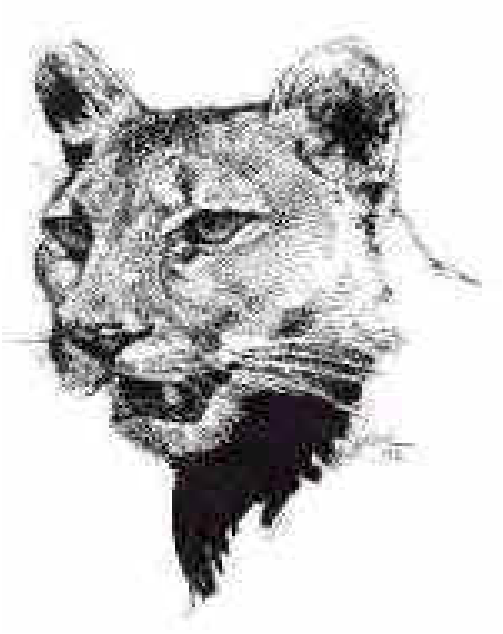
MOUNTAIN LION MANAGEMENT GUIDELINES
LION DAU L-3
GAME MANAGEMENT UNITS
6, 16, 161, 17, & 171

Prepared for:
Colorado Division of Wildlife (CDOW)
Northwest Region

By:
Jim Hicks, Terrestrial Wildlife Biologist
Kirk Snyder & Josh Dilley, District Wildlife Managers



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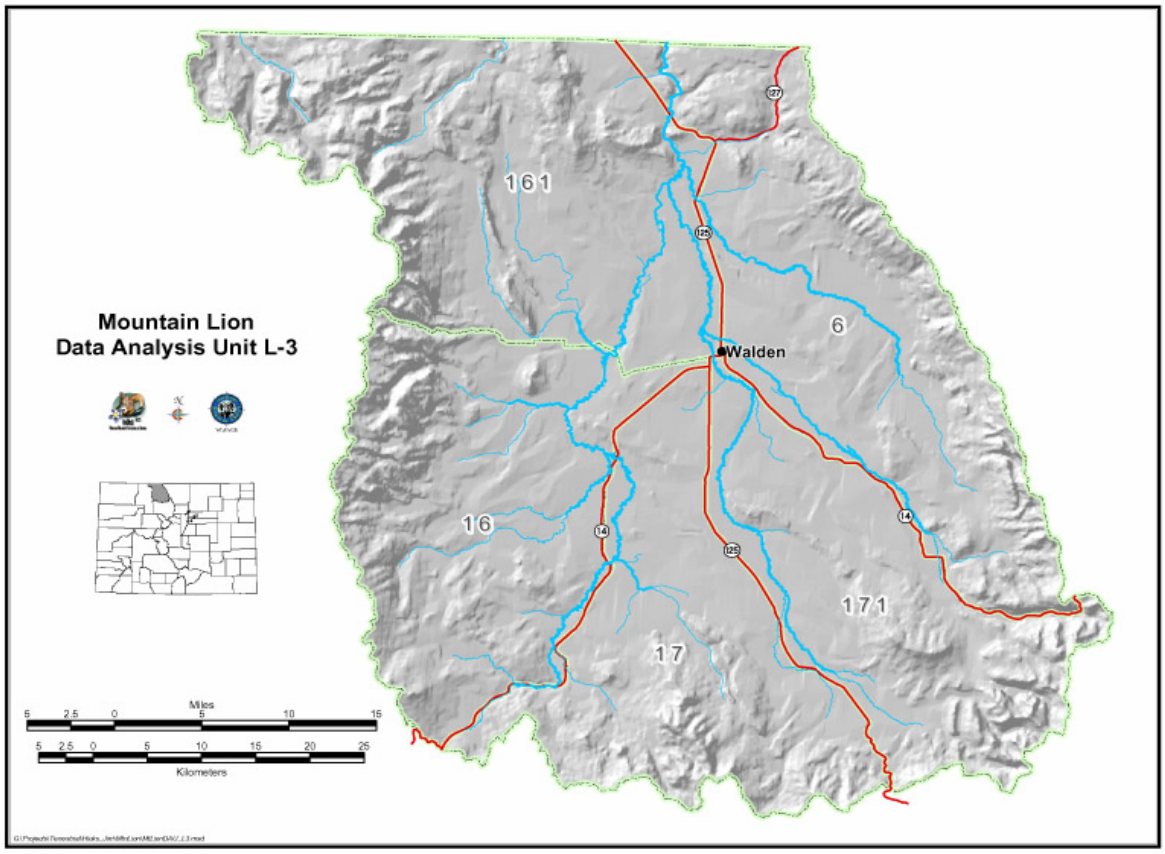
DESCRIPTION OF DAU, HABITAT AND PAST MANAGEMENT

