MOUNTAIN LION MANAGEMENT GUIDELINES

FOR

North-Central Front Range: DAU L-12

GAME MANAGEMENT UNITS

29, 38, 39, 391, 46, 461, 51, & 104 (105 & 110 added Sep. 2010)

Colorado Division of Wildlife

Denver, Colorado

October 21, 2004

DESCRIPTION OF DAU, HABITAT, AND PAST MANAGEMENT

LOCATION, TOPOGRAPHY, CLIMATE, LAND USE, LAND STATUS

Data Analysis Unit (DAU) L-12 is located in north central Colorado (Figure 1). It is made up of game management units (GMUs) 29, 38, 39, 46, 51, 104, 391, and 461. The total area of this DAU is 9980 square kilometers (2,466,152 acres). ***See also the 2010 amendment to the DAU plan – GMUs 105 and 110 added to the DAU.*** It includes the Denver-Boulder metropolitan area and contains the urban interface areas west and south of the metro area. It is bounded on the west by the Continental Divide, on the north by Lefthand Canyon and the Brainard Lake Road, on the east by the Kiowa-Bennett Road and on the south by the Douglas-El Paso County line, the South Platte River and Highway 285.

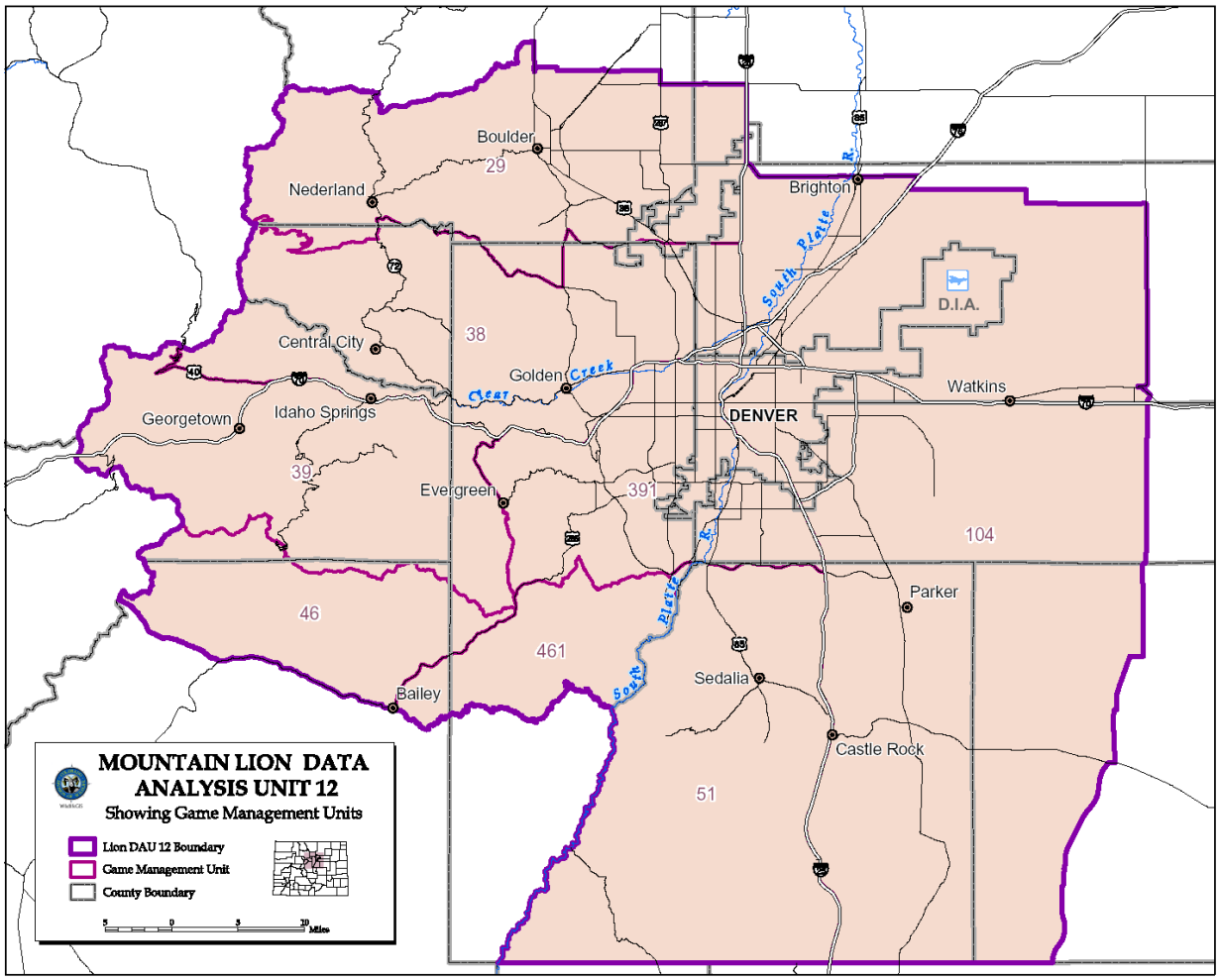

Figure 1. Map of DAU L-12

DAU L-12 includes all or part of the following counties: Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Douglas, Denver, Elbert, Jefferson, and Park. This DAU extends from

the continental divide to the eastern plains and from the Palmer Divide to central Boulder County. The DAU ranges in elevation from under 1,600 meters (5,100 feet) in the east to over 4,300 meters (14,000 feet) in the west.

