MOUNTAIN LION MANAGEMENT GUIDELINES
FOR
LION DAU L-1

Game Management Units 1, 2, 201

Prepared for:
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Northwest Region
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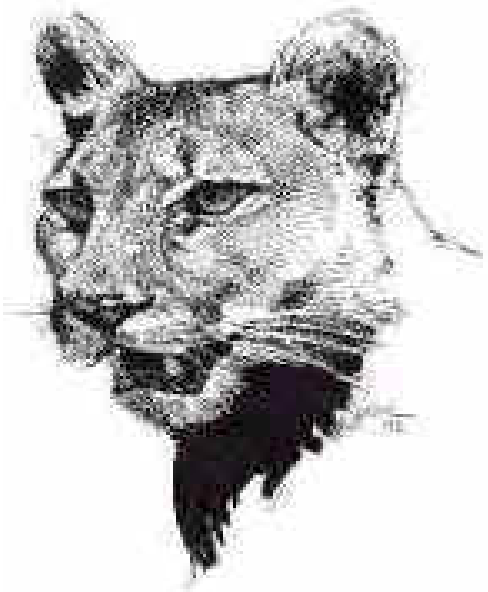

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DESCRIPTION OF DAU, HABITAT, AND PAST MANAGEMENT

Location and Habitat

DAU L-1 is located in the extreme northwestern portion of the state (Fig. 1). It is bounded on the north and west by the state line, on the east by the Little Snake River, and on the south by the Yampa River. The DAU matches the area of the Little Snake deer DAU and the Cold Springs and Green River elk DAUs. The DAU consists of three GMU's 1, 2, and 201. The topography and vegetation varies from sagebrush steppe and pinyon-juniper breaks in the eastern portion of GMU 2 to mountainous, subalpine areas in the west near the state lines in GMU's 1 and 201. The central part of the DAU is dominated by steep, sandstone canyons. The major geographic features in the DAU include Sandwash Basin, Vermillion Creek, and Douglas, Cold Springs, Diamond, and Wild Mountains. The entire DAU is year round occupied lion range. The DAU is 4048.3 km^2 in size with land primarily in the control of the BLM (75.9%), private (8.8%), National Park Service (8.1%), State lands (6.0%), and USFWS (1.2%).

