Bienn. Symp. North. Wild Sheep
and Goat Counc. 9:139-143.

MOUNTAIN GOATS ON MOUNT EVANS, COLORADO - CONFLICTS AND THE IMPORTANCE OF ACCURATE POPULATION ESTIMATES

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Abstract: Translocation of mountain goats (*Oreamnos americanus*) to Mount Evans Colorado has led to perplexing management challenges. From 15 animals released in 1961, the population increased to at least 168 by 1983. Concern regarding interspecific competition between mountain goats and mountain sheep (*Ovis canadensis canadensis*) was addressed by a research project conducted from 1980 to 1986. Coordinated multi-route ground counts have been conducted since 1978. Discovery of an error in estimating the minimum population after the 1991 harvest and a subsequent effort by members of the public to eliminate hunting of mountain goats, led the Wildlife Commission to reduce the number of permits from 44 to 8 in 1992. A resolution proclaiming the Rocky Mountain goat native to Colorado was passed by the Wildlife Commission. A mountain goat population goal of 100 was set tentatively for providing watchable wildlife, hunting, and for keeping mountain goats at a population level which would reduce the possibility of competition and disease transmission with bighorn sheep.

Mountain goats were not known to occur in Colorado when the Game, Fish and Parks Department began releasing them in 1948. Fifteen goats were released in the Mount Evans area of central Colorado in 1961, with the population increasing to at least 168 by 1983. Concern about interspecific competition between mountain goats and mountain sheep (Hobbs et al. 1990) was addressed by a research project conducted from 1980 to 1986. Upon project completion, hunting permits for mountain goats were increased from 15 (1982-86) to 20 (1987), 22 (1988), 30 (1989), and 44 (1990-92). Discovery of an error in determining the minimum population of mountain goats (140 vs 88 in 1991, calculated by eliminating duplicate sightings from a total ground count) led to reduction of 1992 hunting permits from 44 to 8, and to 3 hunting permits for 1993 and 1994.

A simultaneous and ongoing effort by members of the public to stop mountain goat hunting on Mount Evans highlighted the conflict between hunters and recreationists, and the need for better knowledge of user needs and attitudes. The Colorado Division of Wildlife contracted the Human Dimensions in Natural Resources Unit at Colorado State University to cinduct a survey of public attitudes in summer and fall, 1993. Results provided managers with a better understanding of the sociological factors considered in determining wildlife objectives.

In 1993, the International Order of Rocky Mountain Goats proposed that mountain goats be declared a "native" species in Colorado. The Colorado Wildlife Commission passed this resolution on 11 March 1993 (Colorado Division of Wildlife, 1993).

This paper provides a case study of the events on Mount Evans, showing how critical census accuracy can be. Errors can become the focus of public conflict about wildlife management and misinterpretation of agency management objectives. Numerous people participated in the Mount Evans counts over the years including personnel from the U.S. Forest Service and Colorado Division of Wildlife, and members of the Rocky Mountain Bighorn Society. R. A. Larson, D. J. Todd, R. B. Gill, K. A. Green, G. Hain, R. D. Hernbrode, R. R. Oehlkers, S. M. Werner, J. J. Vaske, and K. A. Wittmann were members of the Mount Evans wildlife-associated recreation analysis team. J. L. George analyzed and re-analyzed count data and reviewed the manuscript.

BACKGROUND AND STATUS

Population Estimation and Harvest

Ground counts of mountain goats and mountain sheep were used to estimate populations in the Mount Evans area, about 100 km^2 of mountainous

terrain east of Guanella Pass. Coordinated multi-route ground counts were initiated in 1978, and have been conducted annually since, yielding 16 years of population estimates. Annually, 25-35 people were divided into 12-15 teams covering 12-15 routes in one day. The counts were made during late July, starting at first light. The methodology involved counting and classifying groups of animals, noting their location on maps and recording the time of observation. Afterward, count data were summarized and probable duplicate sightings were eliminated to produce a minimum population size.

