

## Colorado Mountain Lion Status Report

Jerry A. Apker, Colorado Division of Wildlife, 0722 South Road 1 East, Monte Vista,  
CO 81144 USA, [jerry.apker@state.co.us](mailto:jerry.apker@state.co.us)

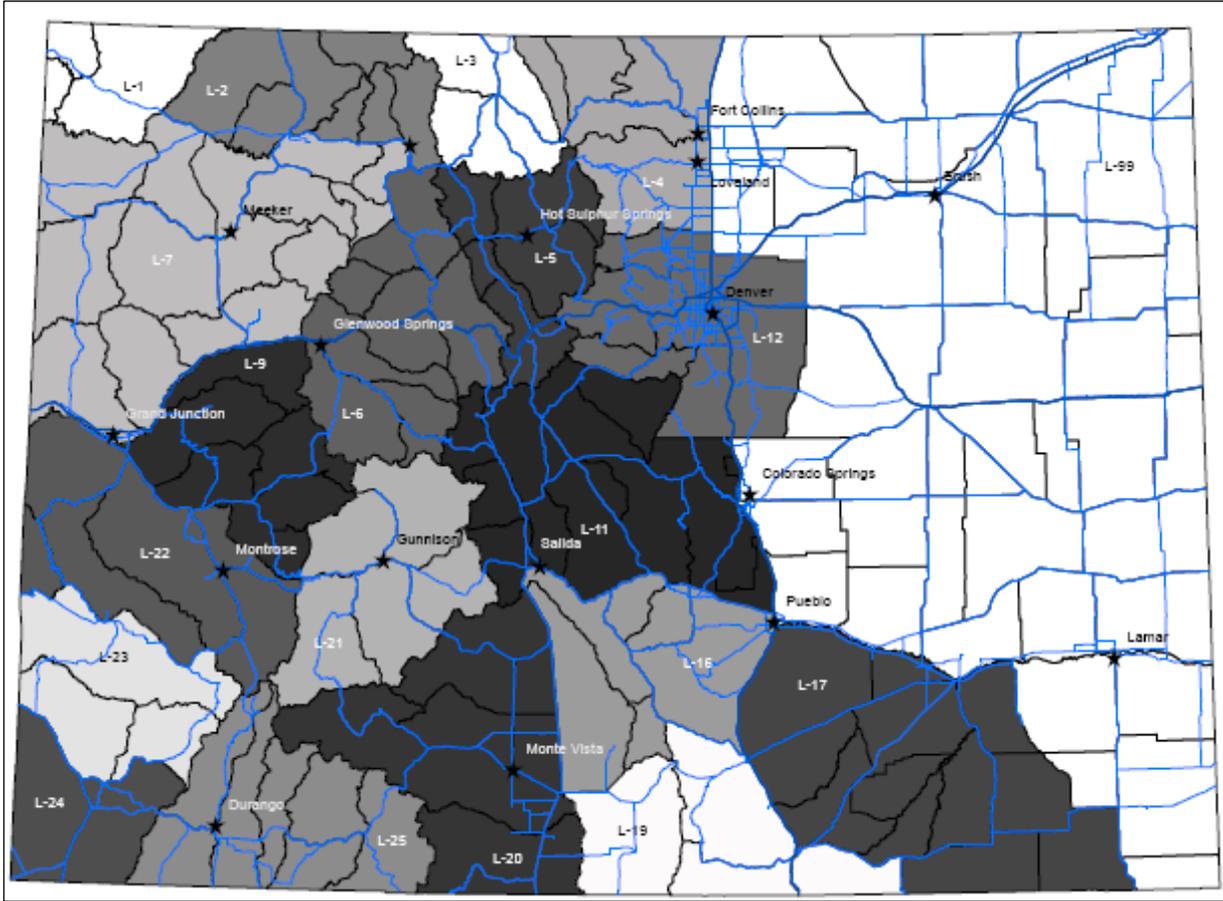
### Management Background

Mountain lion (*Puma concolor*) received no legal protection and were classified as a predator in Colorado from 1881 until 1965. During these years the take of mountain lion at any time, any place was encouraged by bounties and other laws. The bounty was abolished in 1965, but some provision for landowner take of a depredating lion remains in Colorado laws to this day. In 1965, mountain lion were reclassified as big game. In 1996 the Colorado Department of Agriculture (CDA) was granted “exclusive jurisdiction over the control of depredating animals that pose a threat to an agricultural product or resource.” Thus, CDA has exclusive authority to determine the disposition of an individual lion if it is depredating on livestock, while the Colorado Division of Wildlife (CDOW) retains authority to manage lion populations, all forms of recreational or scientific use, and resolution of human-lion conflicts.