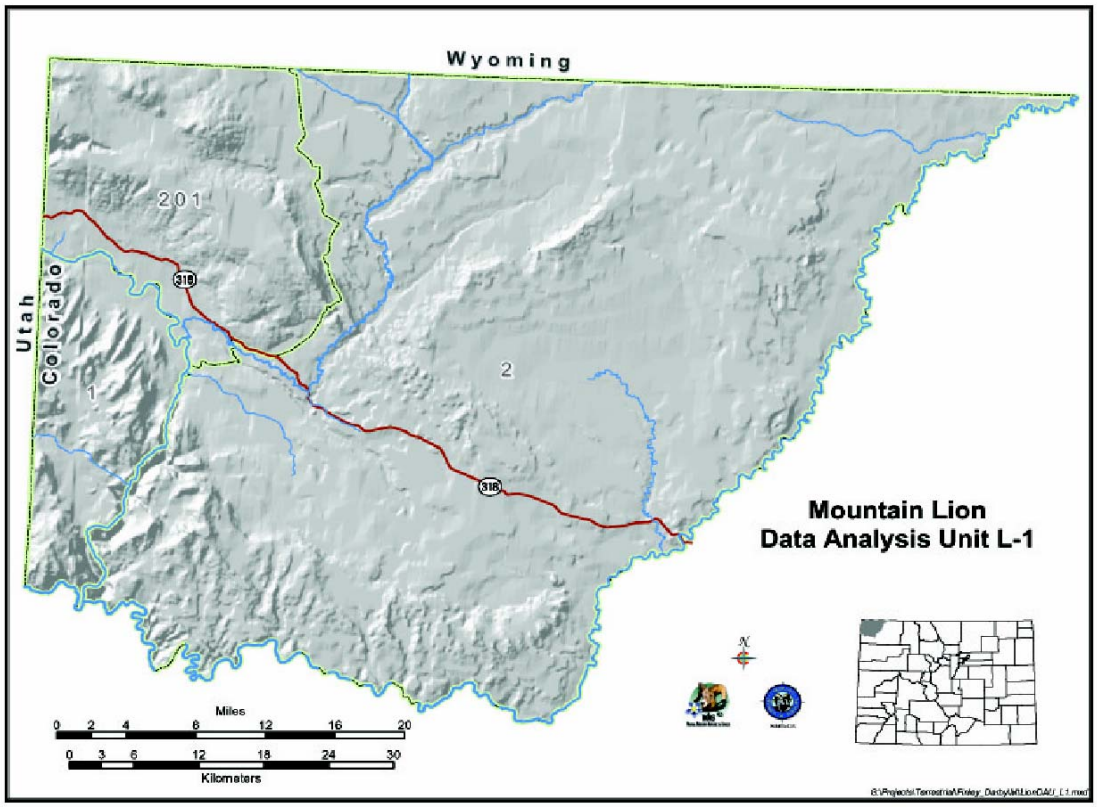

Figure 1. Mountain lion DAU L-1 boundary.

MANAGEMENT HISTORY

Statewide lion season dates are from January 1st until March 31st and from the 1st day after the close of the regular deer and elk seasons until December 31st. New harvest quotas begin on January 1st of each year.

The first mountain lion management guidelines report for L-1 (CDOW 1999) stated, "No formal estimate of the lion population has been made." Indicators used to determine relative population

numbers of lions in the initial plan were sightings, tracks, and harvest rates. According to the initial plan, based on these observations during the 1990's it was believed that lion numbers were increasing.

Past management goals, while not specifically documented in the initial DAU plans (called management guidelines) for L-1, were to maintain lion populations at a stable level. It is stated in the first lion management plan, "…… in recent years the quota for L-1 has been raised and is seldom reached thus, there is no compelling reason to change in the near future."

In the last year (2003-2004) the CDOW has developed a better defined approach to lion management. The first approach is termed managing for a *stable-increasing* population. The second is termed management designed to *suppress* a population. In 2003, the CDOW and Colorado Wildlife Commission indicated that the management strategy for DAU L-1 would be characterized as a population with a management goal of stable.

Harvest and Management Statistics

The CDOW has assembled pertinent management data since 1980. Data includes harvest, quotas, success rates, and harvest by sex of animal. Information is also available that includes similar information for animal damage control kills and other mortality such as road kills.

Sport harvest quotas for DAU L-1 have doubled in the past 25 years. In 1980, the harvest quota was 8 lions for the entire DAU. In 1982, the DAU quota was reduced to 6 and separate quotas were assigned by GMU. Units 1 and 2 had a combined quota of 3 lions and Unit 201 also had a quota of 3. From 1985-1997 the sport harvest quota for the DAU was 10 mountain lions per year. The current DAU harvest quota is 12 mountain lions per year. GMU's 1 and 2 are currently managed with a combined harvest quota of 6 mountain lions. The current harvest quota for GMU 201 is also 6 lions. The 10 year average combined harvest for GMU's 1 and 2 has been 4 lions, compared to a 10 year average of 1 lion killed in GMU 201 (Figure 2). The quota was raised from 10 to 12 in 1998. The DAU quota has never been met over the past 10 years. Harvest has varied from 1 to 10 over the last 10 years with an average of 7. The female portion of the DAU-wide harvest has averaged 58% for the last 5 years and 55% for the last 10 years. Total quota achievement has averaged 38% for the last 5 years and 46% for the last 10 years (Figure 3). Quotas are seldom reached due to the difficulty of hunting the rugged terrain in the DAU.