Mountain goat and bighorn sheep population minima ranged from 44-168 and 60-210, respectively, during 1978-1993 (Fig. 1). The mountain goat population may have been relatively stable (1981-1989) with a harvest of 10.8 percent (i.e. mean harvest = 14.9 ±0.9 SE animals and mean minimum population = 137.1 ±6.6 SE). The bighorn sheep population may have been stable only during 1981-1984 (mean ram harvest = 3.6 ±0.8 SE, mean minimum population = 120.3 ±12.9 SE). Mountain goat harvest objectives were increased in 1989 to bring the goat population closer to 100. Harvest was 28 in 1989, 41 in 1990, 44 in 1991, 7 in 1992, and 3 in 1993. A decreased harvest quota in 1992 and 1993 was set following a July 1992 count of only 68 goats and evidence of a miscalculation in 1991 (88 vs 140, resulting from failure to exclude all duplicate sightings). In subsequent counts, data were rechecked to prevent recurrence of such errors.

Upon Division request, the Wildlife Commission took emergency action and reduced the 44 licenses issued for 1992 to 8. A new drawing was held for the 8 licenses. The remaining 36 license holders were offered a license in another goat unit, first priority for Mount Evans in 1993 if licenses were issued, a license in 1993 with one unit to be offered, or given a refund.

Hunter - Recreationists Conflicts

Two conflicts between hunters and other recreationists resulted in a public outcry and media coverage in the Denver newspapers. The first occurred on 9 September 1984 when a licensed hunter took a mountain goat above Summit Lake and brought the animal through the parking lot on a busy Sunday afternoon. The second incident occurred on 26 August 1990 when a licensed hunter shot a sheep in full view of a number of other visitors. The sheep was shot too close to the Mount Evans Highway to be in regulatory compliance and the hunter was prosecuted.

Regardless of the legality of hunters' actions, the public questions the compatibility of hunting in an area of high general recreational use. Temporal separation of users was implemented in 1985, 1986, and 1987. The goat season was moved from September to October when the road was closed to vehicles because of potentially dangerous driving conditions. However, in 1985 and 1986, early winter storms during the first week of October made hunting conditions and access difficult. The season was then returned to September-early October but split into two periods, with weekday openings. In addition, letters were sent to all hunters asking their assistance in preventing conflict in this area of extreme sensitivity. In 1990 and 1991, there were four 5-day seasons with no weekend hunting. In 1994, the area within a half-mile of the highway was closed to hunting.

Based on the surveys conducted in 1993, about 75 percent of the people who visited Mount Evans had no conflicts with other users. Conflict resulting from individual visitor behavior interfering with other visitors was rare, and was primarily related to viewing and wildlife feeding.

Population Objectives

The intent of increasing the number of permits during 1989-1991 was to reduce goat numbers. We believe that failure to crop the mountain goat population results in increased interspecific competition and transmission of Johne's disease (*Mycobacterium paratuberculosis*). Opposing the effort to reduce goats was a group that espoused making the Mount Evans area into a "preserve" and terminating hunting. These citizens favored a mountain goat population that was disposed primarily to "watchable wildlife." In an effort to balance these opposing objectives, a minimum population objective of 100 (based on ground count minima) was established.

DISCUSSION

Minimum Viable Population

Small populations may not maintain genetic variability or persist over time. They are subject to stochastic extirpation events or slow extinction due to accumulation of deleterious alleles through inbreeding (Lacava and Hughes 1984, Reed et al. 1986). Thomas (1990) suggested, based on empirical evidence, that 10 is far too small (genetic

