MOUNTAIN LION DATA ANALYSIS UNIT MANAGEMENT PLAN
Northern Front Range:
DAU L-4

GAME MANAGEMENT UNITS
7, 8, 9, 19, 191, & 20
Northeast Region

Prepared for:
Colorado Division of Wildlife

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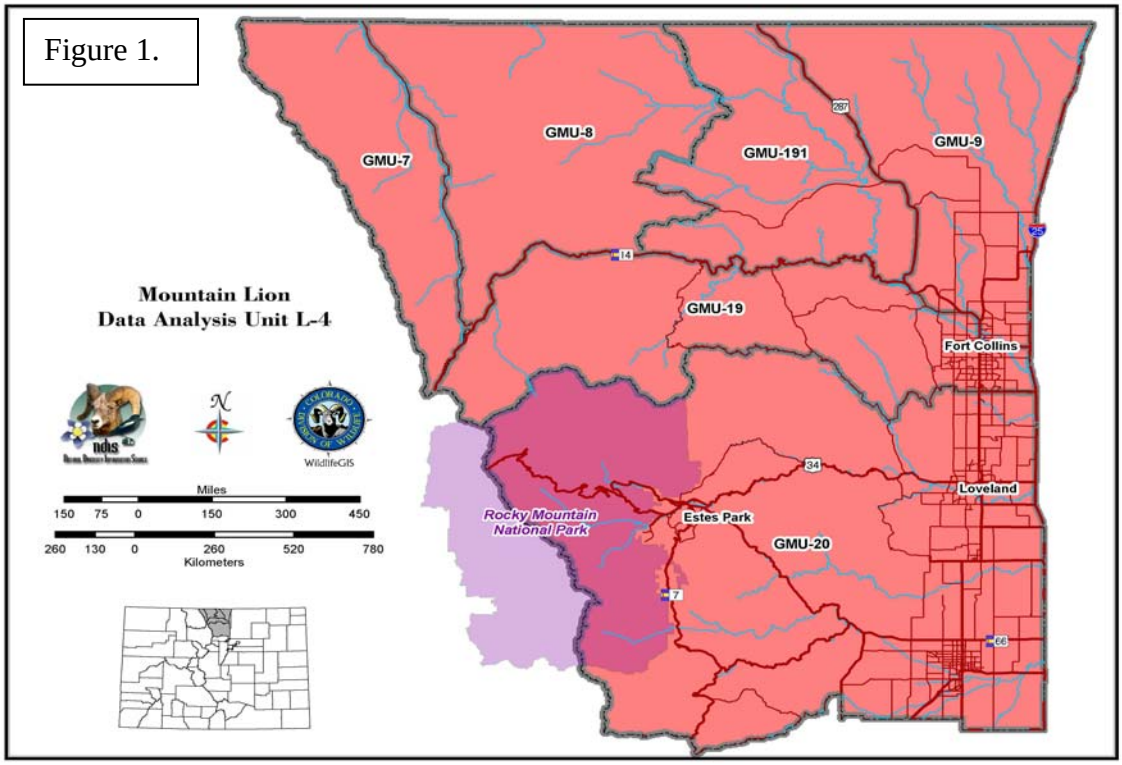
DESCRIPTION OF DAU, HABITAT AND PAST MANAGEMENT

LOCATION, TOPOGRAPHY, CLIMATE, LAND USE, LAND STATUS

Mountain lion Data Analysis Unit (DAU) L-4 is located within Larimer and northern Boulder counties in north-central Colorado (Fig. 1). It is made up of Game Management Units (GMUs) 7, 8, 9, 19, 20 and 191. The boundaries of L-4 are formed by the Wyoming state line to the north, on the west by the Jackson County line and the Continental Divide through Rocky Mountain National Park, and on the east by I-25. The southern boundary is defined by Colorado 52, US 36, Boulder Co. Rds 34, 94, 81, 106 and 95 (Lefthand Canyon Dr), 102 (Brainard Lake Rd) and the ridgeline from Brainard Lake to Pawnee Peak. Towns and cities within the DAU include Fort Collins, Loveland, Estes Park, Lyons and Longmont. Excluding the smaller towns of Estes Park and Lyons, most populated areas fall on the far eastern edge of the DAU, and represent the area that is considered urbanized with some limited agriculture. The major drainages found in L-4 include the Cache La Poudre, Big Thompson, St. Vrain and Laramie Rivers.



