MOUNTAIN LION DATA ANALYSIS UNIT L-25
MANAGEMENT PLAN

GAME MANAGEMENT UNITS
74, 741, 75, 751, 77, 771 & 78
San Juan Basin of Colorado
Southwest Region

Prepared for:
Colorado Division of Wildlife

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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.

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.

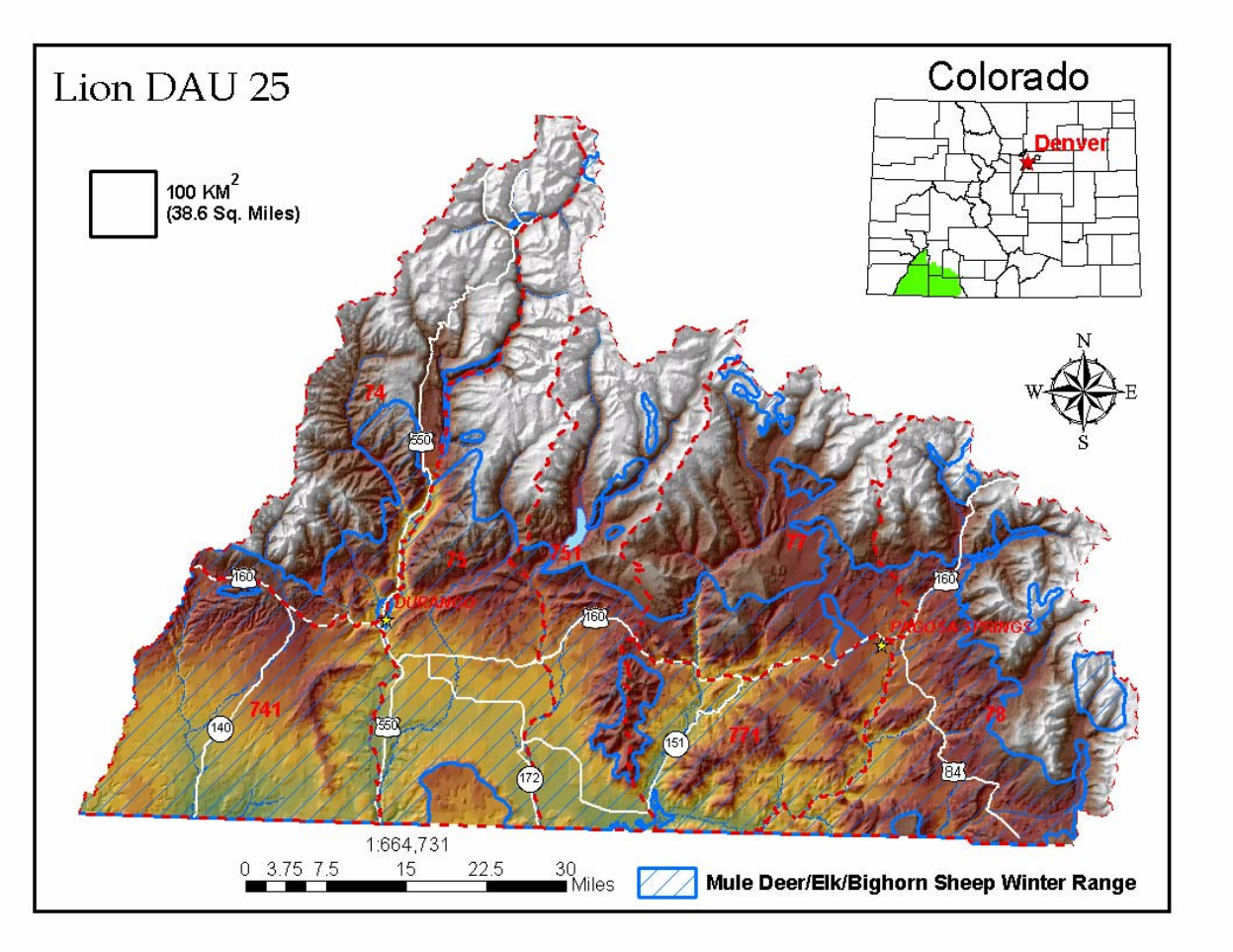
Finally, local biologists examine the estimated number of puma in DAUs and make adjustments based upon their knowledge of various qualitative habitat conditions. Conditions such as intensive agriculture, subdivision development, prairie, and relative prey density are types of factors that may influence 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 estimation 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 San Juan Basin Puma Data Analysis Unit in Colorado

The San Juan Basin Puma DAU (L-25) is in southwest Colorado (Figure 1), and includes all of La Plata and San Juan Counties and parts of Archuleta, Mineral, and Hinsdale Counties. The unit ranges from 6000 feet to a few peaks over 14,000 feet, and the Continental Divide forms the eastern and northern boundaries. Nearly all of the DAU is considered moderate or high puma density habitat, and there are significant populations of primary prey species- deer, elk, and mountain sheep.