The western part of DAU L-12 is mountainous and includes many heavily forested areas, high alpine tundra, rocky outcroppings, shrubs, and open grasslands. The southern part is mid-elevation grasslands, shrubs such as scrub-oak and mountain mahogany, and open ponderosa pine forest. Willows are found in riparian areas throughout the DAU. The center of the DAU is urban, including the Denver metropolitan area and surrounding areas. These areas are experiencing increasing development and are becoming more densely populated. The northern and eastern parts of the DAU are predominantly agricultural or short grass prairie with some cottonwood-willow riparian areas along small perennial or intermittent streams and larger rivers such as the South Platte. Land ownership in the DAU is 25% state and federal public lands and 75% private or city/county open space (Figure 2).

The western and southern parts of DAU L-12 have good to excellent habitat for mountain lions. The central urban area is not suitable for mountain lions, although occasionally mountain lions are seen there. The northeastern portion of the DAU is mostly agricultural and generally not suitable mountain lion habitat. It is likely that some mountain lions have established home ranges in the southern part of the DAU where grasslands are interspersed with ponderosa pine forests and oak brush.

Two interstate highways, I-25 and I-70, run through the center of the DAU. Several other high-speed highways and roads are found within lion habitat. These roads are sources of mortality and possible barriers to mountain lion movement. Other potential barriers to movement are urban areas such as Denver and Boulder.

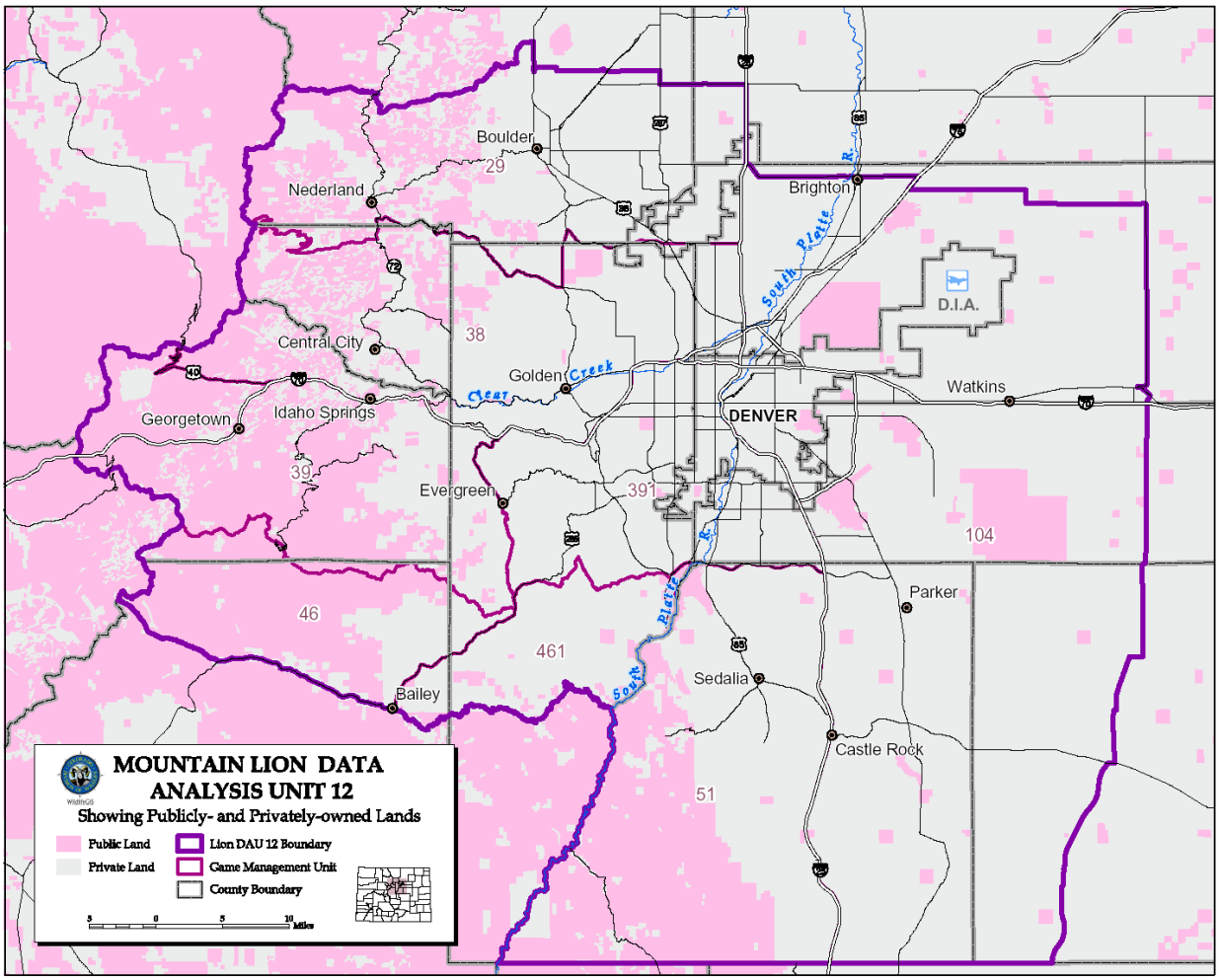

Figure 2. Land ownership in DAU L-12

KEY MANAGEMENT ISSUES

A major management issue in this area is maintaining an acceptable number of mountain lions while minimizing 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 management objectives. Most of the public comments were in favor of maintaining a stable mountain lion population, but others believe that there are too many mountain lions and that we should increase harvest in order to reduce conflicts. Because of the large human population, hunting of mountain lions is very restricted in most 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 would be unlikely to reduce conflicts.