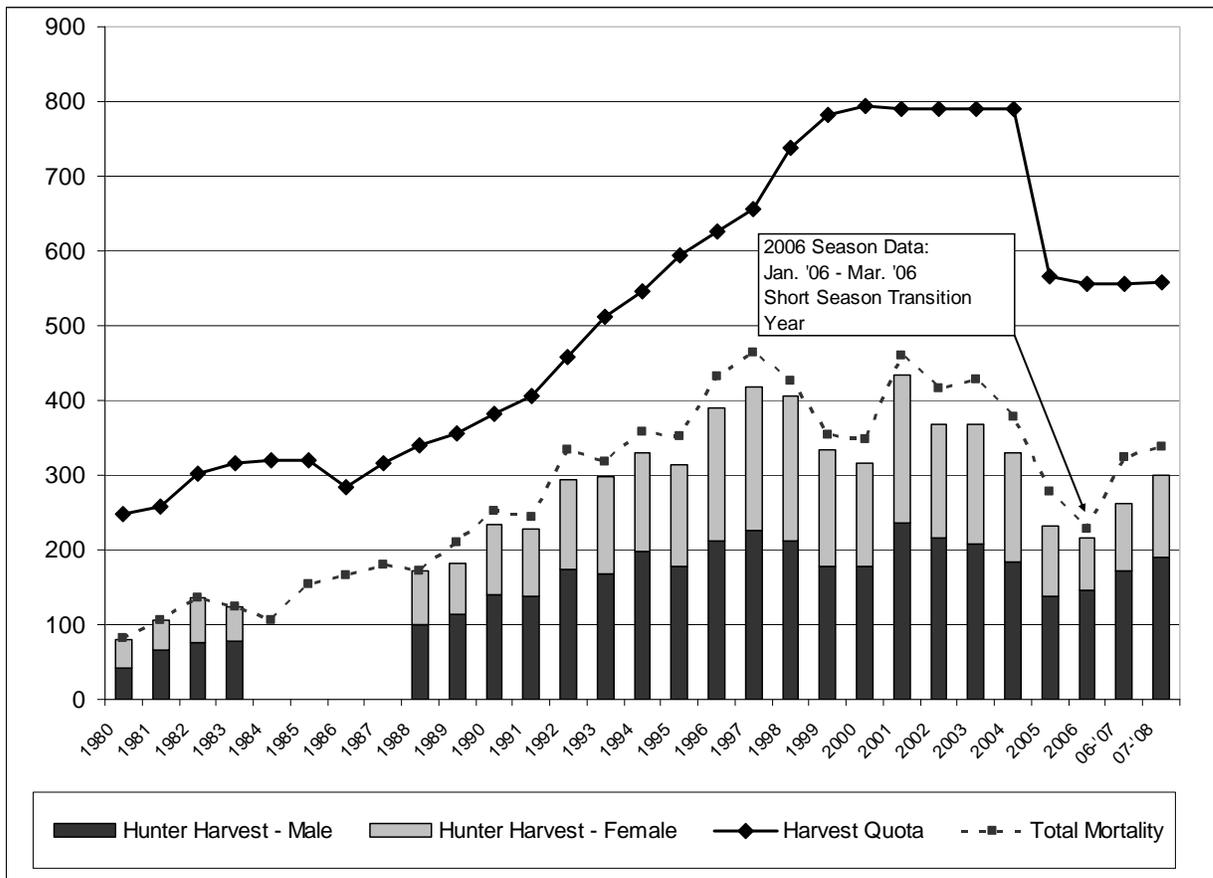
The State is divided into 19 Data Analysis Units (DAUs) for the purpose of lion management (Fig. 1). DAUs are assemblages of Game Management Units (GMUs). Since 1972, Colorado sets harvest limit quotas for one or more GMUs within DAUs for the purpose of limiting and distributing harvest. Hunters are allowed to take one lion per season of either sex. Colorado does not currently use female harvest limit sub-quotas.