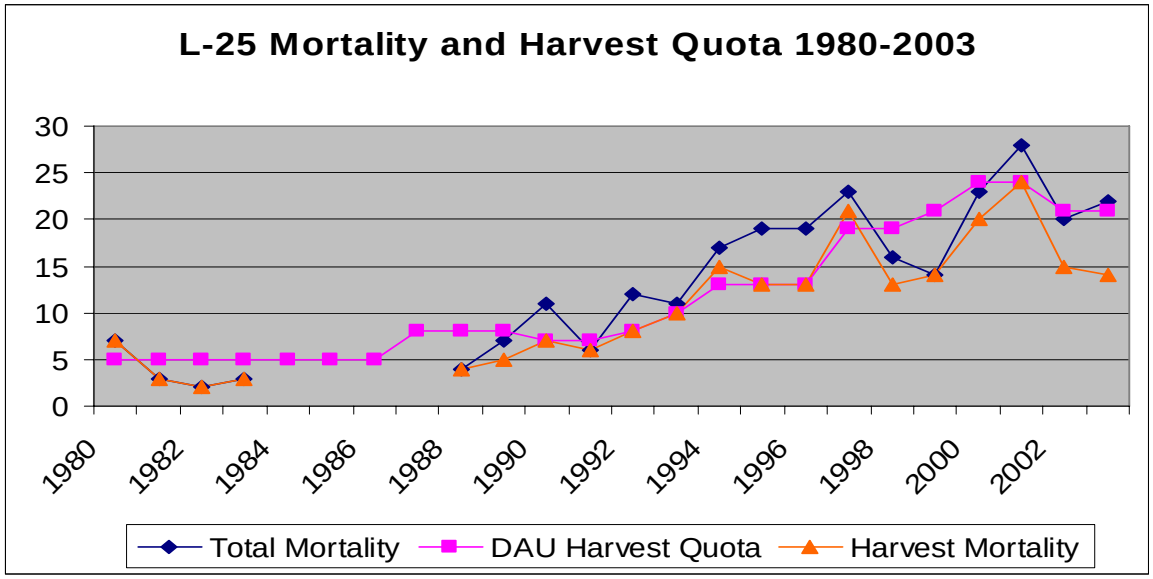
Figure 1. Location and mapped attributes of L-25, the San Juan Basin Puma DAU. The cross-hatched area is mapped as deer, elk, or mountain sheep winter range, and therefore high density for pumas, and other areas up to 11,000 feet elevation are mapped as moderate density for pumas.



A. Harvest and mortality data and trends

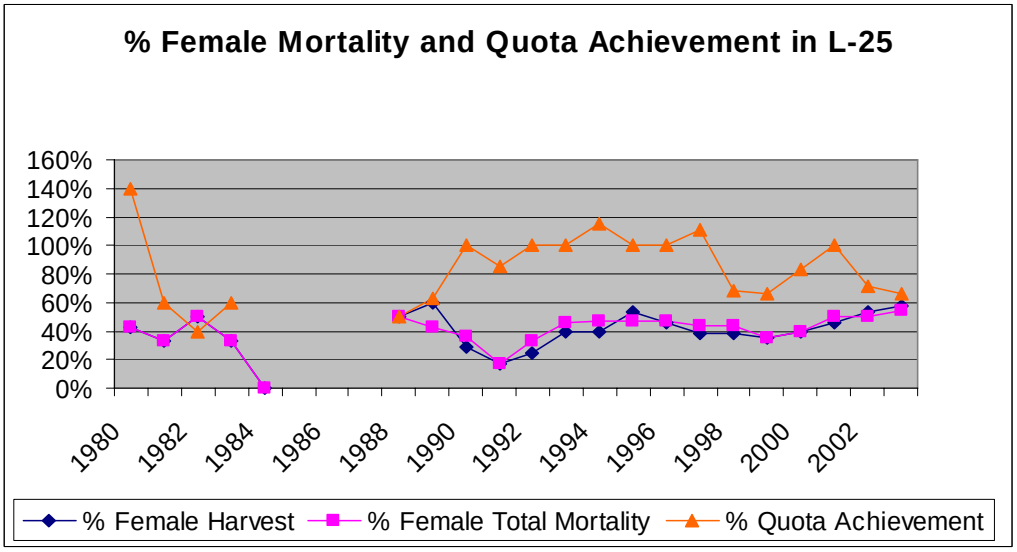
The sport harvest quota has increased from 5 in 1980-1982 to 22 in 2001-2003, while the harvest has increased from 2-7 in the early years to an average of 16 in the last 10 years, 17 in the last 3 years (Figure 2). Concurrently, the female proportion of the harvest has generally been below 50% throughout the period, except in the last 2 years (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.