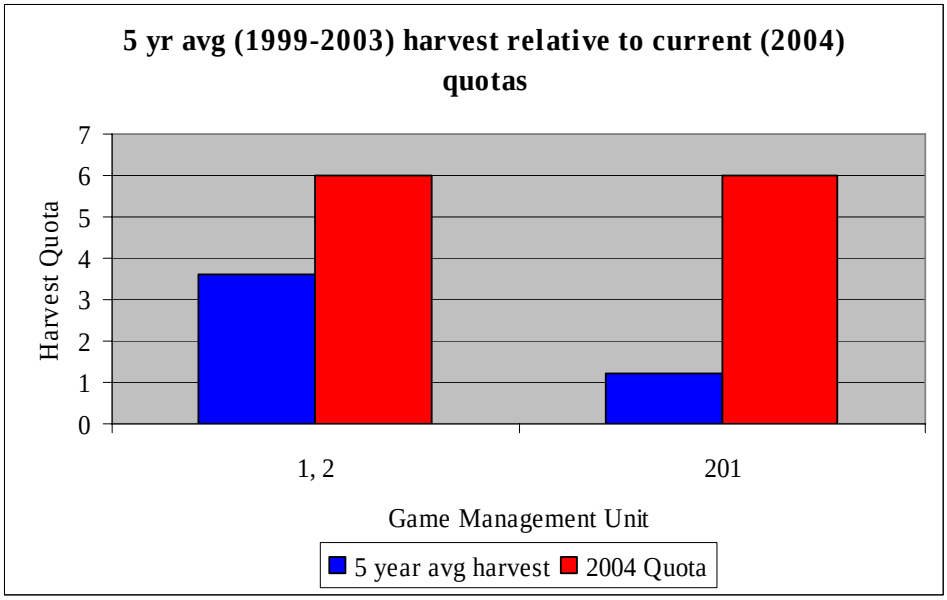

Figure 2- Five year average harvest quota compared to current (2004) quota.

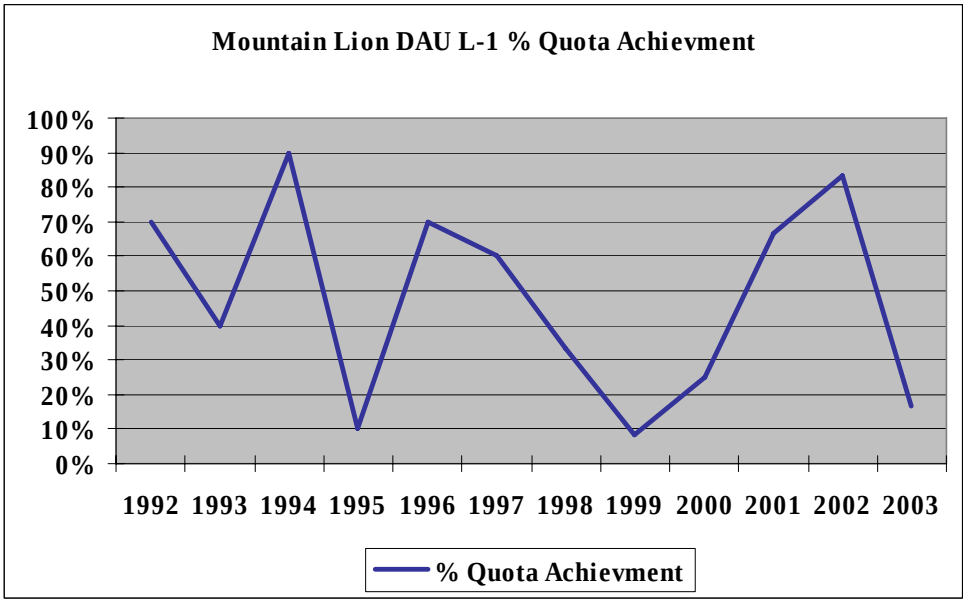

Figure 3- Percent quota achievement for L-1 from 1992 to 2003.

Mountain Lion Populations

The L-1 lion population projection is based primarily on 2 factors; defining the area of suitable lion habitat within the 4,048.3 km^2 DAU and applying a probable lion density for that same area. Due to their low density, secretive nature and the subsequent lack of quality field methods for estimating population sizes for lions as outlined by researchers (Anderson 1983, Logan and Sweanor 2001), the L-1 estimate could not be based on quantitative field observations within the DAU. It is however, based on a synthesis of lion densities from other published studies in the western U.S. as

well as geographic information systems (GIS) data on habitat and spatial variables.

In L-1, winter range lion habitat is defined as areas below 10,500 ft. in elevation. Due to the fact that L-1 transitions from lesser quality lion habitat in the east to higher quality lion habitat in the mid to high elevation portions of the DAU, probable lion density estimates were applied to the areas of varying degrees of quality habitats. While lion harvest locations are clearly not random, they can be used as a confirmation to assess habitat where lions are found. Reported harvest locations over the last decade from mandatory hunter check forms occurred almost entirely within the habitat boundaries described above and shown in Figure 4.