Land use

The Front Range of Colorado has experienced a large amount of development in the last ten to fifteen years. Mountain lion habitat is being converted into residential subdivisions throughout much of the DAU as development extends outward from the Denver and Boulder metropolitan areas. Much of the residential development in the DAU has occurred in areas that are prime wildlife habitat. In some parts of the DAU, homes are on moderately sized acreages which continue to provide suitable habitat for large prey such as deer and elk. Deer and elk hunting is reduced in many of these areas because of safety concerns or because hunting is socially unacceptable. Some of the counties and cities have developed open space programs that set aside land for recreation and wildlife habitat, but do not allow hunting. Ungulate populations are difficult to control under these circumstances. As a result of the abundant prey, mountain lions continue to use these areas.

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, p. 368). 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 provision for landowner take of depredating lions remains in Colorado law to this day. The Division of Wildlife also became fiscally liable for agricultural and livestock damage caused by lions.

Human-lion conflicts

Human-mountain lion conflicts are not new to this DAU. Conflicts arise when lions are seen in residential areas, attack and sometimes kill pets or livestock, act aggressively toward people, or actually attack people. In 1991, a high school student was killed by a mountain lion near Idaho Springs. In response, lion harvest quotas were increased, but the full quota for the DAU has never been reached (Figure 3).

The fatal attack also led to a human dimensions study of opinions on lion management on the Front Range. The results of the survey showed that most people value mountain lions as part of the ecosystem. The study concluded that it was important to most people to know that

mountain lions exist on the Front Range. About 80% of all respondents reported having a positive attitude toward mountain lions (Zinn and Manfredo, 1996).

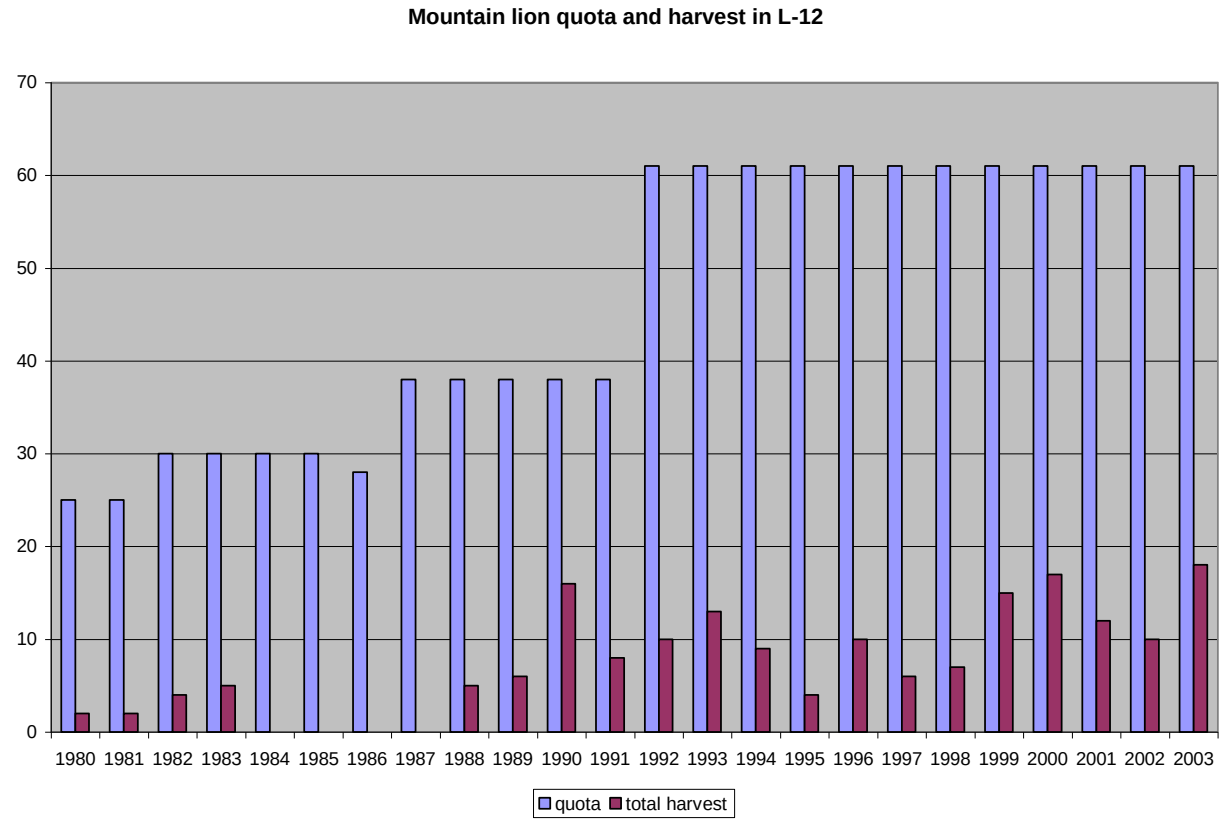

Figure 3. Mountain lion quotas and harvest in L-12 from 1980 to 2003

Past harvest, quotas, and other mortality

The harvest has ranged from 4 to 18 over the last 10 years, with an average of 11. The average harvest since 1980 is 9, and the average harvest in the last five years is 14. The current DAU quota is 61. The quota is seldom met in any of the GMUs due to the suburban land ownership patterns and parks and open space where hunting is not allowed. Both hunter harvest and known non-hunting mortality have been increasing over the past 15 years (Figure 4). The percentage of females that have been killed is also increasing (Figure 5). An average of 54% of mountain lions harvested by hunters in the last 5 years has been females, and 59% of the total mortality was female.