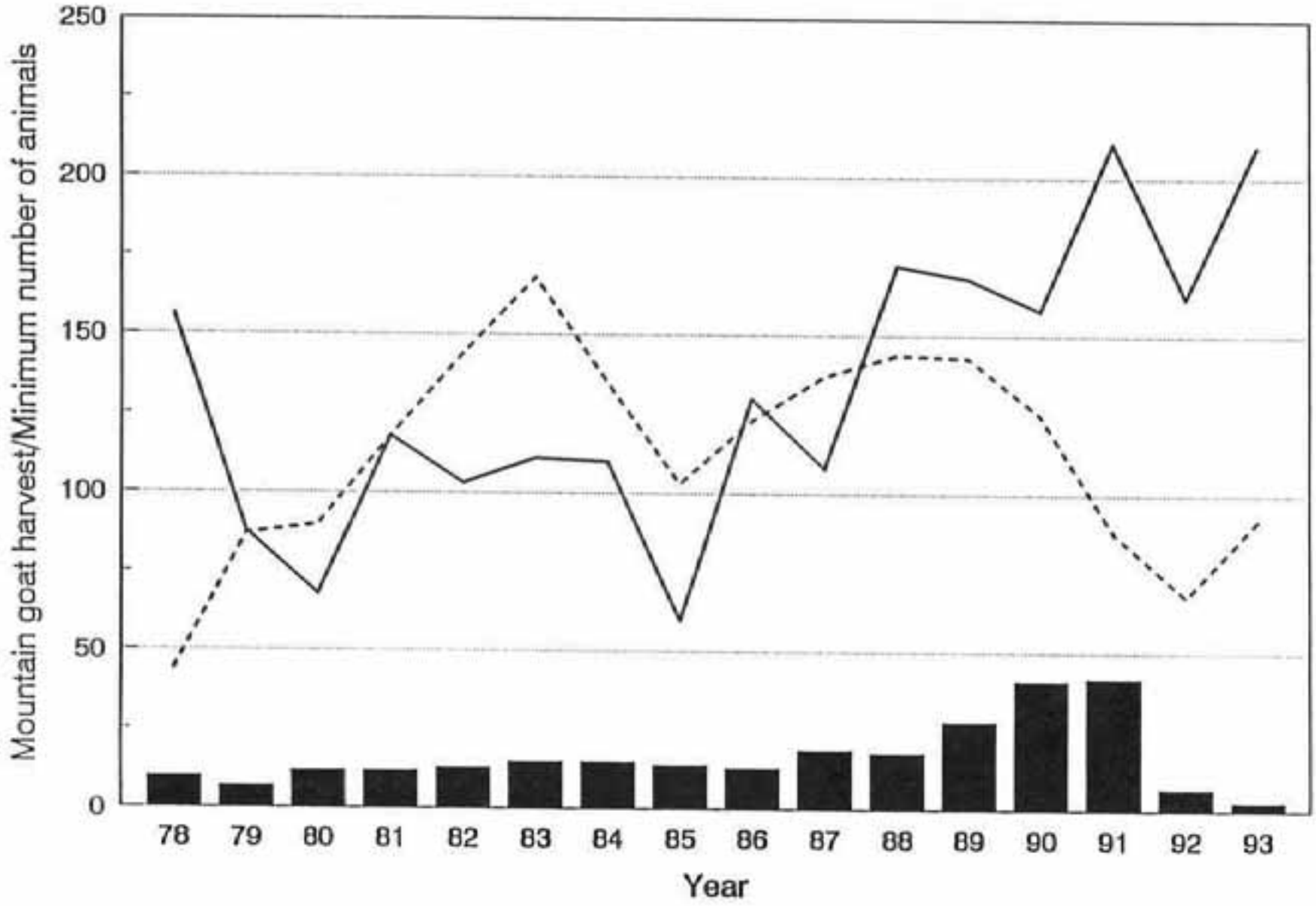

Fig. 1. Minimum number of mountain goats (dashed line) and bighorn sheep (solid line) based on annual ground counts, and number of mountain goats harvested (solid bar), 1978-1993.

variability will be lost rapidly and extinction will likely be swift) and that 100 usually is inadequate. For example, a simulated grizzly bear (*Ursus arctos*) population of 50 has a 0.06 probability of remaining extant for 300 years with an expected time to extinction of 114 yrs (Shaffer 1978, Shaffer and Samson 1985). An effective breeding population of 50 may be sufficient to avoid loss of variability, but a larger population may be required to neutralize the effects of genetic drift (Franklin 1980).

Berger (1990) found that all sheep populations of fewer than 50 animals went extinct within 50 years and that populations with more than 100 persisted for 70 or more years. He concluded that herd objectives should be >100. It has been suggested that a "best estimate" minimum viable population (MVP) for mountain sheep is 125 (Smith et al. 1991). Presuming that mountain goats fit a similar paradigm and that the population may not be isolated (about 200 mountain goats occupy Grays-Torreys Peaks, 11 km northwest of Mount Evans), a herd objective of 100 for Mount Evans may be an acceptable MVP.

