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Mountain Sheep in California: Perspectives on the Past, and Prospects for the Future

VERNON C. BLEICH,^{1,2} Sierra Nevada Bighorn Sheep Recovery Program, California Department of Fish and Game, 407 W. Line Street, Bishop, CA 93514, USA

Abstract: The status of mountain sheep (*Ovis canadensis*) in California is reviewed from historical, taxonomic, and political perspectives. Early conservation efforts were primarily passive, resulting in a largely unsuccessful strategy that continued well into the 20th century. In the late 1960s, the California Department of Fish and Game (CDFG) initiated formal surveys to ascertain the status of this species. As a result, recommendations were put forth regarding conservation actions believed to benefit mountain sheep. Since then, management has been proactive rather than passive, and has centered on habitat protection, habitat enhancement, and population restoration, but those efforts have been confounded by legislation and conflicting public opinion. Today, not all activities deemed appropriate for conservation purposes are well received by some members of the public, and disagreements arise frequently between conservation activities and individuals who are philosophically opposed to active intervention on behalf of mountain sheep. Unfortunately, actions of managers can be detrimental to landscape-level efforts to conserve this species if they are carried out in the absence of public support. For conservation to be successful, wildlife managers and land managers should not invoke strategies that are illogical, or appear to be founded on “beliefs” rather than on science. Future conservation successes are in the hands of those charged with that task. Bad decisions and inappropriate justifications will be detrimental to conservation activities in the future, particularly as they relate to recommendations that are perceived by the affected public to be unnecessary or otherwise without merit.

Key words: bighorn sheep, conservation, history, management, mountain sheep, *Ovis canadensis*

BIENN. SYMP. NORTH. WILD SHEEP AND GOAT COUNCIL. 15: 1-13

¹ E-mail: vbleich@dfg.ca.gov

² Present address: Department of Biological Sciences, Idaho State University, Pocatello, ID 83209, USA

Mountain sheep (*Ovis canadensis*) are endemic to North America, and occupy suitable habitat from the northern Rocky Mountains in western Canada, southward through the western United States, to northern Mexico (Trefethen 1975). In California, mountain sheep are found in the Mojave, Sonoran, and Great Basin deserts, in the transverse ranges of southern California, and in the Sierra Nevada (Weaver 1975). The number of mountain sheep in California currently is

about 4,500 individuals, but precise statewide estimates are unavailable (Epps et al. 2003).

Previously, mountain sheep were more numerous in California (Buechner 1960). Based on the current distribution of mountain sheep, and the large number of extirpated populations (Wehausen et al. 1987a), a reasonable estimate may be 10,000 individuals at the end of the 18th century. To the best of our knowledge, those animals were distributed among approximately 100 populations, the majority in southeastern California (Wehausen et al. 1987a). Currently, some 63 extant populations occur in California (Epps et al. 2003). Because some mountain ranges contain multiple populations as defined by the distinct distributions of female groups, there are more populations than there are mountain ranges supporting this species (Wehausen et al. 1987a). Populations of mountain sheep in California have been grouped into 7 metapopulations for purposes of management and conservation planning (Torres et al. 1994, 1996; Epps et al. 2003). Those metapopulations occur in the Sierra Nevada, San Gabriel Mountains, and mountain ranges in the Mojave, Sonoran, and Great Basin deserts (Bleich et al. 1996b).

Throughout much of the range occupied by these native ungulates, the downward trend in numbers began with the human settlement of vast, uninhabited areas (Buechner 1960). Much attention has been given to the potential impacts of unregulated market hunting associated with the influx of gold mining during the 1850s (Buechner 1960). Another, more onerous, decimating factor likely was the introduction of livestock, primarily domestic sheep, throughout much of the

range of mountain sheep (Buechner 1960). Indeed, Francisco Garces, who chronicled the expeditions of Father Anza as he traveled north and west from what is now Arizona toward the Pacific coast of California, described dead and dying mountain sheep in the Santa Rosa Mountains of southern California as early as 1776 (Bolton 1930). Moreover, a legend that describes a pestilence killing many wild sheep in northern Mexico following the arrival of the Spaniards and their livestock persists among the Kaliwa Indians of Baja California (Tinker 1978).