Hunter harvest, non-hunter mortality, game damage conflicts, and human-lion conflicts are monitored annually within DAUs for crude indications of population change. Lion mortality is documented through mandatory checks of hunter kill and mandatory reports for non-hunter mortality and is kept in a database. The database for hunter kill has been kept since 1980 and for non-hunter mortality since 1991. Data on depredation claims since 1979 is also maintained in a database, although the data from 1979-1987 is somewhat suspect due to inconsistent reporting and record keeping.

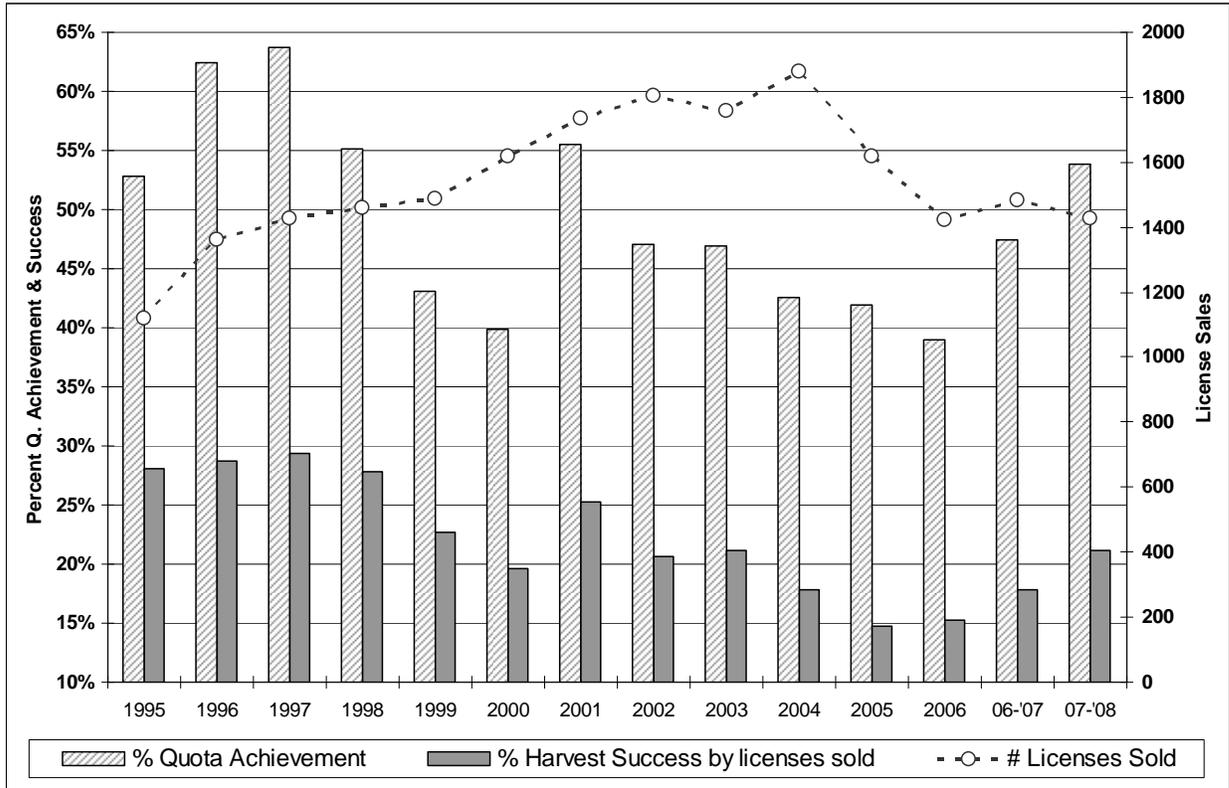
Lion harvest limit quotas increased from 1980 to 1999, leveled out until 2005 when a substantial reduction was enacted, and have been held at about 2005 levels since (Fig. 2). Hunter harvest gradually increased from 1980 to 1997, showed some variability in 1998 to 2004, and declined from the prior 5-year average during 2005 through 2007 (Fig. 2). The 2007 figures are projections based on preliminary harvest and non-harvest data. Variation in 1998-2004 harvest appeared mostly attributed to snow hunting conditions, local public and private land access issues. Reduced harvest levels in 2005-2007 are attributed mainly to efforts to reduce the take of females but are also aligned with the reduction to harvest limit quotas. See further discussion on this in the “New Efforts” section of this report. License sales are recorded as an indicator of hunter participation and hunter success is derived by dividing license sales into harvest (Fig. 3). The level of quota achievement has been used as a surrogate for hunter success on a localized basis



**Figure 1.** Colorado mountain lion Data Analysis Units (DAUs).



**Figure 2.** Colorado mountain lion harvest limit quota, harvest, total mortality 1980 – 2007/2008. Data for 2007/2008 is a projection based on preliminary information.