Location and Habitat

Mountain lion Data Analysis Unit (DAU) L-3 is located in North Central Colorado just east of the Continental Divide adjacent to Wyoming (Fig. 1). DAU L-3 encompasses all of Jackson County, commonly called North Park. DAU L-3 is all of the North Platte River drainage in Colorado. Habitat varies from large expanses of sagebrush with wide riparian-river areas in the center of North Park at 8,000 feet elevation, to aspen and lodgepole pine habitat, then to spruce-fir habitat and up to the alpine habitat. Mule deer are the primary prey species of mountain lion. Elk can be an important prey species in some areas. Mule deer primarily inhabit the aspen, lodgepole pine, and riparian habitat in the summer and the sagebrush and aspen habitats in the winter. The DAU is 1,619 square miles in size with land primarily under control by Federal land management agencies including Bureau of Land Management (18.3%), US Forest Service (32.1%), U.S. Fish and Wildlife Service (1.7%), various state agencies (11.9%) and private landowners (36.0%).

Figure 1. Mountain lion DAU L-3 boundary



Management History

The first hunting season conducted for mountain lion in North Park was in 2000. The public requested the mountain lion season. There is a low-density population of mountain lion in North Park. The average harvest over the last four years has been 2 lion per year from an average quota of 3 permits per year. There has been no reported livestock damage or other conflicts attributed to mountain lion.

Approximately 90% of the deer in North Park migrate out of the DAU in the winter to Wyoming and Middle Park. It is assumed that part of the lion population migrate with the deer. There is a large population of elk within North Park in the winter and those lion that are successful in killing elk probably remain during the winter.

The key management issue is determining the number of mountain lion that remain in the DAU during the winter mountain lion hunting season. The CDOW has documented, through a radio collared deer study that the majority of the deer population migrate out of the DAU in the winter. The mountain lion hunting season is in the winter, so many of the lion that would be in North Park during the summer are not part of the huntable population in Colorado.

Harvest Statistics

The mountain lion season in Colorado starts the day after the end of the regular deer and elk rifle season (mid-November) and continues through March 31 the following year. New harvest quotas start on January 1. The harvest statistics for DAU L-3 over the first four years of the mountain lion seasons are shown in Table 1. The harvest has been declining over the four years of lion hunting and hunters are finding it difficult to locate mountain lion.

Table 1. L-3 harvest data 2000-2004.

GMUs: 6, 16, 161, 17, 171	2000	2001	2002	2003
DAU Harvest Quota	3	3	5	3
% of Quota Achievement	100%	100%	40%	33%
Hunter Harvest - Male	2	1	1	0
Hunter Harvest - Female	1	2	1	1
Total Hunter Harvest	3	3	2	1
% of Female in Harvest	33%	67%	50%	100%

MANAGEMENT OBJECTIVES

Population Estimate

The population estimate for the L-3 DAU is based on two factors; defining the area of suitable mountain lion winter range habitat and determining a probable density of mountain lion. Due to their low relative 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-3 estimate could not be based on quantitative field observations within the DAU. The population estimate is based on mountain lion density research from studies in the western U.S. (Anderson, 1983, Logan and Sweanor, 2001) as well as geographic information systems (GIS) data on habitat and spatial variables.

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-3. In addition the CDOW used these data to develop a medium population density of 3.0 lion per 100 km^2. Multiplying these high, medium and low densities by a given area of lion habitat generates a population estimate.

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 somewhat 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 main food base of mule deer. Colorado is initiating, in 2004, 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 lion densities presented here in our population estimates. We suspect our prey densities are higher, to much higher than those reported in other studies and we think when the more precise numbers for Colorado are developed, our current lion population assessments will be demonstrated to be low estimates.

Considering the restrictive amount of winter range in North Park and the migratory nature of the deer, the population calculation based on the amount of winter range of their prey species best represents the population of mountain lion in North Park. Estimating the population is based on the area of winter range of main prey species at different puma densities (Figure 3). Vegetation maps, WRIS winter range maps, harvest locations, and the knowledge of field personnel were used to identify the mountain lion habitat and determine the density. There are an estimated 1,144.5 Sq. Kilometers of Winter Range in DAU L-3

The map depicts winter range areas and the lion densities (Fig. 2). Based on these calculations the mountain lion population estimate for North Park DAU L-3 is a range of 23 to 53 lion.