Following discovery of gold in California, a number of populations of mountain sheep were extirpated, but the causes of those losses remain speculative. Despite that uncertainty, the obvious losses of mountain sheep and other wildlife populations resulted in the initiation of legal protection for mountain sheep and other big game species. In 1872, the California Legislature passed a law protecting elk, pronghorn, and deer for 8 months of the year. In 1878, the Legislature amended the Act to establish a four-year moratorium on the taking of any elk, pronghorn, female deer, or mountain sheep. In 1883, the moratorium on the taking of mountain sheep was extended indefinitely, and in 1933 mountain sheep became the first species in California to receive "full protection" by the California Legislature (CDFG 2005). Despite the well-intentioned efforts of the California Legislature, however, total protection did not halt the loss of mountain sheep in California.

Populations continued to disappear up to the present (Epps et al. 2003). At least 45 populations disappeared in California since 1850 (Wehausen et al. 1987a); 50% of them since 1920. About 30% of the

populations in 1920 no longer exist. These figures suggest that the rate of population loss declined little, if any, despite effective wildlife law enforcement since about 1920 (Wehausen et al. 1987a).

Persistent losses suggested that legislative protection did not affect factors primarily responsible for the extirpation of mountain sheep in California. Indeed, assumptions inherent in the concept of total protection likely revolved around the notions that (1) over-hunting was a cause of extirpations, and (2) that protected populations would increase in size and expand into unoccupied habitat. Both of these assumptions were faulty (Wehausen et al. 1987a): the first failed to consider the potential role of diseases and habitat destruction, and the second was erroneous, because mountain sheep are notoriously slow to disperse from occupied ranges (Geist 1971). Nonetheless, conservation actions continued to focus on total protection and, with minor exceptions, these specialized ungulates retain "fully protected" status.

Nomenclature

Until recently, taxonomists recognized three subspecies of mountain sheep in the state, including *O. c. californiana* (which was thought to occur throughout the Sierra Nevada and historically in northeastern California), *O. c. nelsoni* (which occurs throughout the majority of the Mojave and Sonoran deserts and in the transverse ranges of southwest California), and *O. c. cremnobates* (which occupied the peninsular ranges located primarily near the border with Mexico) (Cowan 1940). In a recent taxonomic revision (Wehausen and Ramey 2000), animals in the Sierra Nevada were designated *O. c. californiana* and are the only representative of that

taxon; at the same time, all other wild sheep formerly designated as *californiana* were synonymized with *O. c. canadensis*, and are now recognized as the Rocky Mountain subspecies. Mountain sheep in the peninsular ranges, formerly the subspecies *cremnobates*, were synonymized with *O. c. nelsoni*, and no longer are considered a distinct subspecies (Wehausen and Ramey 1993). To further complicate nomenclature, assignment by Wehausen and Ramey (2000) of sheep in the Sierra Nevada to the subspecies *californiana* was in error. Joseph Grinnell (1912) assigned the subspecific epithet *sierrae* to animals he described from the Sierra Nevada before Cowan (1940) published his revision of the taxonomy of North American mountain sheep. Because Wehausen and Ramey (2000) synonymized *californiana* with *canadensis*, and because sheep in the Sierra Nevada warrant subspecific recognition, judicious application of the rule of priority as it appears in the International Code of Zoological Nomenclature dictates they are once again assigned to the subspecies *sierrae* (Wehausen et al. 2005).