In almost all cases in Colorado, lion habitat overlaps with the range of their principle food sources, mule deer and elk. Visual inspection of overall deer and elk ranges, is an essential duplicate of the lion habitat as defined above. Figure 5 shows mule deer and elk winter range, which is only a portion of the overall deer and elk range, in relation to overall lion range. This is also the area where on a localized scale within the DAU, lion densities would be expected to be the highest. Given the constraints and exclusions outlined above, the total area of winter lion habitat used in population projection calculations was 3,593.5 sq. km. (Figure 4).

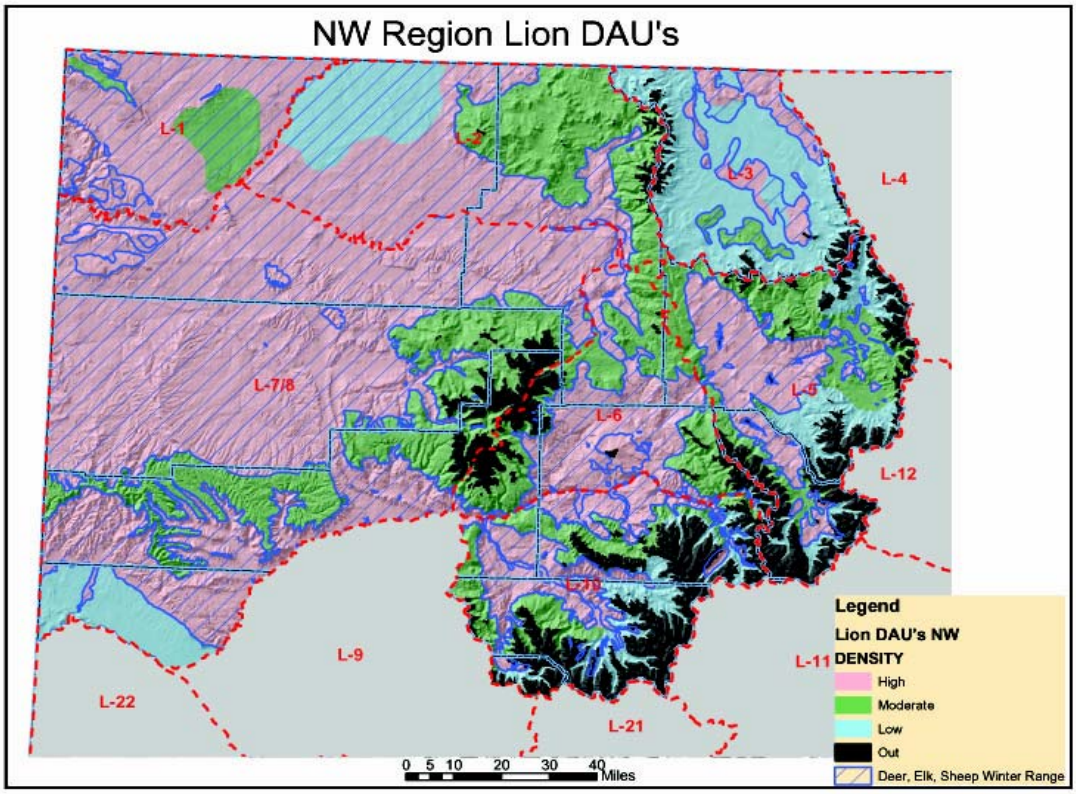

Figure 4- The mapped northwest region analysis of lion density estimates based on winter range defined as areas below 10,500 feet. Areas were mapped based on probable lion density estimates applied to areas of varying degrees of quality habitats.

Based on a comprehensive review of lion research literature, Logan and Sweanor (2001) offer a range of lion densities observed on projects from throughout the western United States. Given the similarities between Colorado and states/provinces such as Wyoming, New Mexico, Alberta, British

Colombia and Idaho, densities were extrapolated from those studies to arrive at a low density estimate of 2.0 lions/ 100 km^2 and a high density estimate of 4.6 lions/100 km^2 in L-1. Multiplying these high and low densities by a given area of lion habitat creates a range of population sizes. Age structure within the total L-1 population was also calculated based on a formula generated from the existing lion literature (Logan and Sweanor 2001). Both Logan and Sweanor (2001) and Ross and Jalkotzy (1992) reported that kittens, or dependent young, comprised approximately 33-34% of the total population. The calculated population point projection as based on overall analysis of available lion habitat and prey densities is 174. For the point projection estimate, we mapped areas of high, medium, and low lion densities and used these data to estimate lion populations. Overall, habitat in L-1 can be subjectively rated as being high to intermediate in quality based on terrain, vegetation, and historic lion harvest as well as known preferred lion habitats in Colorado.