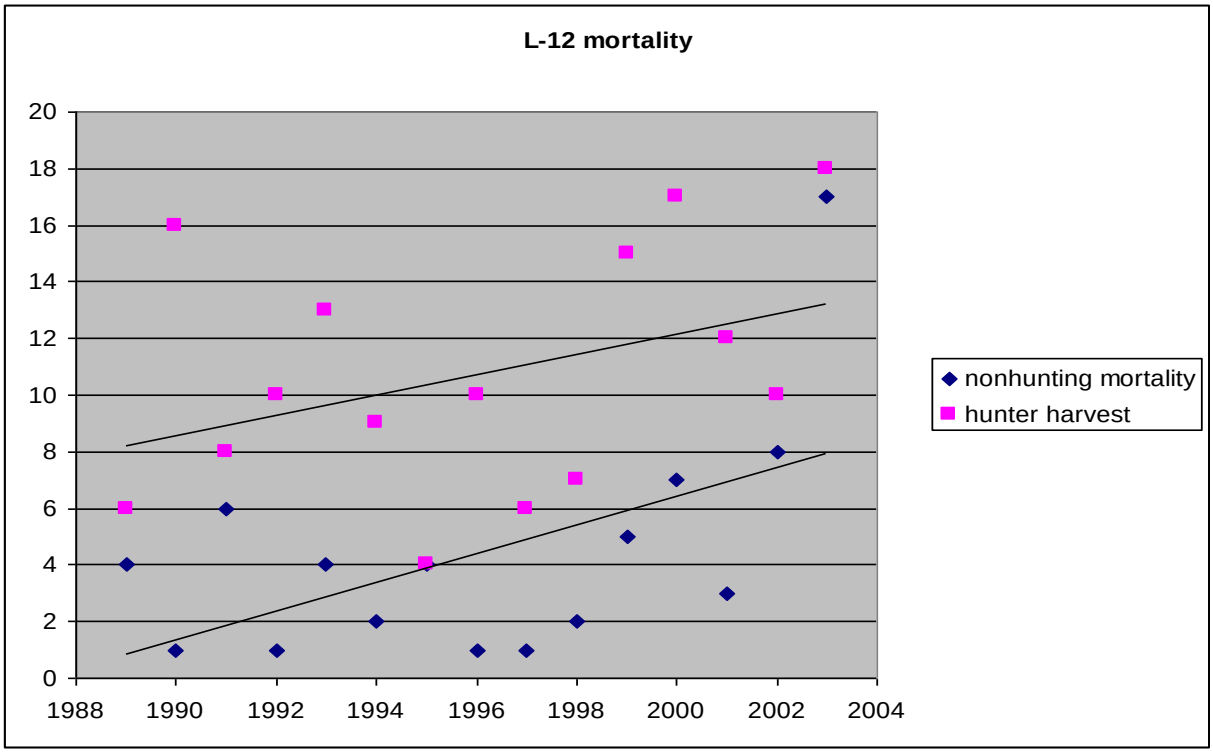

Figure 4. Hunting and non-hunting mountain lion mortality in L-12.