Habitat varies from the ponderosa pine-mountain mahogany-shrub foothills community at approximately 1,500 meters (5,000 ft.) in elevation to spruce-fir stands in progressively higher terrain ending with alpine tundra or high mountain peaks at over 4,270 meters (14,000 ft.) in Rocky Mountain National Park on the far southwestern edge of the DAU. The lower and middle elevations of the DAU are very good lion habitat, with the higher areas being intermediate in quality. Areas east of US highway 287 between Fort Collins and Longmont are not suitable lion habitat due to urbanization. However, due to the proximity of low-elevation deer and elk herds in the foothills just west of US 287, the northern Front Range urban corridor quickly transitions to quality lion habitat

within a few miles of the west sides of Loveland, Longmont and Fort Collins. The DAU is 7,757 sq. km. in size with land primarily under control by US Forest Service (36.5%), National Park Service (8.7%), various state agencies (3.9%) and private landowners (49.2%).

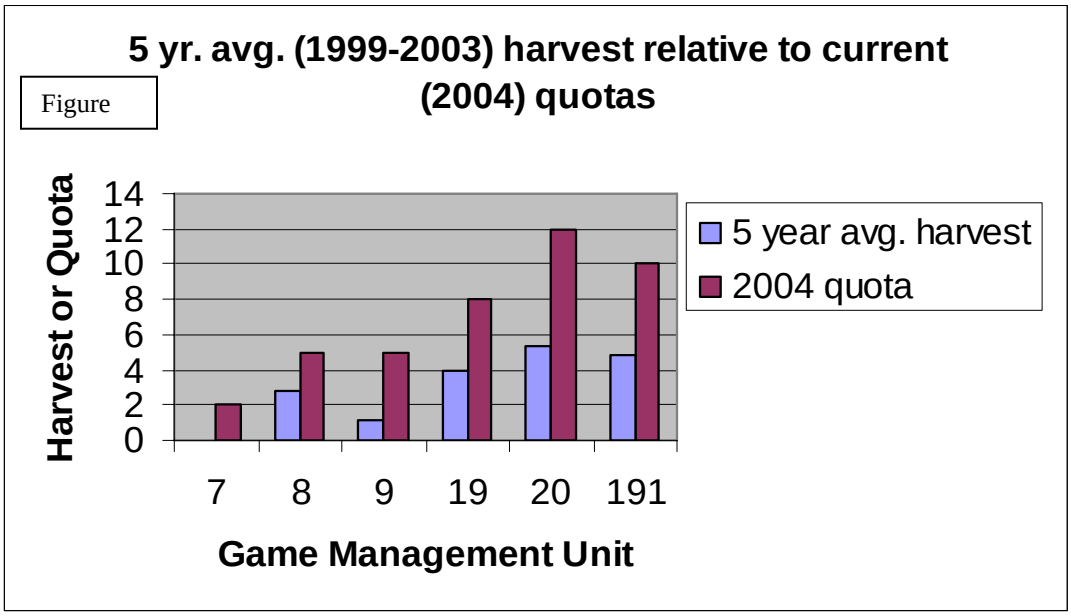
HISTORY

Legal status

Mountain lions received no legal protection and were classified as a predator in Colorado from 1881 until 1965 (Fitzgerald et al. 1994). During that time take of mountain lions was encouraged by bounties and other laws. In 1965, mountain lions were reclassified as big game animals and hunting seasons were created. The bounty was abolished, but some provisions for landowner take of a depredating lion remains in Colorado law to this day. The Division of Wildlife (DOW) also became fiscally liable for agricultural and livestock damage caused by lions.

Hunting season and quotas

From 1992-2004 the harvest quota in L-4 has been 42 mountain lions per year. 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. While quotas have very rarely been met over the last 15 years in any GMU in L-4, GMUs 8 and 191 represent the units that come the closest to being filled (Figure 2). The female portion of the DAU-wide harvest has averaged 41% for the last 5 years and 43% for the last 10 years (Figure 3). Total quota achievement has averaged 44% for the last 5 years and 48% for the last 10 years (Figure 4). This similarity between the long-term and short-term harvest trends potentially indicates a sustainable level of harvest.