**Figure 3.** Colorado mountain lion license sales, success, quota achievement 1995 – 2007/2008. Data for 2007/2008 is a projection based on preliminary information.

when quotas have remained static or have only gradually been adjusted. The utility of this as a surrogate for hunter success, however, becomes suspect if there are significant or frequent changes to the quota.

The 2005 harvest limit quota reduction stemmed from analysis which occurred during revision of DAU plans in 2004. In some cases harvest limit quota reductions were intended to produce a slight reduction in lion harvest, but in most cases reductions were intended to have a negligible harvest affect but realign the harvest limit quota closer to the harvest objective. In most DAUs the harvest limit quota is somewhat higher than the harvest objective due to a DAU history in which the objective is rarely or never achieved. Yet in these DAUs, harvest limit quota represents the upper limit on harvest that managers believe could be endured for a one or two year period. The caveat being that if mortality did not drop to within harvest and mortality objectives in a two year period, then harvest limit quota reductions would be the likely response.

### **New Efforts Since 2005**

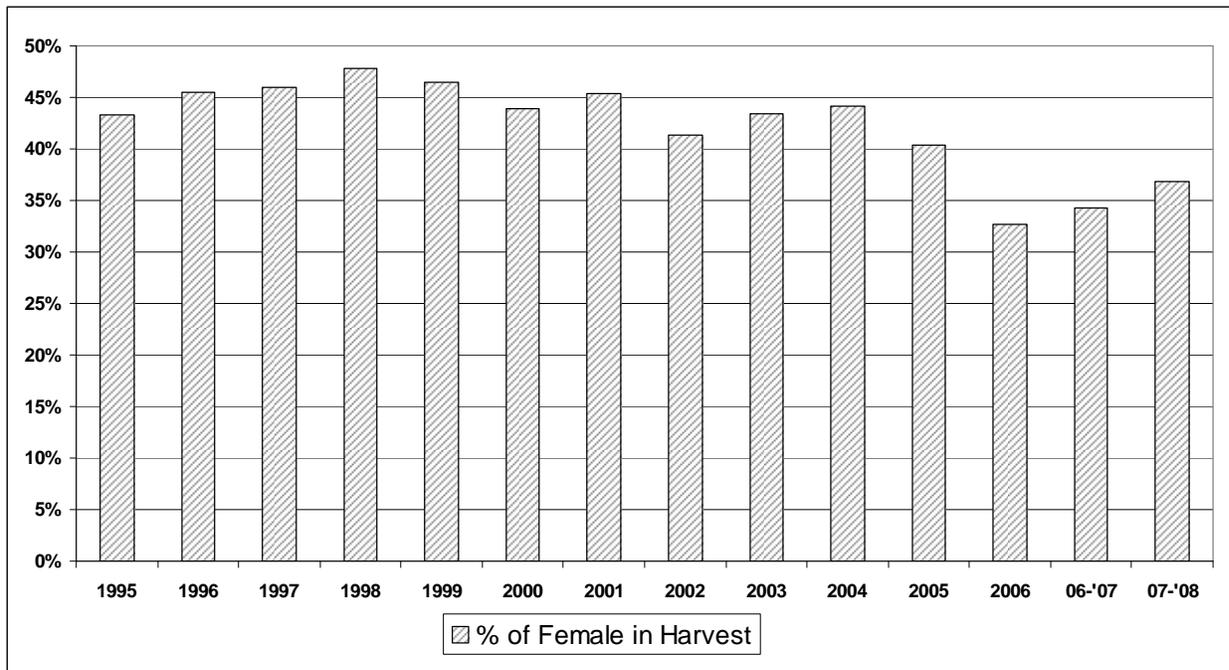
Since the Colorado status report provided at the May 2005, 8<sup>th</sup> Mountain Lion Workshop an update on new or ongoing initiatives includes: voluntary efforts to reduce female component in hunter harvest, Uncompahgre research project will enter a new phase, human-lion interaction research, mountain lion genotype testing, and telomere aging applications research. Following is a brief discussion of each of these efforts.