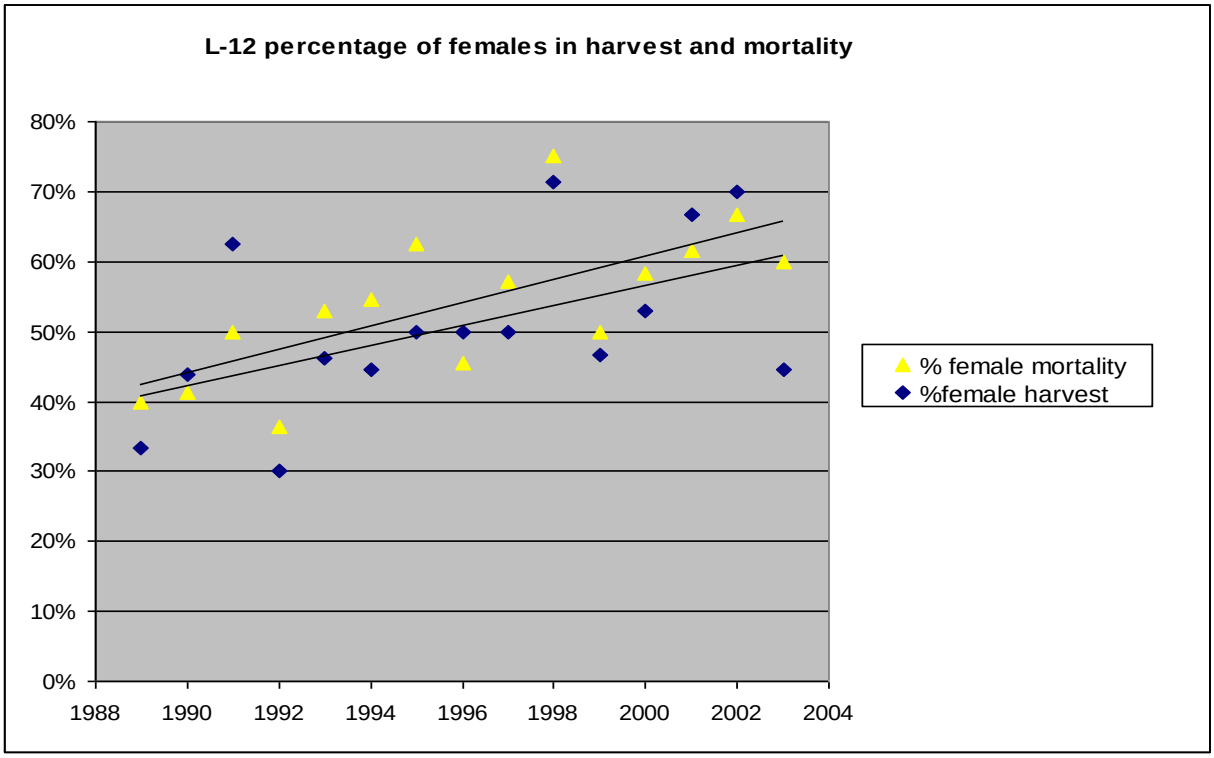

Figure 5. Percentage of female in harvest in L-12 from 1989 to 2003

STRATEGIC GOALS

The strategic goal for DAU L-12 is to suppress the mountain lion population. Mountain lion hunting will be managed in accordance with this goal. This goal was selected by the Director of the Division of Wildlife due to concerns about potential public confusion regarding mountain lion harvest and populations relative to human conflicts. The Division will continue to collect and analyze both biological and public opinion information related to mountain lion management and use new information to reevaluate goals and management strategies.

Mountain lion harvest has fluctuated significantly from year to year, so it is not possible to predict future harvest with certainty. However, hunting quotas will be set based on recent average harvest at a level that will not reduce hunting opportunity or expected harvest. In addition, lions causing game damage and other conflicts will be managed on an individual basis. Often times individual lions are causing conflicts and damage so increased general harvest will not effectively address these problems. The DOW will continue to monitor lion harvest and non-hunting mortality, 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. According to CDOW deer and elk population models, large ungulate populations have increased in L-12 over the past 10 years. In 1990 there were approximately 11,600 deer in the 2 deer DAUs within L-12, and since then the population has increased steadily to just under 16,000 in 2003. There are also additional deer within lion habitat in the southern end of GMU 104 which is in a third deer DAU that primarily falls outside L-12. As with any model, the population is not known with certainty, but it is our estimate based on the best information we have. Based on this estimate, the density of deer in these DAUs is approximately 2.55 deer/km^2.

Most of the literature on mountain lions does not include actual estimates of deer density, but Logan and Sweanor provided a model of the deer population in their study area in the San Andres Mountains of New Mexico. The density there ranged from approximately 0.36 deer/km^2

to 0.78 deer/km^2. The study area lacked elk, but did have other prey such as peccary. The density of mountain lions in the San Andres Mountains ranged from 2.0 to 4.3 lions/100 km^2. It is possible that DAU L-12 can support a higher mountain lion population than other areas because of the abundant prey populations on the Front Range of Colorado.

It is not surprising that DAU L-12 supports a higher prey density than some other habitats. Artificial landscapes, which are fertilized and irrigated, provide highly palatable forage for deer and elk. In addition, illegal feeding of deer, elk and other wildlife contribute to higher prey densities. Raccoons, skunks, and other small mammals are also common in residential areas, and occur at higher densities than in native habitats. These animals can serve as alternate prey for mountain lions. Therefore, the highest prey densities are in the same areas as high human densities.

PROCESS FOR DETERMINING MANAGEMENT OBJECTIVES

No scientific population estimation studies have been conducted in L-12. In the absence of a science-based population estimate, the lion population of this DAU was projected by applying lion density estimates from 3 studies in other areas most similar to the lion habitat in L-12. Three previous studies have provided reliable estimates of lion density in hunted populations in habitats similar to that of L-12. Logan et al. (1986) studied a hunted population of lions in the Bighorn Mountains of Wyoming from 1981 to 1983. This study estimated the density on winter range (late October to mid April) to be 3.5 to 4.6 lions per 100 km^2. Ross and Jalkotzy (1992) studied a hunted population in southwestern Alberta from 1981 to 1989. This study estimated the density on winter range (December through April) to be 2.7 to 4.7 lions per 100 km^2. Logan and Sweanor (2001) estimated lion densities on an annual basis instead of on winter range due to the desert habitat they worked in.

The population projection for L-12 was based on winter range instead of on annual range because 2 estimates were available for winter range while only one was available for annual range. The outer limits of the estimated density range from Logan et al. (1986) and Ross and Jalkotzy (1992) were used to construct the preliminary range, 2.7 to 4.7 lions per 100 km^2, for population in L-12. This range was then narrowed to 3.7 to 4.7 lions per 100 km^2 (i.e., moderate to high density) in recognition of the abundance of prey and high quality of lion habitat in L-12 (Ken Logan, personal communication).

The density range of 3.7 to 4.7 lions per 100 km^2 was applied to the estimated area of mountain lion winter range in L-12. For the purposes of this DAU plan, lion winter range was defined as non-urban, forest and shrub areas below 2895 meters (9,500 feet). This elevation was selected based on the upper bound of mule deer winter range, lower bound of spruce/ fir vegetation, and locations of lion kill sites by hunters. Lions are known to shift their seasonal range in response to seasonal shifts of prey species. Although mountain lions are occasionally found at higher elevations during the winter, they normally restrict their movements to lower elevation areas where prey species concentrate in the winter (Seidensticker et al. 1973).

Using GIS mapping functions, the lion winter habitat in L-12 was calculated to be 3,394 km^2 (838,678 acres). The area included in this calculation is shown in Figure 6. Previous studies have shown that grasslands do not support high densities of mountain lions (Dickson 2002). However, low densities of lions do occur in portions of grassland habitat in L-12. These small numbers of lions are accounted for in the population projection by incorporating the forested areas that are adjacent to and interspersed within the grasslands of this DAU.