Figure 2. Total and sport harvest mortality of puma in the San Juan Basin of Colorado, L-25



Mortality due to control of depredating puma (Figure 2) has been relatively low (< 10% of harvest) throughout the period, with the exception of 6 killed in 1995. Likewise, the proportion of females killed in control actions has generally been <50% (Figure 3). Mortality due to factors other than harvest and control actions (roadkills mostly, Figure 2) has also been relatively low (<10% of harvest) until the last 2 years, when it has been over 10% of sport harvest. This could be due to greater effort to document all puma mortality, or it could be related to environmental factors (drought, human development), or it could be a biological response to population suppression as sub-adult pumas disperse through the area.

Figure 3. Female proportion of mortality and harvest of puma in the San Juan Basin of Colorado, L-25.



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 157-361 puma in the DAU (Table 1).

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 248 puma in deer and elk winter ranges and 96 puma elsewhere, totaling 344 puma.

Given this range in density projections for the DAU, that number can be further broken down into approximate numbers of adults, subadults, 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, subadults 14%, and cubs 34%. Applying these data to the previous population estimates results in the projections in Table 2. Therefore, the puma population in this DAU should be comprised of 82-179 adults, 22-48 subadults, and 53-117 cubs. Because the point estimate is 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 134-179 adults, 36-48 subadults, and 88-117 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. 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 3). For this purpose, the huntable population is comprised of all subadults and adults.

Table 1. Low and High density puma population estimates for the San Juan Basin DAU of Colorado, L-25. Area calculations are all portions of the DAU below 11,000 elevation.

L-25 San Juan Basin	Km^2	Relative Effectiveness	Effective Area (km^2)	Low Density (2/100 km^2)	High Density (4.6/100 km^2)

Subdivisions	1098	67%	736	15	34
Cities/Reservoirs	78	0%	0	0	0
Intense Agriculture	445	33%	147	3	7
Remainder of DAU	6967	100%	6967	139	320
Total for DAU	8588		8410	157	361

Table 2. Demographic breakdown of projected puma population in the San Juan Basin of Colorado, DAU L-25.

L-25 San Juan Basin	Adults ~~males~~	Subadults	Cubs	Huntable Population
Low Density	82	22	53	104
High Density	179	48	117	227
75^{th} percentile	134	36	88	170