**Female Harvest Component:** During the summer of 2005, CDOW and the United Houndsmen of Colorado conducted and co-sponsored a series of workshops across the State. These workshops provided information about the biology and life history of mountain lion as well as the importance of females. Our effort was intended to spread the word within the lion hunting community about our request for hunters to voluntarily refrain from the take of females in most DAUs in Colorado. This was followed up with information published in our hunting brochure along the same line, but more specifically identifying the DAUs in which the reduction in female harvest was aimed.

Consequently, there was a slight drop in the proportion of females in hunter harvest from about 44% on average during the prior 5 years to about 40% in 2005 (note that the information and request came during the summer break in 2005 lion hunting season). There was a more significant decline in the 2006 and 2006/2007 lion seasons to about 34% female component of hunter harvest (Fig. 4). For 2007/2008 lion seasons, at the direction of our Wildlife Commission, CDOW implemented a mandatory mountain lion hunter education requirement. The course provides training information to hunters about mountain lion ecology and hunters must pass an exam demonstrating ability to identify lion gender characteristics.

During 2005 through 2007/2008 seasons hunter harvest declined, apparently as an unintended consequence of hunter efforts to reduce female harvest (Fig 2). Hunters that passed on taking a female lion likely did not have a subsequent opportunity to kill a lion during the time they had available for hunting. Therefore, preceding the 2007/2008 seasons CDOW communicated to lion hunters a change in criteria for selecting the DAUs

in which we request voluntary reduction in the take of females. As a consequence of this change we anticipated a slight increase hunter harvest and in the female component of harvest in 2007/2008. Based on preliminary information we project that the female component of hunter harvest during the 2007/2008 hunting season will rise to about 37% (Fig. 4).