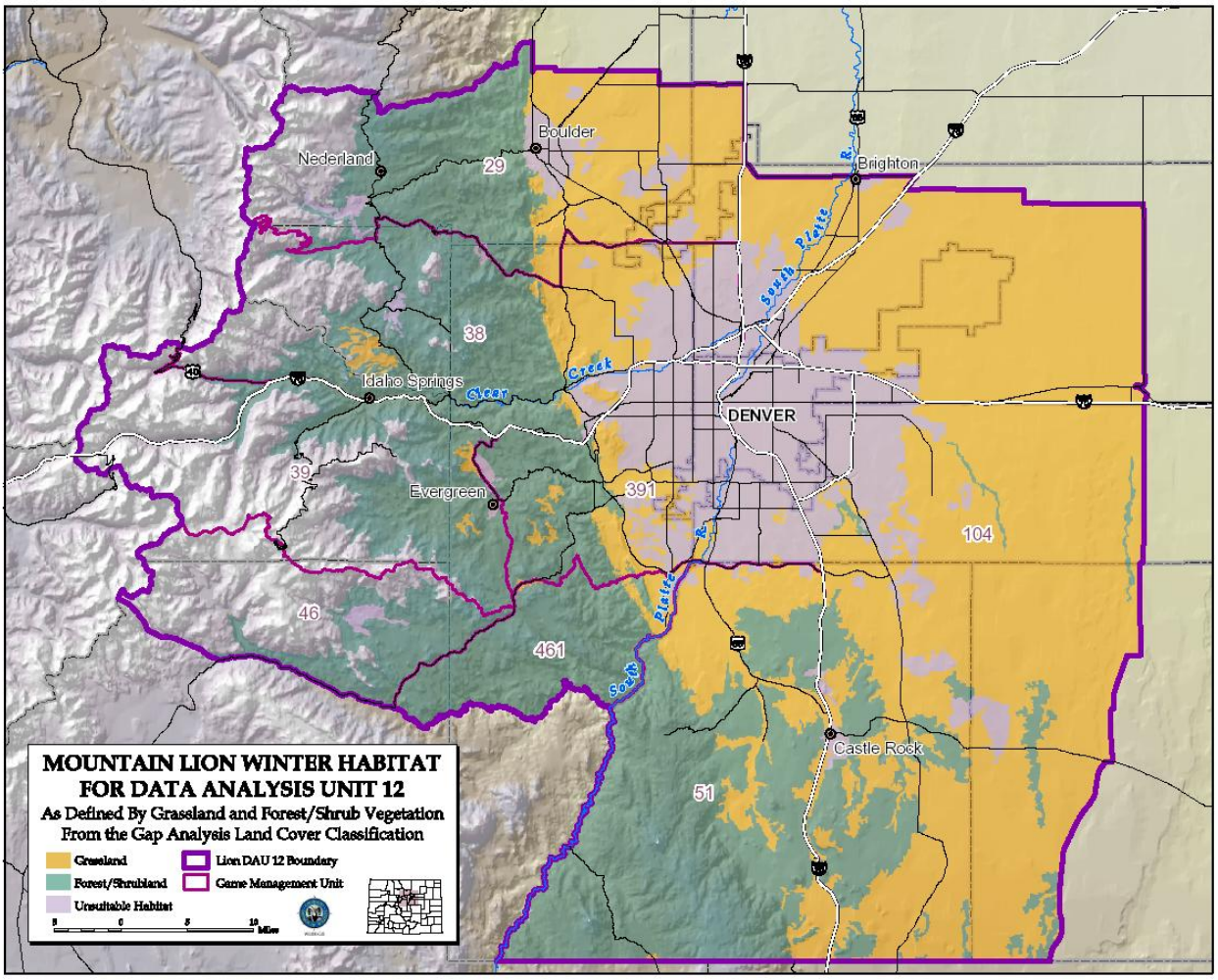

Figure 6. Mountain lion habitat in L-12. Green indicates area occupied by mountain lions in winter.

The prey density of 4.7 lions per 100 km^2 reported by Ross and Jalkotzy, which is one of the highest observed, was selected as the most reasonable for L-12. This density was chosen because of the high populations of ungulates and alternate prey in the DAU. We also believe that this density is appropriate because we eliminated marginal habitat, which might support a few lions, from the land base that was used to calculate an expected population.

Based on a density range of 4.7 lions per 100 km^2, and a winter range of 3,394 km^2, the population projection for L-12 is 160 lions. Kittens cannot legally be hunted in Colorado. Therefore, the number of lions that can be legally hunted was determined by subtracting the kittens from the total population projection. Logan and Sweanor (2001) reported that kittens comprised 34 % (±10%) of the population in a study area with simulated hunting pressure. Ross

and Jalkotzy (1992) found that 33% of the population, on average, was dependant juveniles and kittens. Assuming that the age structure of the L-12 population is similar to the populations cited above, the projected population of L-12 contains 107 legally harvestable lions.

MORTALITY OBJECTIVES

Management strategy

Harvest objectives will be set on an annual basis in accordance with the goal of suppressing the mountain lion population. We will attempt to reach the harvest objective by setting annual quotas for the game management units (GMUs) within the DAU. Quotas will be set based on recent average harvest, so that the expected harvest will not fall below current levels. We will monitor hunter harvest and other mortalities and adjust our harvest objectives and quotas as needed annually.