Legal Status

There were a number of legislative attempts to change the status of mountain sheep to that of a game animal. One such attempt occurred in 1922, when Senate Bill 527 proposed an open season, with a \$100 license fee and tag system; the legislation was unsuccessful. In 1979, Senate Bill 83 proposed that the Nelson subspecies be classified as a game animal, while maintaining threatened status for the other two subspecies then recognized, but the legislation also was defeated. In 1983, Assembly Bill 1548 proposed the same

changes as Senate Bill 83, but also emphasized the need for a statewide study of the status of populations, effects of competition and disease, and reintroduction needs in accordance with a study plan prepared earlier by the Department of Fish and Game; Assembly Bill 1548 also failed to gain approval. The Legislature did, however, allocate monies for the investigations called for in the failed legislation. Resulting research yielded important information related to capture methods (Kock et al. 1987*a, b, c*), status of diseases among mountain sheep populations (Clark et al. 1985, 1993), importance of nutrition and effects of cattle grazing on mountain sheep (Wehausen 1989), and long-term syntheses of behavioral (Bleich et al. 1997) and demographic phenomena (Wehausen 2005).

In 1986, the Legislature passed Assembly Bill (AB) 3117, which reclassified mountain sheep as game animals in two geographic areas but retained fully protected status for all other populations. In part, passage of AB 3117 occurred because both reclassified populations had provided large numbers of animals for translocation stock, circumventing arguments that limited sport hunting would jeopardize them (Wehausen et al. 1987*a*). The bill also provided that one sheep hunting tag could be made available for fund raising on an annual basis, and stipulated that the number of permits offered would not exceed 15% of the mature males counted annually in each population. Assembly Bill 3117 also contained a sunset clause, perhaps making it more palatable to legislators concerned about potential impacts of hunting on the targeted populations.

Subsequently, additional legislation

eliminated the sunset clause and provided the Fish and Game Commission the authority to consider additional hunting opportunities for mountain sheep, required the Department to prepare management plans necessary for the conservation of subpopulations, and authorized an additional fund-raising tag to be issued if a minimum number of permits was available to the general public on a drawing basis during any particular year. This action did not occur without protest; nonetheless, it is law in California, and mountain sheep inhabiting 6 geographic areas will be game animals during the legal hunting season in 2006. They will retain fully protected status for the remainder of the year.

Threatened or Endangered Status

During the early 1970s, the Legislature enacted the California Endangered Species Act, and two of the subspecies of mountain sheep then recognized were listed as “rare” by the California Fish and Game Commission (CDFG 2005). Indeed, *O. c. californiana* and *O. c. cremnobates* were limited in distribution and presumed to be distinct (Cowan 1940). As a result of State listing, recommendations were made for the development and implementation of recovery plans for each subspecies. Both of these listings subsequently were revised to threatened, and mountain sheep in the Sierra Nevada eventually were uplisted to endangered by the Fish and Game Commission (Epps et al. 2003).

Mountain sheep in the peninsular ranges, formerly recognized as *O. c. cremnobates*, were listed in 1998 as an endangered population segment by the U. S. Fish and Wildlife Service, and sheep in the Sierra Nevada similarly were listed by the federal government a year later (Epps

et al. 2003). With federal involvement, conservation of mountain sheep in California became more complicated. A recovery plan was completed for sheep in the peninsular ranges, and the recovery plan for sheep in the Sierra Nevada is underway (Epps et al. 2003); both plans are being implemented. In the case of sheep in the peninsular ranges, the U.S. Fish and Wildlife Service remained the lead agency for recovery, but no funding to implement recovery actions became available as a result of the listing process. Recovery efforts in that range are being implemented by a number of governmental and non-governmental organizations. A primary rationale for listing these animals as endangered was the threat of continued loss or modification of habitat (USFWS 2000). Disease(s) may have been a factor in the depression of recruitment rates beginning in the late 1970s (Wehausen et al. 1987*b*) and, as a result, could have contributed to a population decline prior to listing (USFWS 2000), but subsequent investigations (Boyce 1995) did not yield evidence that disease resulted in a demographic consequence. The most important source of mortality in the peninsular ranges was identified as predation (Hayes et al. 2000).