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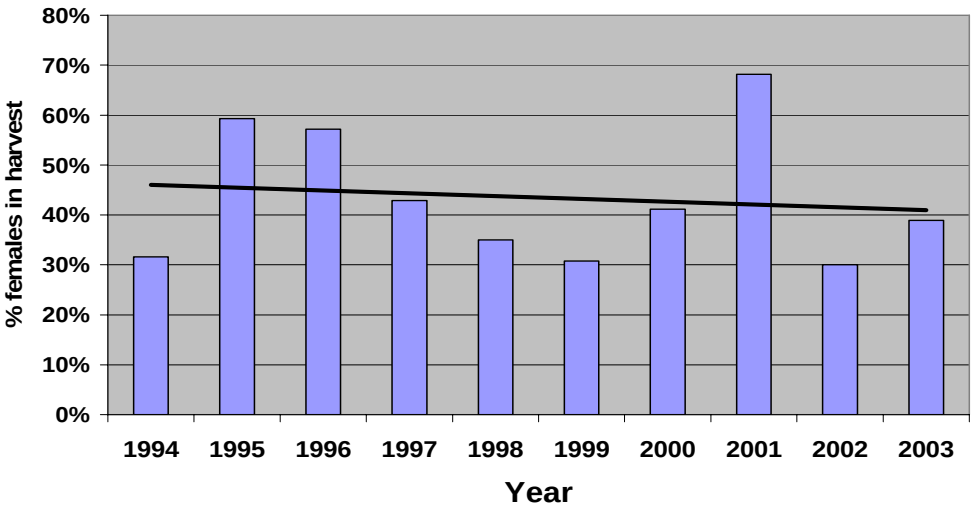

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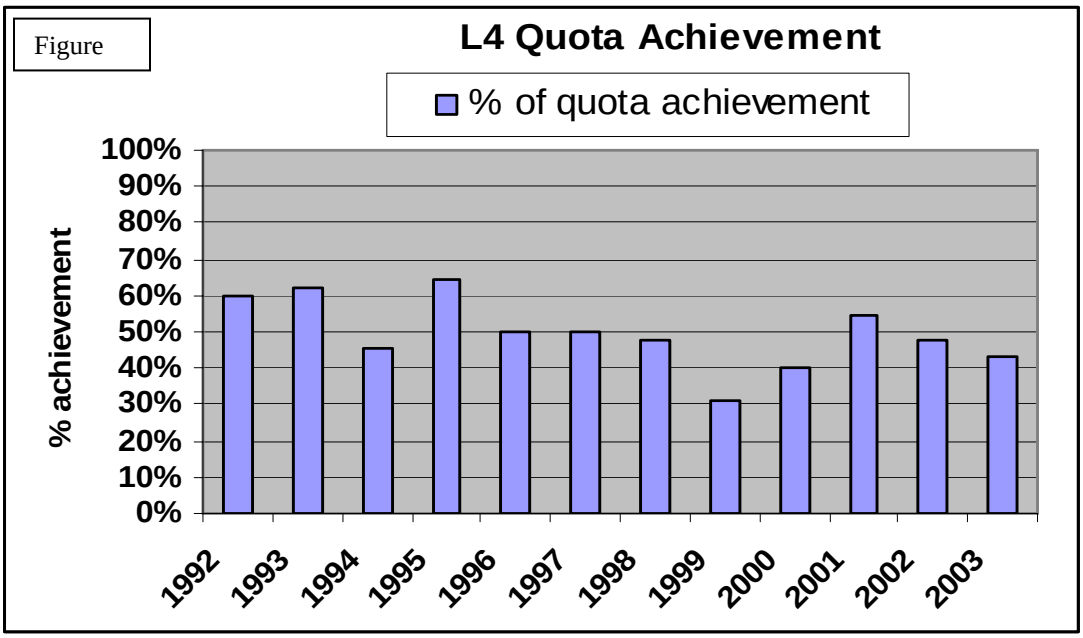


KEY MANAGEMENT ISSUES

A major management issue in this area is the need to maintain a stable mountain lion population while considering human conflicts and game damage. Public open houses were held in Fort Collins and Denver as part of the scoping process for public input. In addition to the comments that were received at the open houses, several comments were submitted by mail. The comments were considered in developing strategic goals and management objectives. Most of the public comments were in favor of maintaining a healthy population, but others stated that there are too many mountain lions and that harvest should be increased in order to reduce conflicts. Because of the

dense human population and associated residential developments, hunting of mountain lions is difficult in many of the areas where conflicts occur. Therefore, even if an increase in harvest could be achieved (which is improbable based on the fact that in current years the DAU quota has remained over 50% unfilled), it is unlikely to reduce conflicts.

