because of the significantly higher prey densities found here versus in their study area of the San Andres Mountains (Table 5). For this purpose, the huntable population is comprised of all subadults and adults, or approximately 106-142 (Table 2).

Table 1. Low and High density puma population estimates for the Cortez-Mancos DAU of Colorado, L-24. Area calculations are all portions of the DAU below 11,000 elevation.

L-24 Cortez-Mancos Area	Km^2	Relative Effectiveness	Effective Area (km^2)	Low Density (2/100 km^2)	High Density (4.6/100 km^2)
Subdivisions	96	67%	65	1	3
Cities/Reservoirs	13	0%	0	0	0
Intense Agriculture	96	33%	32	1	1
Remainder of DAU	4612	100%	4612	92	212
Total for DAU	4817		4817	94	216

Table 2. Demographic breakdown of projected puma population in the Cortez-Mancos area of Colorado, DAU L-24.

L-24 Cortez-Mancos Area	Adults males	Subadults	Cubs	Huntable Population
Low Density	50	13	32	63
High Density	112	30	73	142
75^{th} percentile	84	22	55	106

Table 3. Guideline removal rates for puma populations under different strategic goals.

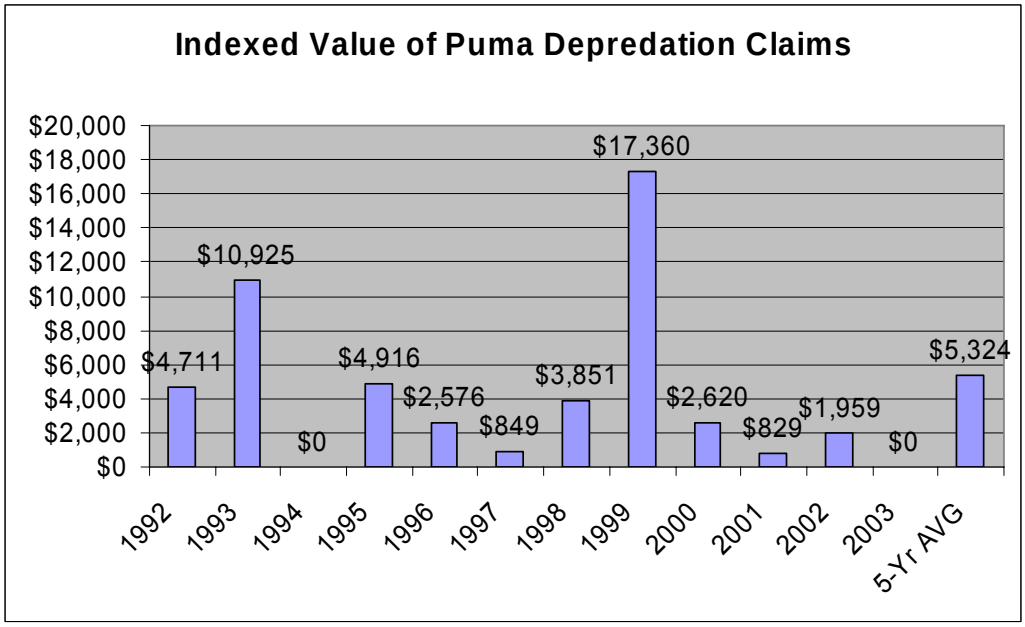
Strategic population goal	Permissible removal rates (all mortality)
Increase	8% of huntable population
Stable	15% of huntable population
Decrease	28% of huntable population

An additional consideration is whether any "refuge" areas may exist within the DAU. In order to have population level effects, a refuge must be very large (maybe greater than 1000 km^2), and this size area rarely exists. For the purposes of this DAU Plan, areas that might provide protection (refuge) for one or a few breeding females and a male (greater than 100 km^2) might be considered sufficient to replenish areas temporarily vacant of resident puma. In order to represent these areas, harvest mortality from the mid 1990's to present can be used to determine areas with low harvest where puma would be expected. These areas of low harvest usually occur because of poor access for lion hunters, but may occur for additional reasons. The distribution of harvest in this DAU is fairly evenly distributed in areas considered deer, elk, or bighorn sheep winter range, with concentrations near Dolores, Mancos to Cortez, Summit Ridge, and west of Highway 491 (formerly 666). Areas with relatively lower harvest are the extreme western edge along the Utah border (this portion of Utah is heavily hunted), the upper portion of Haycamp Mesa, and south of Dove Creek. Mesa Verde National Park is about 210 km^2, and therefore provides refuge for a few puma. The Ute Mountain Ute Reservation usually has some harvest, but is often lightly hunted and part of the Reservation is not hunted. These four areas are widely distributed in the DAU. Each of the above four identified areas could be large enough to protect a single resident female or more, and might function as small refuges to provide for dispersal into more heavily hunted areas.