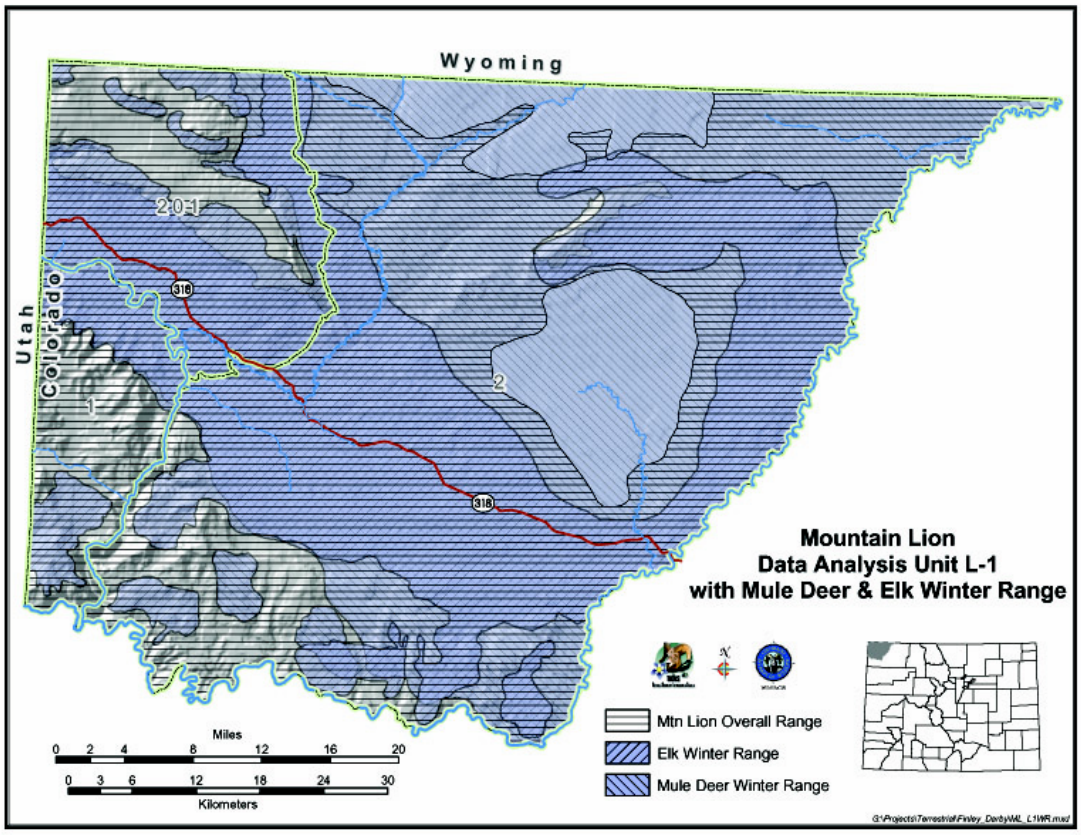

Figure 5- Mule deer and elk winter range in DAU L-1 mapped with overall mountain lion range. Although current literature supports the range from 2.0 to 4.6 lion per 100 km^2, there is reason to believe that prey densities and prey species composition in Colorado is higher and different than those described in the supporting reports. Colorado's elk populations are the highest anywhere in the United States and provide alternate prey for the lion's principle food base of mule deer. In 2004, Colorado is initiating an intensive (approximately 10 years) mountain lion population study on the Uncompahgre Plateau to document lion densities. However, until this or other information is available, we will continue to use the standard prey densities presented here in our population estimates. We suspect our lion densities maybe significantly higher than those reported in other studies and we think when more accurate numbers for Colorado are developed, our current lion population estimates will be demonstrated to be low.

Table 1. Estimated mountain lion population in DAU L-1 based on total DAU acreage.

Population Range	Population Estimate	Males	Females	Subadults	Cubs	Total
Low density	81	21	21	11	28	81
High density	186	48	48	26	64	186
Point projection	*174*	*45*	*45*	*25*	*59*	*174*

Estimates of male and female winter home range size vary widely between studies in western North America. Males clearly have larger home ranges, often with minimal overlap of other males, while females tend to have smaller home ranges with a tolerance for more same-sex overlap. In many cases one male's home range boundaries will include several female ranges. Female winter home range estimates between some study areas span an order of magnitude; in British Columbia winter ranges were observed at 28 sq. km., in Idaho 90 sq. km. and in Utah 207 sq. km. Male estimates on winter range in Idaho were 126 sq. km. while researchers in Utah again observed much larger home ranges averaging 503 sq. km. The current and past research in Colorado has generated overall annual home range estimates which don't allow comparison to be made for winter range calculations.