STRATEGIC GOALS:

The strategic goal in L-4 is to maintain the current level of lion density, perpetuating a biologically sustainable population level. The DAU is being managed for a 'stable' lion population. This goal was chosen due to consideration of desires expressed in the public scoping process, results from public surveys (Zinn and Manfredo 1996, Manfredo et al. 1998), and the fact that in L-4 there is no correlation between damage/conflicts and harvest levels. Game damage and other conflicts will be managed on an individual basis. The DOW will continue to monitor lion harvest and non-hunting mortality sources, engage in incorporating data from pertinent research as it becomes available and persist in refining and improving current knowledge of local mountain lion populations and management.

MANAGEMENT OBJECTIVES:

Prey densities

Predator populations depend on their prey base and it is likely their numbers are correlated with prey densities. While localized herds within L-4 may have increased in some cases according to CDOW deer and elk population models (e.g. GMU 20 elk), overall ungulate populations have been stable to decreasing in the DAU over the last 10 years. In 1993 there were approximately 19,000-20,000 deer in the 2 deer DAUs within L-4, since then the population has decreased, numbering just under 13,000 by 2003. In parts of L-4, particularly in the north-central areas, much of this reduction in the deer herd has been by design as part of chronic wasting disease management. Elk populations have increased slightly from 6,700 in 1993 to 8,000 in 2003. These population estimates are in some cases a reflection of quadrat-based sampling, but mostly are derived from computer population modeling using observed classification and harvest data. As with any model, the population is not known with certainty, but the estimates are based on the best information available.

Prey numbers in L-4, relative to some studies in other areas of the west, are moderate to high. While most of the literature on mountain lions doesn't include actual estimates of deer density, parts of L-4 directly along the Front Range can be argued to have deer densities exceeding those found by Logan and Sweanor (2001) in the San Andres Mountains of New Mexico, and likewise may have lion densities at the higher end of the spectrum. On the other hand, parts of L-4 that are grasslands or have undergone deer population reductions support lower levels of lions, deer and elk. Relative to other parts of the Colorado Front Range overall L-4 ungulate densities are moderate with localized areas of high concentration.