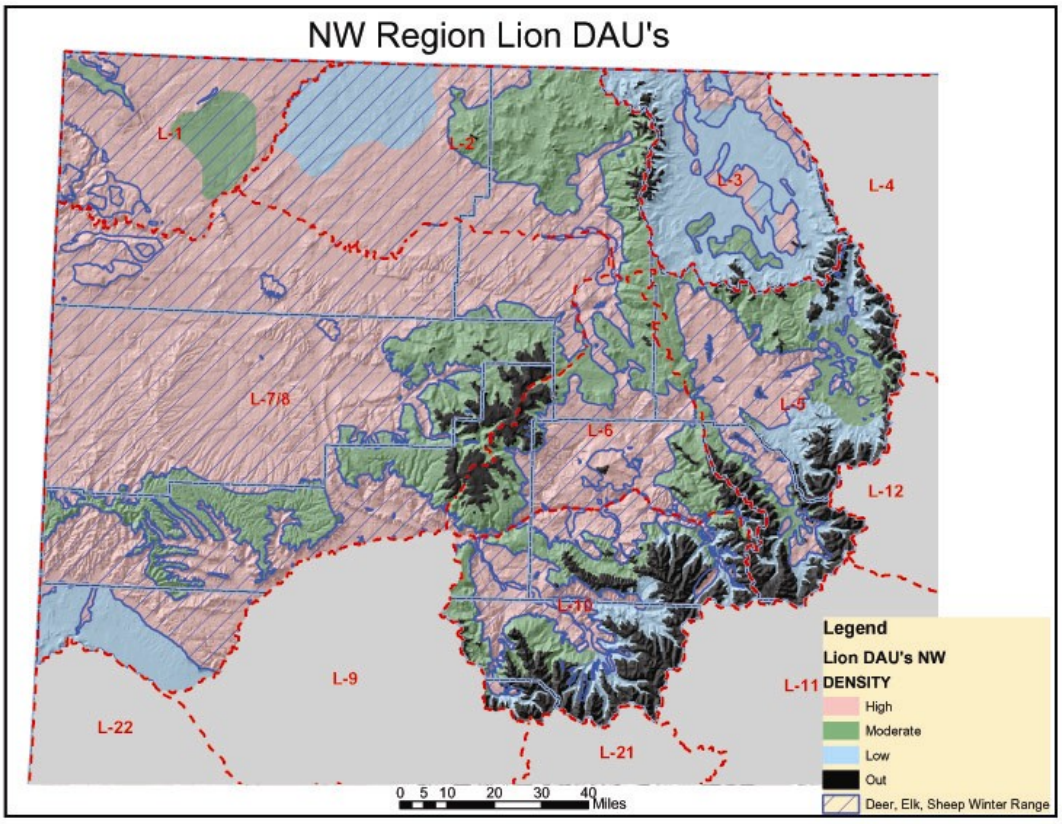


Figure 2- The mapped northwest region analysis of lion density estimates based on winter range defined as areas below 10,500 feet. Areas were mapped based on probable lion density estimates applied to areas of varying degrees of quality habitats.

Wyoming Game and Fish estimates their North Platte mountain lion population to be approximately 50

lion. From that population they plan to harvest about 15 lion per year. They are trying to suppress their lion population because they allowed it to increase for Anderson's study. Wyoming has good information on their mountain lion population in the North Platte Valley, because of the research study, a study that we can utilize. They also have approximately 26,000 deer wintering in the North Platte Valley compared to the 600 deer we estimate are wintering in North Park.

Table 2. Estimated mountain lion population in DAU L-3 based on deer,elk, and bighorn sheep winter range.

Population Range	Population Estimate	Males	Females	Subadults	Cubs	Total
Low density	23	6	6	3	8	23
High density	53	14	14	8	17	53
Point Projection	*23*	*6*	*6*	*3*	*8*	*23*

The calculations shown in Table 2 are an estimate of the population of mountain lion in North Park, 23 to 53 lion. Based on Wyoming's estimate of 50 lion for a much larger area with a much larger deer population, and considering North Park's harsher winters, 53 lion would seem too high. It is not believed that North Park has a high density of lion represented by the 4.6 lion per 100 sq. kilometers. Because of the migratory patterns of the mule deer, the moderate density of lion, 34 lion, would be reasonable for the summer population of mountain lion in DAU L-3. The low density of lion, 2.0 per 100 sq. kilometers or 23 mountain lion, best represents the winter or huntable population of lion in North Park.

The age structure for the winter North Park mountain lion population estimate 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. It is difficult to obtain data on adult sex ratios, but literature indicates that a 1:1 ratio is a reasonable estimate.