Game Damage Considerations

Damage payments have averaged $5324 (Figure 4) in the last 5 years, but this is heavily biased by a single very large claim for exotic livestock in 1999. Since then, the State Legislature limited the State's liability to $5000 per individual unit of livestock loss. The yearly average 1992-2003 excluding 2000 is $4216, and forms the basis for the recommended Management Objective. Damage payments seem to follow a pattern of extreme ups and downs (Figure 2), with most years <$4216, but four years in 12 exceeding that. A relatively new occurrence is the proliferation of hobby livestock ranches. Relative to more traditional livestock operations, these hobby ranches typically raise smaller breeds of livestock (llama, alpaca, goat, etc). Many times, these animals are more concentrated and of a higher per unit value. Educating landowners of livestock practices to minimize this potential is the primary means of reducing this type of conflict.

Figure 4. Indexed value of puma depredation claims in L-24, Southwest Colorado, 1992-2003.



III. *DRAFT* MANAGEMENT OBJECTIVE recommendations for L-24

Sport harvest has averaged 4-5 males, 2-4 females, and the proportion of females in the harvest has been below 40%, and lower over the last 5 years than over the last 10 years. Historic non-sport harvest mortality has averaged only 1 puma per year.

As stated previously, the Ute Mountain Ute Reservation has permitted the removal of some pumas in the past, and since the realistic DAU population estimates include the Reservation and Mesa Verde, those areas must be considered. The removal from the Reservation is NOT included in the above harvest or total mortality data. Tribal and National Park lands make up about 41% of the total land area, so potentially Colorado's "allowable off-take" could be 59% of the biological maximum.

Population Objective supported by CDOW staff**.** Stable/increasing population- To manage for a stable or increasing population, the total mortality number should be in the range of 8-15% of the legally harvestable lions, or 11-16. Colorado's sport harvest objective would then be 7-10, and total mortality would be 8-11. Current total mortality is within this range (7-10), and therefore no change in sport harvest quota may be necessary. The harvest on the Ute Mountain Ute Reservation, and mortality within Mesa Verde will need to be tracked annually, and the harvest objective in Colorado can be adjusted on an annual basis.

Objectives: total mortality 8-11, sport harvest 7-10, maximum female mortality ≤6

Population Alternative not supported by CDOW staff**.** Suppress the population- To suppress the population, total mortality should be in the range of 28% of the legally harvestable lions. There would need to be a clear and articulable reason to suppress this population, such as excessive game damage problems or extensive human-puma conflicts. Conflicts do occur in and around Mesa Verde National Park, but since the Park prohibits hunting of puma and their primary prey, deer, the Park serves as a reservoir, and population suppression outside of the Park would likely have little effect within the Park. In addition, the Park has instituted a puma incident reporting and tracking system to identify and handle concerns.

Game Damage Objective. Game damage should not exceed $4216 per year based on a 3-year average. The CDOW will utilize hunters whenever possible to harvest depredating lions. DWM's and Biologists will continue to inform and educate the public on ways to prevent or minimize losses of domestic animals.

Literature Cited:

Logan, K. A. and L. L. Irwin, and R. Skinner. 1986. Characteristics of a hunted mountain lion population in Wyoming. J. Wildl. Manage. 50(4):648-654.

Logan, K. A., and L. L. Sweanor. 2001. Desert puma: evolutionary ecology and conservation of an enduring carnivore. Island Press, Washington, D.C.

Ross, P. I., and M. G. Jalkotzy. 1992. Characteristics of a hunted population of cougars in southwestern Alberta. J. Wildl. Manage. 56(3): 417-426.