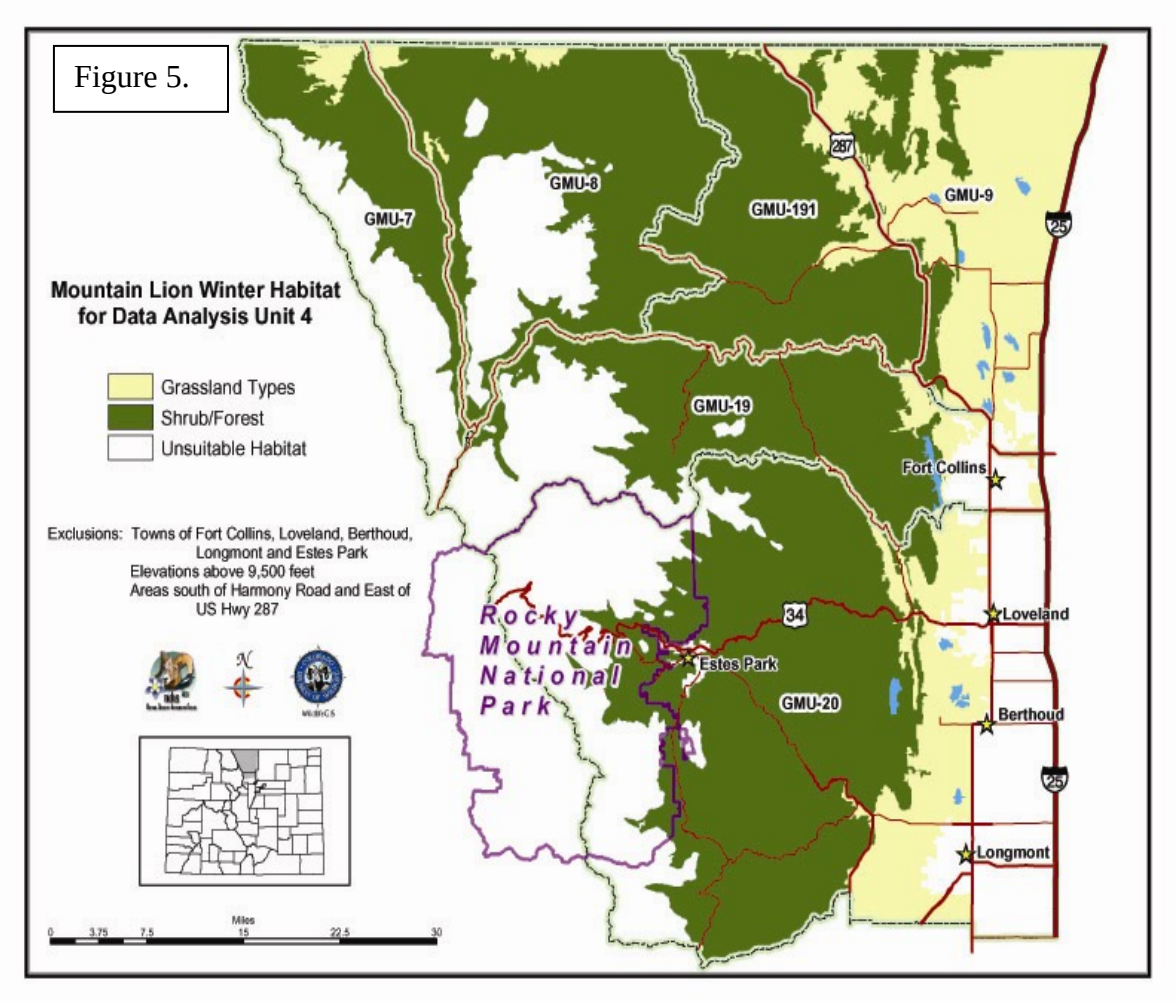
PROCESS FOR DETERMINING MANAGEMENT OBJECTIVES

The L-4 lion population projection is based primarily on 2 factors; defining the area of suitable lion habitat within the 7,757 sq. km. 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),

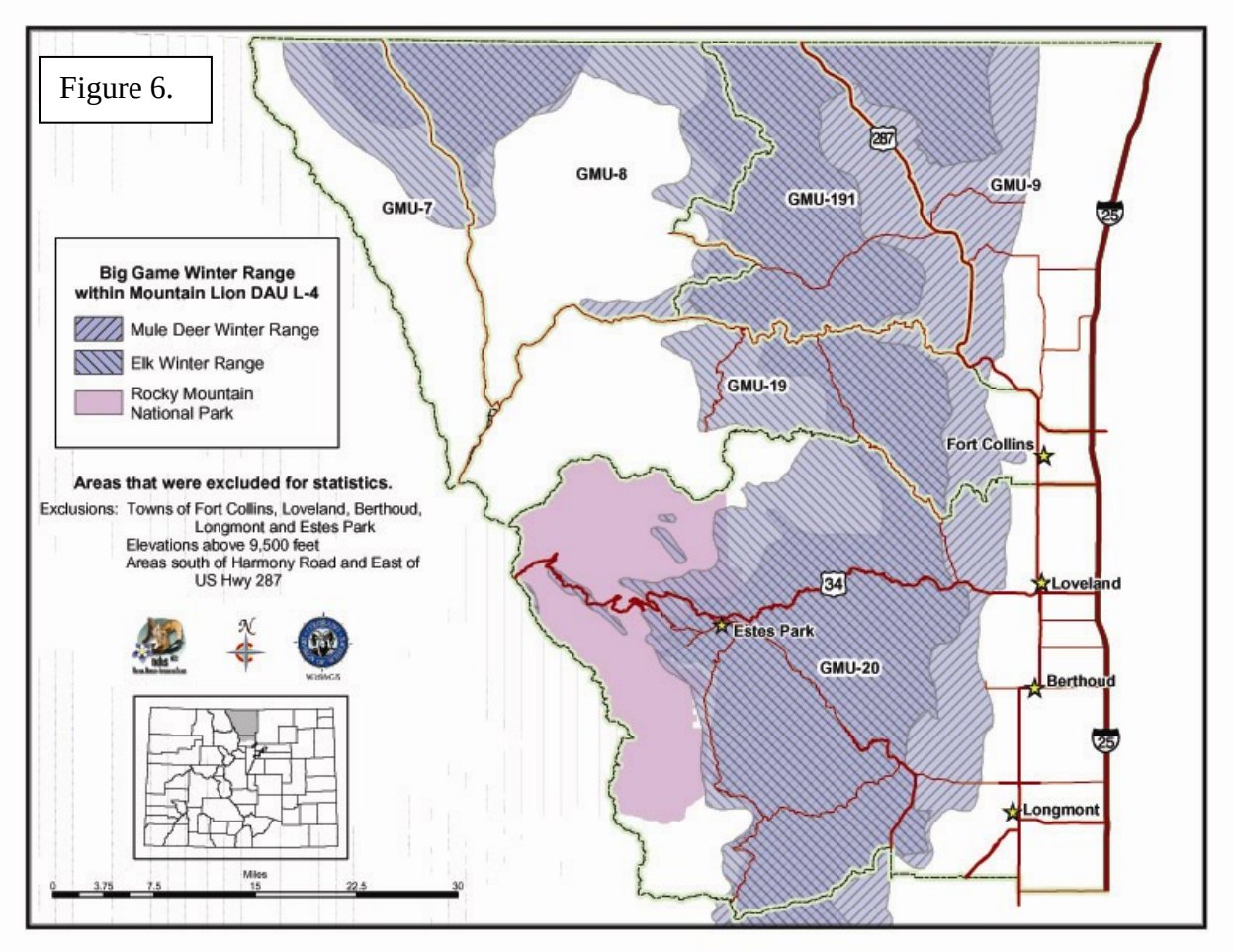
the L-4 estimate could not be based on quantitative field observations within the DAU. The population projection is however, based on a synthesis of lion densities from other published studies in the western US as well as geographic information systems (GIS) data on habitat and spatial variables.