Adult Males	Adult Females	Subadults	Kittens	Total
6	6	3	8	23

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 overall 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-3. Thus, it is important to maintain conservative caution when generating an estimate of a harvest level that the 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 population control, managers may have to apply rates of removal at or exceeding 28% of the population for a period of several years to suppress a population.

The best estimate of lion population is this DAU is 23 animals. The estimated number of huntable lion is 15, which excludes kittens.

Two management options are available for mountain lion management guidelines: stable-increasing and suppression.

Stable-Increasing Population Management

Using a harvest rate of 12% (average of 8% and 15%) applied to a huntable population of 15 lion would result in an annual harvest of 2 male and female lion. Average harvest over the last 4 years would fall within this range.

Suppression Management

A suppression management strategy results in a decline in the overall numbers in a population, rather than the population remaining stable or increasing. Since Logan indicates that a harvest rate of up to 28% can suppress a population and 12% (range of 8%-15%) will allow it to be stable to increasing, a range between 15+% and 28% would tend to decrease a population.

Using a harvest rate of 28% applied to a huntable population of 15 would result in an annual harvest of 5 mountain lion.

Non-hunting Mortality – Annual Estimate

Non-hunting lion mortality has remained low to non-existent. The current expectation is that non-hunting mortality will be maintained at that level for the foreseeable future. Therefore, this estimate will be integrated into the preferred management strategy for this DAU. If increased lion mortality from non-hunter sources is observed over several subsequent years, then future hunter mortality objectives will be modified to reflect the predicted impacts to the population due to this factor.

Game Damage Objectives

Damage to livestock by lion has been very low with no claims in the last 5 years. It is expected that this level will continue. If it occurs, game damage should be managed by targeting offending lions on an as needed basis. The CDOW has an effective working relationship with the United State Wildlife Services agency 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 Conflict Objectives

There is no formal number of allowable human/lion conflicts outlined for L-3.
Human conflicts with mountain lion in this DAU have been rare with no specific incidents recorded. 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 CDOW district wildlife managers. As needed, the CDOW will continue to conduct workshops for public agencies, law enforcement personnel, and concerned public groups.

Monitoring

Monitoring of mountain lion – human interactions will be accomplished through annual review of the CDOW's conflict reports. Specific instances will be handled according to CDOW policy.

Key Management Issues

Public input on lion management was sought as part of this DAU plan revision process with no specific input received. CDOW management concerns revolve around maintenance of healthy lion populations that include a range of age classes, sex ratios in balance with lion social habits, and reproduction and survival rates that are adequate for maintenance of a population.

Management of hunting opportunity is an important issue since this activity has the greatest single impact on a lion population. The potential exists that populations may be over-harvested if annual harvest quotas are not balanced with biological potential of the population. Therefore, adherence to management strategies developed in this plan as well and the collection of annual harvest and other pertinent biological data is essential for sound management. Game damage, as discussed earlier in this plan, is an ongoing issue that must be addressed in a balanced approach and in a cooperative manner with livestock operators.

A secondary goal for this DAU would be to estimate the mountain lion population of the North Platte River Valley in combination with the Wyoming Game and Fish Department by developing a model of the interstate mountain lion population as was done with mule deer. This model would be based on the Ph.D study Charles Anderson completed on mountain lion in the North Platte Valley of Wyoming in 2003.

Preferred Management Strategy – Stable to Increasing Population

The preferred management strategy for L-3 is to manage lion 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 managing for a stable to increasing population and uses the population

point projection of 23 (15 huntable) lion 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, the number of lions harvested in the DAU and other non-hunting mortality factors. The non-hunting mortality should be included in the total mortality recommended for the DAU. The process of setting quotas outside the DAU plan allows for flexibility in setting annual harvest objective in response to changing factors affecting the lion population.

The present quota system will remain in effect. This quota system allocates a limited number of licenses to each game management unit and once the quota is filled in the GMU it is closed to further hunting.

The long-term goal is to maintain healthy lion populations that can sustain annual sporting harvest while maintaining very low damage levels and near zero human conflict levels.
Emphasis on mountain lion management will be placed on the lion population within the DAU rather by GMU. Total DAU harvest should be the guiding factor influencing annual mortality, since research has shown lion populations are a landscape wildlife species and not confined to smaller geographic areas such as a single GMU.

The current four-year average annual harvest has been 2 lion in the DAU.

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 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-3 shows the existence of limited areas where no lion hunting or very limited lion hunting occurs. It is also felt that due to the light hunting pressure on the front range foothills, north and west of Fort Collins, significant numbers of lion move into L-3 from the east.

Monitoring

Anderson (2003) in his 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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