Population Management Alternatives and Outcomes

Harvest Potential

Using the portion of the projected population that is huntable (adults and sub-adults), an acceptable level of total mortality within a DAU can be estimated. Logan and Sweanor (2001) suggest that the level of hunting and non-hunting mortality can be gauged relative to the rate of population growth. They further suggest that managers can use the rate of growth documented at 11% by Logan as an acceptable annual mortality assuming managers have a reliable estimate of the lion population and that the population is increasing. Neither of the parameters is known definitely in L-1. Thus, it is important to be conservative when generating a harvest level estimate the lion population can support. Current CDOW guidance is to use 8-15% of the huntable population to provide a range of acceptable harvest for populations managed for sustained recreational opportunity and a stable-increasing lion population. Logan and Sweanor have documented the high resiliency of lion populations and have recorded a 28% growth rate in a treatment area following a period of high lion removal rates. Thus, the CDOW suggests that for a huntable population with sustained recreational opportunity and a stable lion population to apply a harvest rate of 12%.

Currently there are two principle management options available for mountain lion management guidelines: stable-increasing and suppression.
*Stable-increasing Population Management***-** guidelines for stable-increasing population management would be defined as managing a lion population for 8% of the high and 15% of the low total mortality levels of the adult population.
Suppression Management- guidelines for suppression management includes a total mortality range of the adult population of 15-28%..

The operating population projection outlined in this document is approximately 115 harvestable lions (174 total), however, as more refined data analysis tools become available, or as research results from studies currently underway in Colorado are analyzed, population projections will be refined and reassessed. Since L-1 is being managed for a stable population, it is current DOW

management direction that the total lion mortality be within 8-15% of the total legal population (adult and subadult) to be considered management directed at maintaining a stable to increasing lion population.

Using a projection of 115 legally harvestable lions, this off-take range corresponds to an annual removal of 9 (8%) to 17 (15%) lions. Given the 10-year average harvest is 7 (6%) lions, the current level of sport harvest in L-1 would suggest a stable to increasing population.

The current average 5-year harvest is 5 lions, which is a 4.3% harvest rate. This rate of removal is lower than the 12% rate used for a stable-increasing population. Thus, indications are that the current management has tended to allow for a stable-increasing population in this DAU.

Non-hunting Mortality Objective – Annual Estimate
The total mortality objective for L-1 has typically been the same as the hunter harvest objective. Two non-hunting mortalities have been observed in the past 10 years. In the event increased lion mortality from non-hunter sources (roadkills, damage kills) is observed over several subsequent years, the future hunter mortality objectives will be modified to reflect the predicted losses in the population due to non-hunting factors.

GAME DAMAGE OBJECTIVE

Game damage levels should be held below $5,000 annually with the most effective control being targeted harvest of individual animals involved in damage. Levels of game damage in L-1 are very low. Cattle grazing is spread across the DAU at fairly low levels. Sheep grazing is concentrated in the higher elevation areas of 2 and 201 in the summer and in the eastern portion of Unit 2 in the winter. Most damage by lions in the DAU is to sheep. There has been one sheep damage claim in the past 5 years at an average annual cost of $1456. Increased quotas have not had an effect on the level of damage.

Barriers and Strategies - Game damage should be managed by targeting offending lions on an as needed basis. The CDOW has an effective working relationship with Wildlife Service including a contract for annual damage control assistance. Claims can be minimized through effective communication with landowners and CDOW.
Monitoring - Monitoring of game damage claims will occur on an annual basis. Significant increases in game damage may induce harvest objective changes. Most likely the GMU quota will be amended to focus harvest in the area of damage.

HUMAN / LION CONFLICT OBJECTIVES:
Objective Level - There is no formal number of allowable human/lion conflicts outlined for L-1, however, the goal for nuisance complaints should be low. The potential for human encounters with lions in L-1 is extremely low. There has been one report of lion-human conflict in the last few years when a lion killed a dog near a residence in Brown's Park. Tolerance of aggressive or acclimated lions in this area is low, therefore lions that show these tendencies are quickly removed from the population. Education of the public on how to live in lion country appears to be the most successful method of reducing both depredation and non-depredation conflicts.