Total Mortality Objective

A mortality level at or below a population's rate of increase leads to stable or increasing populations, while a mortality level exceeding the rate of increase will suppress a population. Logan and Sweanor (2001) observed an 11% 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% rate of growth in the treatment area following a period with a high rate of removal.

Although the rate of increase in L-12 is not known, it is expected to be at least 11% and likely greater due to the substantially more abundant prey in L-12 than in Logan and Sweanor's study. In order to be certain that a population is suppressed, harvest should exceed 28% of the population. In DAU L-12, this would equate to a harvest objective of 30 lions. Harvest over the last 5 years averages 14 mountain lions, which is 13% of the projected population. Total mortality averages 22 lions, which is 21% of the projected population. Current hunting quotas are unnecessarily high, even with suppression as a goal. Hunting quotas for the DAU have never been met in the past 24 years (Figure 3) and quotas are seldom met in any of the GMUs. As a result, hunting in this DAU has been effectively unlimited. If the current quotas were met, it could result in over half of the projected huntable population being harvested. Even with the current quotas the total mortality has only exceeded 28% of the projected population once (in 2003) partly due to unusually high nonhunting mortality in that year. Therefore, we may not be

able to meet an objective of harvesting 28% of the population. A more reasonable goal will be to keep quotas high enough that hunting opportunity will not be reduced and that will not result in a lower expected harvest.

Hunter Harvest Objective

Over the last 5 years in L-12, an average of 7 lions per year have died as a result of non-hunting mortality, including car collisions and control kills. Given a total mortality objective of 30 lions per year, an average of 23 lions should be harvested annually in L-12. This estimate is based on the best current information. As new information or better methods for collecting and analyzing data become available, we will reassess and adjust population projections, total mortality and harvest objectives. Total mortality and harvest of lions, as well as the proportion of female lions in the harvest will be monitored annually and objectives adjusted accordingly.

Barriers and Strategies to Achieving Mortality Objectives

Urbanization, increasing roads and traffic, and the resulting loss of habitat are the most important barriers to achieving objectives for this DAU. Increasing human activity is a factor in the increase in mountain lion mortality in recent years. Much of the mortality is due to road kills. These factors are difficult to control. The Division of Wildlife comments on land use proposals, and will continue to do so, but counties and municipalities have the ultimate authority to make decisions involving land use. We will continue to educate people about the impacts of habitat loss and fragmentation on mountain lions and other wildlife.

Expanding development in recent years has precluded mountain lion hunting from large areas of L-12. Even with this trend, harvest in the past 5 years is well above the average for the past 25 years. Some speculate that this is due to a higher mountain lion population, but many other factors could affect harvest, including the number of hunters, hunter effort, access to land for hunting, and weather conditions.

Monitoring

Hunter harvested mountain lions are required to be registered with CDOW staff. We will continue to collect biological information from these lions, as well as lions that are killed by other causes. In addition to the data that we already collect, we should attempt to age harvested lions as precisely as possible. Age can be estimated to within 2-3 years by examining tooth

eruption and wear (Anderson and Lindzey 2000). We can improve our knowledge of the mountain lion population by collecting better data on age and sex structure of known mortalities. Additional information from hunters, such as the number of cats seen and treed, could also be useful. As results from other studies become available, the information will be used to modify our mountain lion management objectives and strategies.

GAME DAMAGE

The number of mountain lion damage claims in L-12 has increased since the early '90s. There is some indication of an upward trend from 1990-2003, but the number of claims varies from year to year (Figure 7). The 5-year average of damage claims is approximately $5,000. Most of the damage claims are not on cattle or sheep, but on "other" livestock such as horses, llamas, alpacas and goats. Because these kinds of livestock can be kept on small plots of land and an individual mountain lion might be responsible for depredation while others do not kill livestock, changes in the amount of lion hunting at the GMU or DAU level would not be an effective method to control damage.

Game damage and human conflicts should be addressed through education and by targeting the individual animal that is causing the damage. The primary means of reducing game damage is to educate landowners about livestock practices to minimize the potential for lion depredation. Depredating lions could be removed by agency personnel or by hunters directed to specific depredating lions. Game damage claims will continue to be investigated and recorded. We will continue to track the amount of game damage claims and the amount paid for game damage. We will also continue to record mountain lion complaints and actions taken to reduce damage or conflict.