In the Sierra Nevada, the California Department of Fish and Game was asked by the U.S. Fish and Wildlife Service to serve as the lead agency with respect to recovery of mountain sheep (Bleich 2001). Substantial funding was made available by the California Legislature, and currently 6 employees work full time on the recovery effort. Nonetheless, funds could be reduced at any time due to the fiscal crisis currently facing California. Predation by mountain lions, and resultant affect on habitat use by mountain sheep (Wehausen

1996) are suggested as primary factors in the decline in the Sierra Nevada. Although viable, the hypothesis is not universally accepted as the single causative factor. Objectives of the recovery effort include minimizing mortality of mountain sheep and restoring sheep to historically occupied ranges (Sierra Nevada Bighorn Sheep Recovery Program [SNBS] 2004). Recently, the potential risk of domestic sheep to wild sheep again surfaced as an important issue, and controversy surrounding grazing privileges on public lands is increasingly apparent (SNBS Recovery Program 2006).

Management History

Until recently, management of mountain sheep in California centered largely around an active water development program in desert areas, ongoing since about 1950 (Weaver et al. 1959). Modern management and conservation efforts began in 1968, following passage of Senate Resolution 43, which resulted in the most detailed statewide survey of the species ever conducted. Until then, basic inventory data consisted of information gathered during cursory statewide surveys that occurred in 1940, 1946, and 1957 (Buechner 1960, Berger 1990, Wehausen 1999). Senate Resolution 43 provided funding to conduct the survey during 1968 through 1972. The population was estimated at 3,700 mountain sheep (Weaver 1975), and for the first time the management needs of mountain sheep, including land-use conflicts, habitat acquisition, water development needs, and translocations were addressed comprehensively (Weaver 1972).

The first effort to reestablish mountain sheep on historically occupied ranges in

California occurred in 1971 when 10 animals were captured in British Columbia and placed in an enclosure at Lava Beds National Monument, Siskiyou County (Blaisdell 1972). The population persisted until 1980, when a die-off wiped out the entire population (Weaver 1983), perhaps a result of diseases contracted from domestic sheep (Foreyt and Jessup 1982). Prior to the die-off, 4 sheep from Lava Beds were translocated to the Warner Mountains, Modoc County, in an effort to establish a population in extreme northeastern California (Sleznick 1980); those sheep were supplemented in 1980 with 10 from the Sierra Nevada (Camilleri and Thayer 1982). Mountain sheep seemingly did well in the Warner Mountains until 1988, when the entire population died as a result of disease thought to be associated with direct contact with domestic sheep grazed legally in the area (Weaver and Clark 1988).

In 1979, efforts to reestablish mountain sheep on historical ranges in the Sierra Nevada were initiated, and 102 individuals were translocated to 3 formerly occupied areas. Animals were moved from the Mount Baxter winter range at Sand Mountain to Wheeler Ridge (1979, 1980, 1982, 1986), Mount Langley (1980, 1982), and Lee Vining Canyon (1986, 1988) (Bleich et al. 1990*b*, 1996*a*). Additionally, more than 400 mountain sheep were translocated in efforts to establish populations in 9 vacant mountain ranges in the Mojave Desert, and in the transverse ranges of southwest California (Bleich et al. 1990*b*). Sources of animals were Old Dad Peak and the Marble Mountains, both of which figured prominently in the passage of AB 3117, and the San Gabriel Mountains, once recognized as the largest population of *O.*

c. nelsoni (Holl and Bleich 1983, Holl et al. 2004). There have been translocations to establish additional populations of wild sheep in California since 1992, although several populations were augmented.

Other Management Challenges

The majority of mountain sheep in California are not categorized as endangered, but conservation efforts were severely affected by recent federal legislation. In 1994, Congress passed the California Desert Protection Act (CDPA) that established more than 70 new wilderness areas in the Sonoran, Great Basin, and Mojave deserts of California, elevated the status of Death Valley National Monument and Joshua Tree National Monument to national parks and expanded their boundaries, and created a new National Park Service unit known as Mojave National Preserve. Proponents argued that the legislation was necessary to protect the desert from future threats, despite the intensive efforts of the Bureau of Land Management (Bleich 2005). Indeed, the California Desert Conservation Plan had established some wilderness areas, identified areas with emphasis on special uses, and provided for the aggressive and productive management of mountain sheep and their habitats (Bureau of Land Management [BLM] 1980). Moreover, BLM had been an important cooperator in the management of sheep habitat for many years.