In L-4, winter range lion habitat is defined as areas below 2,900 meters (9,500 ft.) in elevation and not included within the boundaries of a municipality (i.e. Fort Collins, Loveland). This potential habitat was further refined with a GIS vegetation coverage to only include the forest/shrub and grassland community. Due to the fact that L-4 also straddles a transitional zone between good lion habitat in the foothills and poor lion habitat in the human-impacted plains, the area that is both south of Harmony Rd and east of Hwy. 287 was excluded from the surface area used in lion habitat calculations (Berthoud, eastern Loveland, etc). Most of this area is predominantly suburban housing developments, commercial developments and limited agriculture. The level of human use of the area is such that sustained occupancy by mountain lions is exceedingly rare.

While lion harvest locations are clearly not random, they too 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 as lion habitat in Figure 5.



In Colorado, lion habitat overlaps with the range of its principle food sources, mule deer and in many cases, elk. Visual inspection of overall deer and elk range, excluding urban and plains deer, is an essential duplicate of the lion habitat as defined above. This prey habitat boundary provides the basis for the 2,900 meter (9,500 ft) elevational limit used in winter range projections. Figure 6 shows mule deer and elk winter range. The foothills transitional zone can be seen in a north-south band outlined by the presence of quality deer winter range. This is also the area where on a localized scale, 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 5,570 sq. km. (Figure 5).



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 0.02 lions/sq.km. and a high density estimate of 0.046 lions/sq.km in L-4. Multiplying these high and low densities by the given area of lion habitat (5,570 sq. km.) creates a range of population sizes. Age structure within the total L-4 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. Overall habitat in L-4 can be rated as being from very good to intermediate in quality. Based on overall analysis of quality of lion habitat, prey densities (as outlined in the sub-section above) and sustained harvest levels, a population point projection calculated from an intermediate lion density (0.036 lions/sq.km) was developed and is further classified below (Table 1). Kittens were projected to account for 33% of the population and were therefore subtracted from the legally harvestable population. Calculated high and low projections are also provided in Table 1.

Table 1.

Projected Population	Adult	Subadults	Cubs	Total
Low density	58	15	38	111
High density	136	34	86	256
Point projection	*104*	*27*	*69*	*200*

MORTALITY OBJECTIVES (5yr average)

Total Mortality Objective

Annual total mortality objectives are closely tied to projected lion population levels. The operating population projection outlined in this document is approximately 131 legally harvestable lions (104 adults and 27 subadults), 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 DAU L-4 is being managed for a stable population, a mortality level at or below the population's rate of increase is needed to produce stable or increasing numbers. An annual total mortality of 8-15% of the legal population (adult and subadult) can be considered to be the biologically sustainable off-take range to maintain a population (J. Apker, 2004, unpublished CDOW report). Logan and Sweanor (2001) observed an 11% annual rate of increase in the reference area of their study. The authors also documented the relatively high resiliency of lion populations when they recorded a 28% annual rate of growth in the treatment area following a period with a high rate of removal. Although the rate of increase in L-4 is not known, it is expected to exceed the 11% observed by Logan and Sweanor (2001) due to increased overall prey densities relative to their study area.

Using a projection of 131 legally harvestable lions, this off-take range corresponds to an annual removal of from 11 (8%) to 20 (15%) lions from all mortality sources. This maximum off-take level of 15% is believed to be sustainable in L-4.