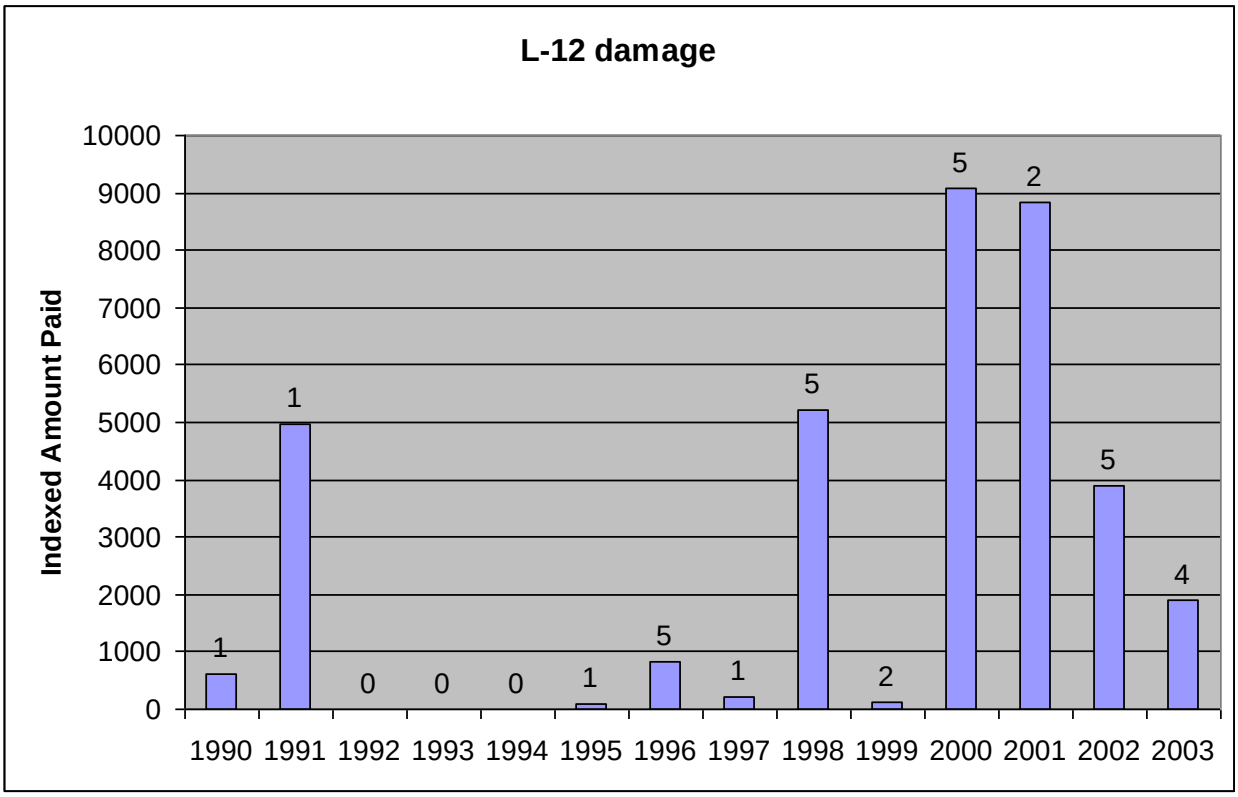

Figure 7. Mountain lion damage in DAU L-12. Numbers above bars represent the number of claims paid in that year.

HUMAN / LION CONFLICTS

Increasing human density in mountain lion habitat is a factor in the number of human-mountain lion encounters and conflicts. As development at the edge of the suburban fringe proceeds, human encounters with lions will continue. Education of the public on how to live in lion country appears to be the most successful method of reducing conflicts.

The results from a 1996 survey of Denver-area Front Range residents' attitudes toward mountain lions provided 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. Many of the people surveyed lived in the L-12 DAU. 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.

RESTRICTED HARVEST/ REFUGE AREAS

The mosaic of various landowners and land management agencies in L-12 with different philosophies or regulations regarding lion hunting, in addition to the variety of human activities and housing densities, has created a patchwork of areas within the DAU where lion hunting is restricted or not allowed at all. While the total effective sizes of these hunting refuges 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-12 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. However, as traffic increases on existing roads and as new roads are built nonhunting mortality may reduce the effectiveness of these potential refuge areas.

Areas such as southern Boulder County and parts of Jefferson and Douglas Counties, where hunting access is limited, might be providing a source of immigrating lions that helps support the population given the current level of harvest and other mortality. 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

DAU L-12 has good habitat and abundant prey that can support high mountain lion densities. High levels of human activity, roads, and traffic can act as sources of mortality or barriers to mountain lion movement. The goal for this DAU is to suppress the mountain lion population. Total lion mortality and female mortality has been increasing in recent years. Based on the population projection for L-12 which was estimated from population rates of increase found in published lion studies, as well as the high proportion of females in the harvest, the recent average hunter harvest and total mortality may be approaching the levels necessary to suppress the population. Game damage and human-lion conflicts will be managed by targeting individual mountain lions, rather than using general hunting. Ongoing research and improved monitoring might yield new information about mountain lion populations. When new information becomes available we will use it to adjust our population projection, total mortality and harvest objectives.

LITERATURE CITED

Anderson, C.R., Jr., and F.G. Lindzey. 2000. A photographic guide to estimating mountain lion age classes. Wyo. Coop. Fish & Wildl. Res. Unit., Laramie. 2pp.

Dickson, B.G. and Beier, P. 2002. Home-range and habitat selection by adult cougars in southern California. Journal of Wildlife Management 66(4):1235-1245.

Fitzgerald, J.P., C.A. Meaney, and D.M. Armstrong. 1994. Mammals of Colorado. Denver Museum of Natural History and University of Colorado Press.

Logan, K.A., L.L. Irwin, and R. Skinner. 1986. Characteristics of a hunted mountain lion population in Wyoming. Journal of Wildlife Management 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, DC, USA.

Manfredo, M. J., H. C. Zinn, L. Sikorowski and J. Jones. 1998. Public acceptance of mountain lion management: a case study of Denver, Colorado and nearby foothills areas. Wildlife Society Bulletin 26 (4): 964-970.

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

Seidensticker, J.C., M.G. Hornocker, W.V. Wiles, and J.P. Messick. 1973. Mountain lion social organization in the Idaho Primitive Area. Wildlife Monographs No. 35.

Zinn, H. C., & Manfredo, M. J. (1996). Societal Preferences for Mountain Lion Management along Colorado's Front Range. (Project Report No. 28). Project for the Colorado Division of Wildlife. Fort Collins, CO: Colorado State University, Human Dimensions in Natural Resources Unit.