Population Estimate Accuracy

Most counts of large wild ungulates approximate two-thirds of the real population (Neal et al. 1993). To what extent variables diminish the accuracy of the ground counts for Mount Evans is unknown. In an attempt to describe the variability, three ground counts (using methods described) were conducted in 1987 (D. F. Reed, pers. obs.). Unfortunately with a small sample size (n =3; i.e., 11 Jul = 132, 25 Jul = 137, and 30 Jul = 113), the standard error was large and 95 percent confidence limits were wide (mean = 127 ±7.3 SE, 95% CI = 96-159). Furthermore, this only described the population minima. How many were missed when the 137 were counted? This is unknown. Similarly, it is unknown for the other 15 years of population minima (Fig. 1). Hence, an independent test of ground count methodology is needed.

Probably the most practical method to independently test the ground count method would be a mark-resight study involving a prescribed number of "telemetry marks" and "helicopter counts." Assumptions involving mark-resight methodology were tested for mountain sheep and a computer program (NOREMARK) developed (Neal et al. 1993; G. C. White, per. comm.). Applying the design feature of NOREMARK to an estimated mountain goat population of 100 and 5 resighting occasions (helicopter counts), the following confidence intervals (CI) were generated:

if number of animals with telemetry marks = 40
then, CI = ±13.7% or ±13.7 animals,

if number of animals with telemetry marks = 50
then, CI = ±10.6% or ±10.6 animals.

To manage for a population of 100 mountain goats, the latter probably represents the CI needed.

MANAGEMENT LIMITATIONS

The "Wilderness" designation (U.S. Forest Service) of the Mount Evans area (excluding the highway and Summit Lake) may constrain approaches to test the ground count methodology. The "mark-resight" method assumes that all animals have an equal chance of capture (and being marked). Capture via helicopter rather than trapping in randomly selected sites may be a reasonable way to accomplish equal accessibility. Secondly, if ground counts were substituted for the 5 helicopter resighting occasions, this would entail organizing and training up to 150 people -- a labor intensive effort. An exemption for helicopter operation in the wilderness is unlikely, hence, the "mark-resight" test will likely not go forward.

Contraceptives may provide future options for controlling wildlife populations. New technologies to regulate the reproductive rates of wild animals may be operational by the end of the 1990s (D. L. Baker, pers. comm.). However, in most wildlife management situations, the promise of controlling the growth of populations with contraceptive technologies may be more symbolic than real. Computer simulations that compare the efficacy of hunting versus contraception to control wildlife populations suggest that fertility control will be feasible only with small populations of large animals (N. T. Hobbs, pers. comm.). On this basis, fertility control of mountain goats on Mount Evans may prove useful. Fertility control technology is so new that we are unable to forecast either its effectiveness or its costs. Furthermore, we have not engaged our publics in debate over the ethical and policy issues that will constrain the use of fertility controls. In any case, public hunting is economically superior to other population control options.

Results of the surveys suggest that conflict over wildlife management policy, is rooted in the

fundamental differences in values that characterize contemporary American society (whether or how people ought to use and enjoy wildlife). It is unlikely that such value conflicts can be managed. However, management strategies, like spatial and/or temporal zoning of uses, can reduce conflicts between people whose values are similar, even if they engage in different forms of wildlife-associated recreation. More specifically, 8 alternative management scenarios were suggested by the public for the Mount Evans corridor (Colorado Division of Wildlife, 1994). Some scenarios do not meet current Division mandates and are incompatible with the U.S. Forest Service mandates. Ultimately the wildlife commission will determine the scenario by which Mount Evans wildlife will be managed.

CONCLUSION

An error in census, although discovered and corrected before negative impact occurred, caused a serious credibility problem for wildlife managers. Opponents of hunting used this error to capitalize on media coverage and public sentiment to further question the Division's ability to manage the outcome for the public trust. Current census methodology has been reviewed. Comparative tests of methodology should be conducted so that census accuracy is ensured.

The wildlife management and wildlife recreation activities which occur in the Mount Evans area must meet the needs of a large and diverse public possessing different and sometimes opposing values. If conflicts are not managed, widespread public support for diverse recreational activities will be jeopardized. This could have long lasting wildlife management consequences.

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