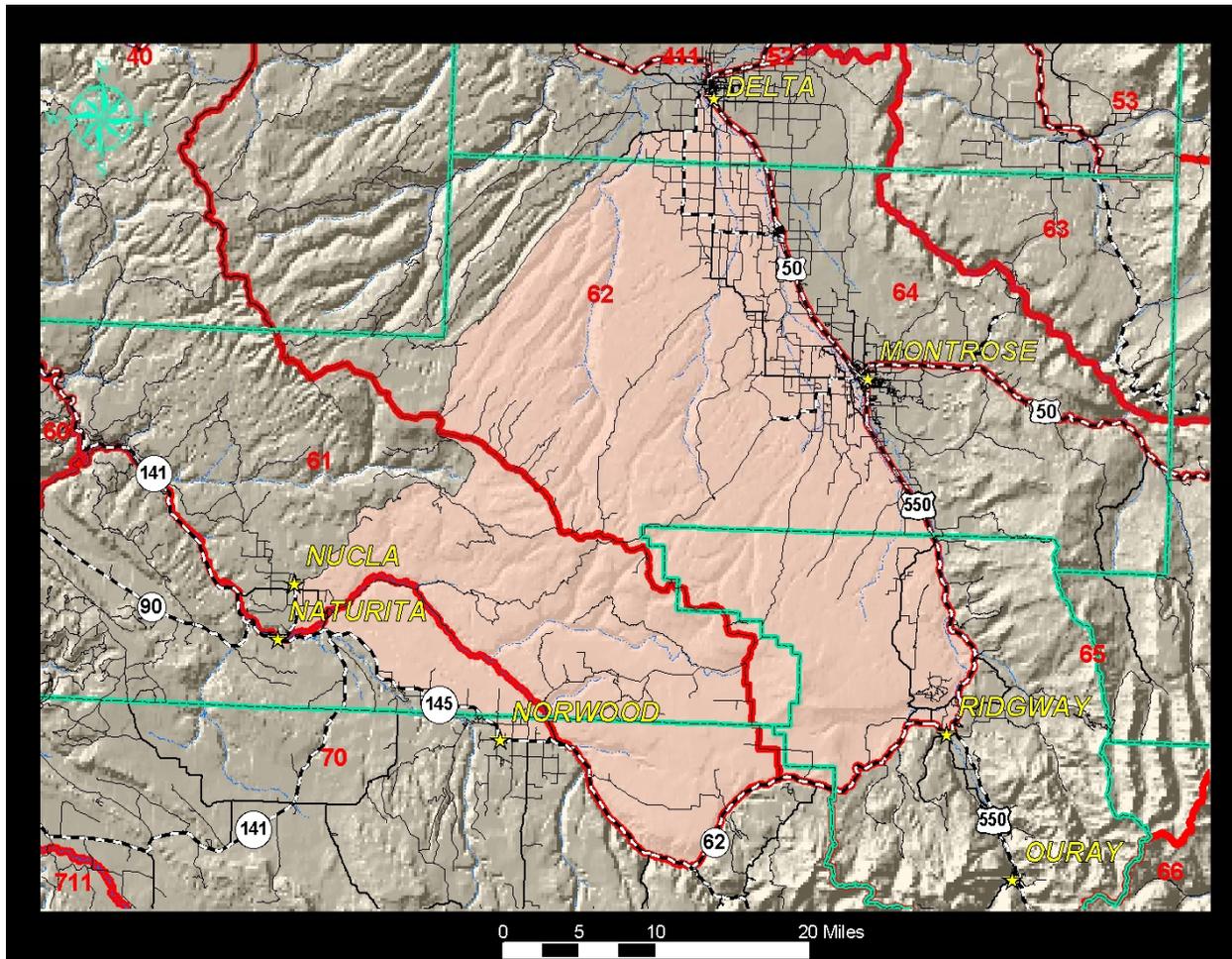


**Figure 4.** Percentage of females in hunter harvest 1995 – 2007/2008. Data for 2007/2008 is a projection based on preliminary information.

The management criteria we currently use for determining which DAUs will be highlighted for reduction in female take by hunters is: the 5-year average females in hunter harvest is > 35% of the DAU harvest objective; or the 5-year average females in total mortality is > 40% of the total mortality objective; and applies only in DAUs managed toward a stable or increasing mountain lion population.

Uncompahgre Plateau Research: An 870 mi<sup>2</sup> area on the southern end of the Uncompahgre Plateau in southwest Colorado was selected for a long-term research project (Fig. 5). The basic research design is an experimental manipulation of the lion population in two 5-year phases. Desired outcomes from this research include: estimation of population parameters and changes during a reference phase (no hunting to influence population dynamics) and a treatment phase (hunting manipulation of the population); identification of habitat preferences and linkages; lion-prey relationships; and testing current CDOW lion management assumptions. Plans are underway to develop and test methods to estimate lion abundance primarily using mark-recapture. Indices to lion abundance under consideration include change in harvest sex and age structure and aerial track surveys. This research is entering the fourth year and capture efforts to date have maintained about 20 adult lions/year marked with GPS collars. In the

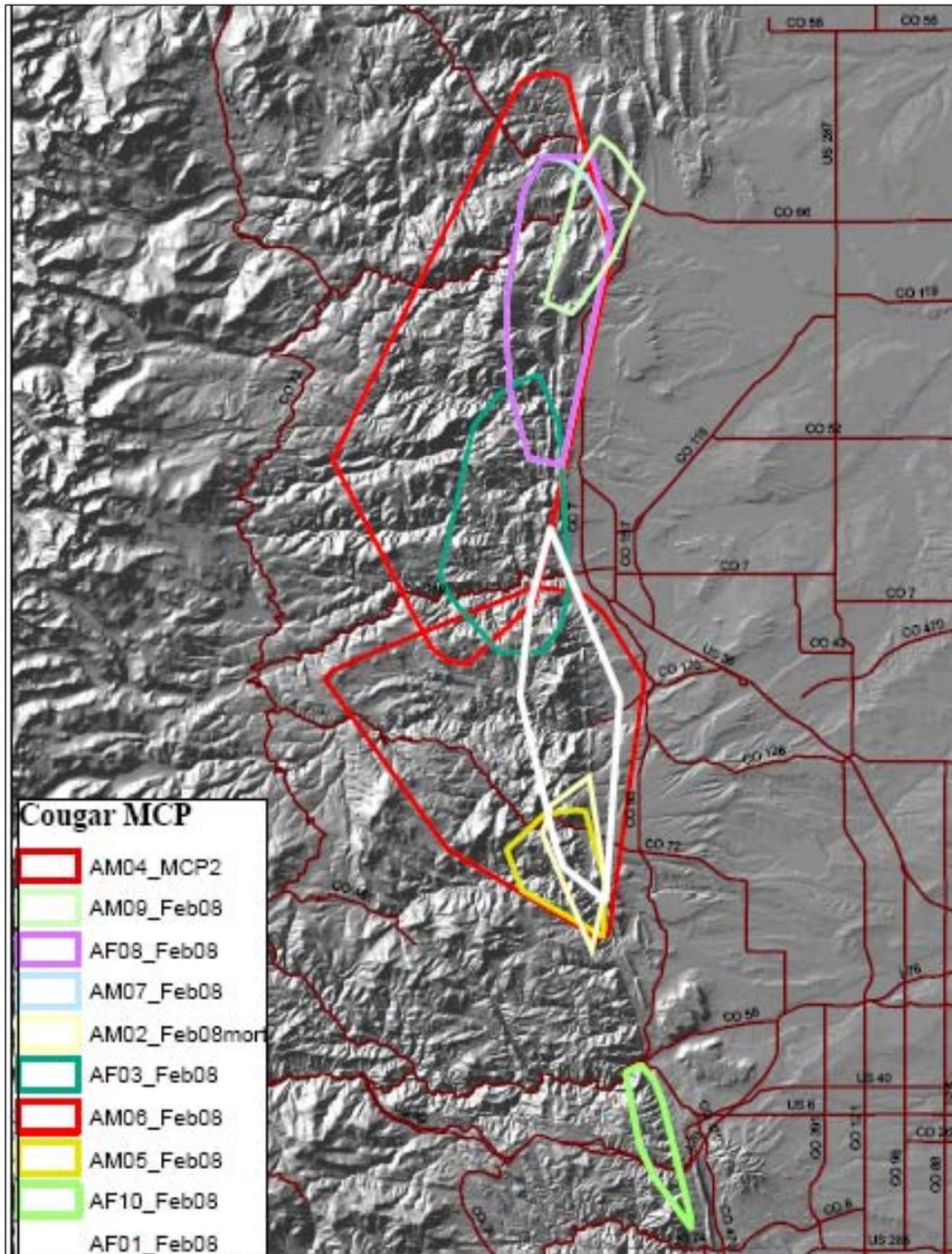
fall/winter of 2009 the treatment phase of the research will begin. Specific research protocols are being assessed, but manipulation of the lion population will primarily be accomplished using hunter harvest managed with harvest limit quotas to limit total and female off-take.