Typically, all documented lion mortality in L-4 has come from harvest. However, in 2003 there were 6 known lion mortalities from non-hunter sources; this is unusually high, as the 10-year average is essentially zero. If increased lion mortality from non-hunter sources (roadkills, damage kills) is observed over several subsequent years, then future hunter mortality objectives will be modified to reflect the predicted losses in the population due to non-hunting factors.

Hunter Harvest Objective

The hunter harvest objective for L-4 has typically been the same as the total mortality objective. Few non-hunting mortalities have been observed, so in recent years it has been unnecessary to lower the hunter harvest objective to compensate for these other presumably additive losses. Given that the 10-year harvest average is 20 lions (15% off-take), the current level of harvest in L-4 would fall at the upper threshold appropriate for maintaining a stable population.

Barriers and Strategies

DOW is assisting in sponsoring educational seminars designed to help lion hunters understand current regulations, provide techniques to classify lions to age and sex while in the field, and understand the outcomes that different harvest scenarios may have on a population.

Monitoring

All known dead lions, from both harvest and non-harvest sources, are checked by DOW staff to obtain biological information. The quality of these data are being improved by further training of service center staff that may check lions and the development of a key for assisting in determining lion age. Precise estimation of age to within 2-3 years can be accomplished by examination of tooth eruption and wear (Anderson and Lindzey 2000). The proportion harvested of each gender will continue to be closely monitored on an annual basis to assure that female mortality rates are not impacting the sustainability of the population.

Beginning in 2002, a Colorado State University/DOW/US Geological Survey graduate research project was initiated to examine the prevalence of chronic wasting disease (CWD) in lion-killed deer and elk to investigate if cougars were preying selectively on CWD positive animals. As a secondary product of this study, informal data on collared lion movement and survival is being collected and shared with the local DOW biologist.

A sample of radio-collared mule deer in L-4 are also being monitored during the follow-up portions of deer survival and movement studies that are being conducted in the area. Mortality causes of radio-collared deer are recorded as part of the data collection process and can be used as an informal way to evaluate and track levels of lion predation. While these studies were designed to gather information on deer, and as such can't provide any statistically significant data on lions, they can contribute anecdotally to our knowledge about local lion predation.

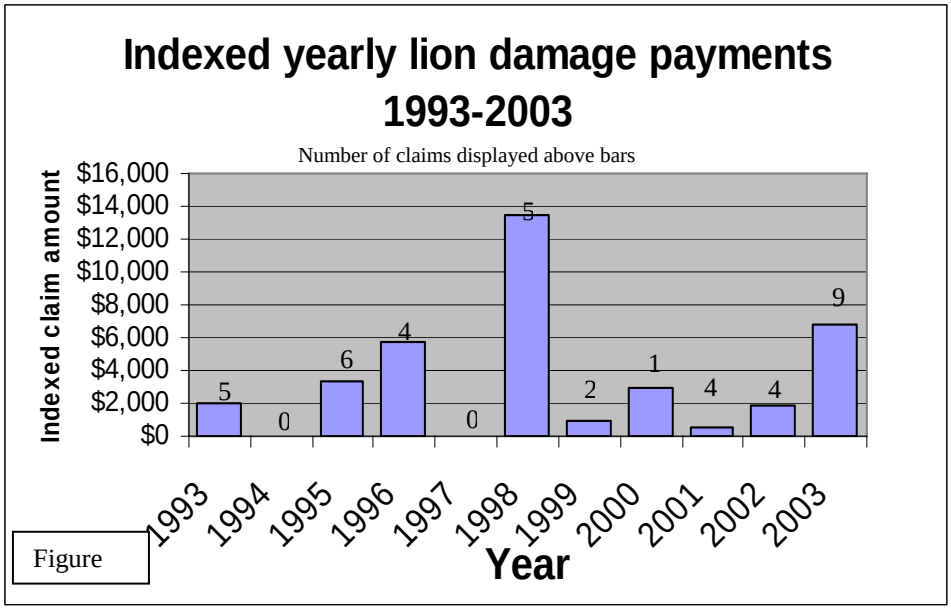
Beginning in 2000, deer numbers in parts of L-4 were reduced, principally by hunter harvest, as a management strategy aimed at reducing and slowing the spread of CWD, a fatal brain disease of deer and elk. Quadrat-based deer population estimates in the northern part of the DAU confirm that the Larimer County portion of the herd has undergone an approximate 20% decrease during the last 3 years; this in turn may have an effect on lion movement, dispersal, survival and depredation rates.