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

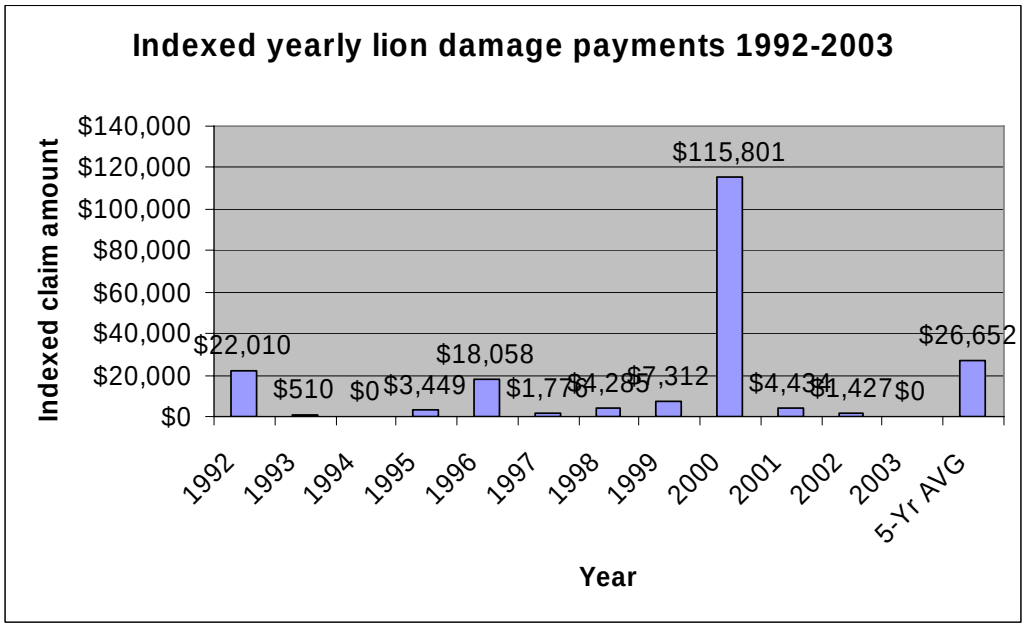
An additional consideration is whether any "refuge" areas may exist within the DAU. In order to have population level effects, a refuge must be very large (maybe greater than 1000 km^2), and this size area rarely exists. For the purposes of this DAU Plan, areas that might provide protection (refuge) 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 north of US Highway and 160 and south to the Southern Ute Reservation, and along US Highway 84. Areas with relatively lower harvest are the upper elevation deer and elk winter ranges, the mostly developed areas around Durango, Bayfield, and Pagosa Springs, and the Southern Ute Indian Reservation. The Reservation currently has relatively low harvest which could increase under current puma management. In addition, the Reservation has significant areas of private land within the exterior boundary where Colorado licensed hunters are allowed to hunt. These lightly hunted areas are mostly in fairly high elevation where most prey species migrate out of, and therefore the resident population of puma is probably fairly low. Puma do winter in these areas, however, and therefore these areas could function as small, widely distributed areas where puma could disperse from.

Game Damage Considerations

Damage payments have averaged $26,652 (Figure 4) in the last 5 years, but this is heavily biased by a single very large claim for exotic livestock in 2000. 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 $2235, and forms the basis for the recommended Management Objective. Damage payments seem to follow a pattern of extreme ups and downs, with most years <$1000, 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-25, southwest Colorado



III. *DRAFT* MANAGEMENT OBJECTIVE recommendations for L-25

Sport harvest has averaged 8-9 males and 7-8 females per year and historic non-sport harvest mortality has averaged 2-3 puma per year (Figure 2). The total allowable mortality for this DAU is 18-25. The Southern Ute Reservation comprises about 13% of the geographic area and is totally within this DAU. The population of lions freely moves on and off the Reservation (Koloski 2002). The Southern Ute Tribe has instituted a mountain lion hunting season on Tribal lands. Each year the Tribe will determine their own allowable harvest and mortality, and will have objectives for total and female harvest. Presently, the Tribe has a quota of 7, with a female sub-quota of 3. In 2003, the first year of the Tribal hunt, 2 female lions were killed, and Tribal Wildlife Managers do not feel demand for lion hunts will increase significantly in the near future.

Population Objective supported by CDOW staff**.** Stable/increasing population- To manage for a stable or increasing population, the total mortality should be in the range of 8-15% of the legally harvestable lions, or 18-25. Current mortality is within this range (20-21). Historic non-sport harvest mortality has averaged 2-3, leaving a biologically sustainable sport harvest of 15-22. From the allowable sport harvest, deduct the potential Southern Ute harvest of 7, and this leaves a sport harvest objective for Colorado of 8-14. Alternatively, if the Tribe only harvested 13% (based on land area) of the allowable sport harvest, this would leave the Colorado portion with a range of 13-19. Based upon the uncertainty of the actual Tribal harvest, and the recent

history of high female harvest , a Colorado harvest of 10-17 would appear to be reasonable and prudent. The balance of Colorado harvest and Tribal harvest will need to be constantly evaluated to maintain total mortality within sustainable limits

Objectives: total mortality 18-25, sport harvest 15-22, maximum female mortality 11
Colorado total mortality 13-19, sport harvest 10-17, maximum female mortality 8

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. In order to accept a population objective of suppression, their must be compelling reasons, such as excessive game damage consistently, or increasing or imminent human-puma conflicts. These factors are not present in this DAU, even though mountain lions are residents of the foothills and mountains adjacent to the cities, and observations of mountain lions are frequent.

Game Damage Objective. Game damage should not exceed $2235 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.

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