**Figure 5.** Location of the Uncompahgre Plateau mountain lion research project.

Front Range Research: Research began in 2007 with pilot efforts to test capture techniques and to develop aversive conditioning protocols in the urban-wildland interface. Currently 13 mountain lions are collared and monitored. Desired research outcomes include demographics on a lion population in a human altered environment, predator-prey relationships, testing aversive conditioning and relocation success (survival, return to capture locations, and recidivism), and testing similar population estimation and indices techniques as the Uncompahgre research. The study area is located in the western foothills of the greater Denver metropolitan area. Mountain lions have been caught and collared west of Boulder, Lyons, and Golden, Colorado (Fig. 6).

Figure 6 is preliminary information not analyzed in detail or validated but is intended to display the general location of the study effort.



**Figure 6.** Preliminary minimum convex polygon home area of mountain lions captured in 2007, Boulder and Jefferson counties, Colorado (MCPs are unvalidated). Some individuals have died after these were plotted.

Genotyping Tests: We are genotyping individual lions from teeth collected from harvested lions to examine population structure and are examining degradation rates of DNA from fecal samples to determine the efficacy of feces as a non-invasive method of population estimation. We are using samples taken from known individuals and related siblings from captive animals. Epithelial cells from fecal samples are exposed to environmental conditions and submitted for analysis in various states of degradation. The desired outcome of this effort is to test the reliability of DNA genotyping from a controlled setting in comparison to field settings.

Telomere Aging: We are testing the applicability of deriving lion population age structure from telomeres. Telomeres are short tandem repeated sequences of DNA found at the end of eukaryotic chromosomes that stabilize the ends of chromosomes. Telomeres shorten in length as the age of an individual increases. There is an apparent high degree of variation in the rate of shortening within species. Thus, telomere length may not be useful for aging an individual precisely, but with enough samples may provide utility for representing the age structure of a population, and also gender specific age structure within the population. The relative change in the slope of best fit regression lines of population age structure and the gender specific age structure may provide insights about changes to the population.

Our initial effort uses samples from known age individuals and samples from individuals for which age has been estimated from cementum annuli. DNA samples from these individuals will be analyzed for telomere length and similarity or divergence of age structure regression will be compared. We are also testing sample quality and amounts to determine if field collection techniques are adequate or need to be modified.