GAME DAMAGE:

BARRIERS AND STRATEGIES

Damage payments have averaged $2,639 per year for the last 5 years or $3,086 for the last 3 years (based on available data through 2003). Damage payments in L-4 seem to follow a boom or bust cycle, whereby payments are low for several years, and then jump significantly in one year with a number of costly claims (Fig. 7).

A relatively new occurrence in L-4 is the proliferation of hobby livestock ranches. Relative to more traditional livestock operations (horse and cattle), these hobby ranches typically raise smaller breeds of animals (llama, alpaca, goat, etc). Many times these animals are more concentrated, potentially making the pen or small pasture they are in a productive target for a depredating lion. Educating landowners of livestock practices to minimize this potential is the primary means of reducing this type of conflict.



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BARRIERS AND STRATEGIES

The CDOW will utilize hunters whenever possible to harvest depredating lions. Biologists and DWMs will continue to inform and educate the public on ways to prevent or minimize damage to domestic animals. Due to reduced deer densities in L-4 as part of CWD management, concerns over the potential increase in lion predation on livestock have emerged as an issue with some landowners. Through the winter of 2003-2004, there has been no significant documented increase in lion depredation. However, in great part to reflect these emerging concerns, a Habitat Partnership Program Committee (HPP) was initiated in 2002 in Larimer County. GMUs 7, 8, 9, and 191 are included in the Northern Larimer County HPP, potentially providing a streamlined option for landowners to receive compensation for verified losses due to lion depredation.

MONITORING

As stated in the Mortality Objectives section, the opportunity to informally receive data on lion kills or depredation events as part of the current CSU/DOW/USGS lion study in L-4 can be of assistance in recording/corroborating game damage claims.

HUMAN / LION CONFLICTS*:*

As development at the edge of the suburban fringe proceeds, human encounters with lions will continue to occur. 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. The results from a 1996 survey of Denver-area Front Range residents' attitudes towards mountain lions provide information on how people who live in lion country view these animals (Zinn and Manfredo 1996, Manfredo et al. 1998). Overall attitudes toward mountain lions across metropolitan and suburban communities were very similar with approximately 80% of respondents in all cases having a "positive attitude" toward lions. This survey also reinforced the idea that the DOW's information campaign regarding living with lions has been successful; a majority of the sample endorsed the

strategy recommended by the DOW for human behavior during a mountain lion encounter.

The only known fatal incident in recent time near L-4 was a 1997 attack on a child in Rocky Mountain National Park; this was west of the DAU, outside the L-4 boundary.

BARRIERS AND STRATEGIES

CDOW biologists, DWMs and service centers will continue to provide the public information on human safety and how to live with lions. This is done through programs as well as printed literature. As needed, the CDOW will continue to conduct workshops for public agencies, law enforcement personnel, and concerned public groups.

RESTRICTED HARVEST/REFUGE AREAS

The mosaic of various landowners and land management agencies in L-4 with different philosophies or regulations regarding lion hunting has created a patchwork of areas within the DAU where lion hunting is restricted or not allowed at all. While the total effective size of these areas is difficult to estimate due to their non-contiguous nature, it is clear that there are significant pieces of land within the DAU that are lion habitat and are not subject to hunting mortality. As the large ranches in L-4 become subdivided or purchased by cities, counties and non-governmental organizations, areas of no hunting mortality or restricted harvest will likely only continue to increase in number and size.

It may be that areas such as Rocky Mountain National Park, Larimer and Boulder County Open Space properties and ranches that do not allow hunting are providing a source of immigrating lions that helps support the population given the current level of harvest. These potential sources of inflow to the population will continue to be further identified as more information becomes available on the role they may play in sustaining population stability.

SUMMARY:

The goal for L-4, as supported by public input, is to maintain a stable lion population. Harvest in L-4 over the last 10 years has been significantly less than the quota level (48%). The 10-year average off-take of approximately 20 lions falls at the upper boundary for the recommended total mortality allowable to maintain a stable population. Game damage and human-lion conflicts will be managed by targeting individual mountain lions. A threat to maintaining the population in the stable range may occur if total mortality sources increase significantly above 20 lions for a number of years or adult females begin to comprise a larger proportion of the harvest. As new information on mountain lion population management, densities and off-take ranges (particularly data from Colorado) becomes available, mortality objectives and population projections will be improved.

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