A survey and project summary report by Zinn and Manfredo (1996) studied societal preference for Mountain Lion management along the Front Range of Colorado. The study measured people's beliefs, opinions, preferences and behaviors towards mountain lions. Although the CDOW lacks similar data from the west slope, several conclusions are still pertinent and advisable. The

summary report recommends, “Education and public information regarding mountain lions and their interactions with humans should continue to be a key component of the CDOW’s mountain lion management strategies” Zinn and Manfredo (1996).

The report also indicates that “education may serve to widen the range of acceptable management options available to wildlife managers” Indications are that the public tends to believe that capture and relocation of mountain lion is a ready option, while at the same time they do not accept frightening lion with rubber bullets or scare devices as an option. Educational information should help the public better understand other control options available including increased lion hunting and controlled mountain lion hunts. This survey also reinforced the idea that the CDOW’s information campaign regarding living with lions has been successful.

Barriers & Strategies- CDOW will continue to provide the public information on human safety and how to live with lions. This is will be accomplished through programs, printed literature, and through informal contact by local district managers. As needed, the CDOW will continue to conduct workshops for public agencies, law enforcement personnel, and concerned public groups.

Monitoring - Human interactions will be accomplished through annual review of the CDOW’s conflict reports. Specific instances will be handled according to the CDOW policy.

Key Management Issues – Public input on lion management was sought as part of this DAU plan revision process. Scoping meetings were held in Grand Junction and Craig. Comments were collected from the public on what lion management issues were most important to them Appendix A. This information will be used as a portion of the decision process in the selection of a preferred management strategy for L-1.

Preferred Management Strategy – Stable to Increasing ---
The preferred management strategy for L-1 is to manage lions at an annual mortality rate, including hunting and non-hunting, in a range between 8% and 15% of the huntable population. This rate of removal would be considered a stable to increasing population and uses the population point projection of 174 lions as the basis for the recommendation.

Hunter harvest objectives, regulated by the current quotas system, will be established annually based on previous year’s harvest success and other mortality factors. The long-term goal is to maintain healthy lion populations that can sustain annual sporting harvest. The five and 10 year average annual harvest has been 5 lions in the DAU.

Table 2. Number of lions harvested at variable mortality rates under stable to increasing management.

Annual Mortality Rate	8%	9%	10%	11%	12%	13%	14%	15%
Hunter Harvest Total Mortality	9	10	12	13	14	15	16	17
Non-hunt Mort.	0	0	0	0	0	0	0	0

Total Mortality DAU Harvest Objective	9	10	12	13	14	15	16	17

Mountain lion populations appear fairly resistant to moderately high levels of harvest as indicated by Anderson's (2003) research. The caveat being, that "adjacent populations facilitate recovery through immigration and that adult female survival provides female recruitment" Anderson (2003). Anderson (2003) also stated, "The most likely factor to inhibit cougar population reduction from harvest is limited hunter access creating local refuges. In these situations, inaccessibility will dictate the degree of resiliency in that population to hunter harvest…"

With the above caveat in mind, a geographic review of DAU L-1 shows the existence of large areas where no lion hunting or very limited lion hunting occurs. The more rugged sections of the DAU and Dinosaur National Monument provide a large area along the southern border of the DAU.

Monitoring- Anderson's (2003) study of the sex and age characteristics of cougar populations documented that, "population decline followed predictable removal patterns of the more vulnerable/ abundant classes until the least vulnerable class, adult females were most abundant in the harvest", and that, "Moving from harvests consisting primarily of sub-adults to adult males and finally to adult females suggests previous population decline"

Therefore, if the percentage of adult females in the harvest begins to increase, and the average age of females in the harvest begins to decline, then harvest adjustments would be warranted until male lions and sub adult lions comprised the majority of the harvest, which would indicate a recovering lion population.

Population monitoring will be accomplished primarily from data collected as a part of the mandatory check of lions harvested. The estimated age of the animal will be determined using techniques outlined by Anderson and Lindzey (2000). Specifically, priority should be given to evidence of previous lactation, annuli aging of premolars, presence of a canine ridge and presence or absence of foreleg bars (Anderson 2003).

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