For background information, see: Nakagawa, S., N.J. Gemmel, and T. Burke. 2004. Measuring vertebrate telomeres: applications and limitations. *Molecular Biology*. 13: 2523-2533.

### **Future Mountain Lion Management Challenges**

In an unscientific poll; a handful of wildlife managers, some representatives of hunting organizations and a species advocacy group were asked to identify the top challenges facing lion management in the future. The two top challenges are: 1) Managing lions and public response management at the urban-wildland interface, and 2) Balancing divergent perspectives about lion management.

Lion Management at the Urban-Wildland Interface: This was the most commonly identified management challenge, but perspectives differed on why it was the greatest challenge. Three central aspects of concern were expressed: managing human social responses to conflicts, managing lion populations, and conserving/maintaining habitat and connectivity.

***Human social response aspects:*** As human populations grow and natural habitats are altered, concerns were expressed about the potential for increasing attacks on

humans, predation on pets, hobby stock, and predation on natural prey (mule deer) in/near residential areas. Concerns about the foregoing are mainly focused on dealing with human responses and reactions, including social and political reactions. The development of rational human-lion response protocols was considered highly important and that response protocols should have broad public/political support and informed consent.

***Lion population management aspects:*** In human altered environments hunting lions using traditional hunting methods is difficult, since land is broken into numerous small parcels with different owners; all of whom may have different acceptance or tolerance of hunting. Some suggest that hunting lions with hounds reinforces a level of avoidance of humans. Others suggest that hunting disrupts stability in lion populations and leads to a younger population structure; which can lead to greater human-lion conflicts, asserting that younger animals have a greater propensity for conflicts with people. Research data is limited and arguments tend to be based more on personal values than by fact. So a challenge facing managers in the future: should lion hunting (either by traditional methods or different methods) in the urban-wildland interface be encouraged?

***Habitat conservation and connectivity aspects:*** Wildlife management agencies have few tools to influence the expansion of human development and conserve natural landscapes, leading to loss of natural lion habitat. Conversely, natural areas in the urban-wildland interface and human residential landscapes often promote abundance of native and alternative prey species which, in some places can support lion populations. Lion populations in these areas might exist at higher densities than those found in other studied populations, considering densities of deer and elk in/near towns and an abundance of alternative prey species including dogs, cats, raccoons, hobby stock, etc. From a habitat connectivity perspective, examples of lion population isolation can be found in some parts of California. Protection of corridors for population connectivity is probably more cost effective now than it will be in the future. So some future challenges: Is Colorado headed toward a future in which lion populations will become significantly fragmented? If so, should connectivity corridors be identified and protected? Moreover, if we accept that some natural landscapes will remain in the urban-wildland interface and lions will likely exist in these landscapes, should mechanisms for managing mountain lions be built into conservation plans for these “natural areas”?

**Balancing Divergent Perspectives:** The public have diverse perspectives about lions and their management, and those perspectives tend to be polarized. In a 2005 Colorado survey, respondents that reported strong to moderate support for or strong to moderate opposition to “continued regulated hunting of mountain lions” were nearly equally split 34% and 33% respectively. When the question was posed in another way, “should mountain lion hunting be banned”, most respondents either strongly agreed (20%) or strongly disagreed (25%), or were not sure (19%). However, there were also many areas of considerable agreement about aesthetic, ecological, and existence values across widely divergent demographic strata. Based on our experience in Colorado:

Mountain lion hunters and hunting interest groups are concerned that environmental and species advocacy interest groups will increase efforts opposing or restricting mountain lion hunting. Hunting interests have a strong desire to improve lion management efforts, but are also concerned about losing a desired form of hunting recreation. This concern is magnified because of the history of some wildlife related ballot initiatives. They have expressed concerns that when CDOW consults with and represents other constituency perspectives that these actions may indicate a dilution of or ignorance toward their concerns and can cause them to question the legitimacy of management decisions.

Species advocacy groups are concerned that they have limited opportunity to influence wildlife management decisions. They tend to view decision making processes as strongly influenced by hunting interests and that the Wildlife Commission is structured to favor these interests. A survey following a past ballot initiative indicated that they felt largely disenfranchised from decision making processes and thus had little recourse but to seek ballot mechanisms to achieve a desired outcome. However, when they feel decision processes have adequately considered their concerns, the outcome holds more legitimacy, even if not fully supported.

So a future challenge is how to incorporate divergent perspectives in a meaningful way and maintain legitimacy of wildlife management decisions.