The California Desert Protection Act resulted in many changes in conservation activities for mountain sheep, and how and where those efforts occur. The Act provided for the use of motorized equipment within the newly established wilderness areas for purposes of conservation activities on lands managed

by BLM, but individual opinions expressed by agency staff frequently complicated conservation efforts (Bleich 1999). A lack of consistency in interpretation of legislation and regulations was identified as an onerous aspect of wilderness management affecting conservation of mountain sheep (Bailey and Woolever 1982).

The CDPA did not specifically authorize construction or development of additional water sources in wilderness areas, but did indicate they may occur pending compliance with the National Environmental Policy Act. Nonetheless, there were no new developments since the CDPA, largely because of actions by wilderness advocacy groups and despite the existence of hundreds, if not thousands, of kilometers of roads, widespread evidence of historical mining activity, and many anthropogenic structures distributed among nearly all of the recently designated wilderness areas (Bleich 2005). Lawsuit after lawsuit has been filed to prevent the construction or development of any water source that would benefit mountain sheep conservation. As a result, conservation activities for mountain sheep in California declined dramatically both numerically and spatially.

The California Desert Protection Act stated plainly, "Nothing in this act shall be construed as usurping the responsibility of the state agency with respect to wildlife management decisions within the preserve." Remarkable progress has been made with respect to conservation issues between the state agency having responsibility for wildlife management decisions and the National Park Service. Nonetheless, the first translocation of mountain sheep from the Mojave National Preserve occurred > 8 years after passage

of the CDPA, and after > 3 years of negotiations. It is possible that resolution to the question of stewardship responsibilities for wildlife within the preserve will be fully resolved only through the legal system.

What the Future Holds

Mountain sheep in California benefited from a diverse and ambitious conservation program (Bleich and Torres 1994). Nonetheless, the future of mountain sheep conservation in California is uncertain, and conservation activities may become more and more difficult to implement. Indeed, recent legislation complicated working relationships among agencies that formerly worked cooperatively to conserve these magnificent ungulates (Bleich 2005). Further, designation of some 70 wilderness areas complicated efforts to manage these herbivores on a landscape level and facilitate the persistence of metapopulation processes (Bailey 1982). Failure to adequately protect areas outside designated wilderness has implications for the long-term persistence of mountain sheep in the metapopulation structure (Schwartz et al. 1986, Bleich et al. 1990a, 1996b, Krausman 1997, Epps 2005) in which they presumably exist. Indeed, development associated with roads, agriculture, and urbanization has major implications for recolonization of vacant habitat (Bleich et al. 1996b) and gene flow (Epps et al. 2005) and, ultimately, for the persistence of small populations that will become increasingly isolated as a result of human actions (Bleich 1999, 2005). Moreover, interagency competition and bureaucratic inertia resulted in failure of efforts to translocate mountain sheep to vacant habitat, cancellation of augmentations to

small populations seemingly faced with extinction, and even failure to manage exotic species, such as feral asses, that are problematic for native wildlife yet are deemed appropriate components of wilderness (Bleich 2005). I believe it incongruous that seemingly well-intentioned legislation actually precludes implementation of conservation actions designed to benefit large, native mammals eliminated from so many areas as a result of human actions.

Similarly, efforts to enhance the persistence of small populations of mountain sheep are questioned because they are deemed inappropriate activities within wilderness. The majority of those areas in the deserts of California include a single mountain range coincidentally occupied by a (sometimes tiny) population of mountain sheep, and those ranges are separated from other populations by many kilometers of desert flats subject to many anthropogenic modifications.

My concerns about the conservation of mountain sheep in the future are confounded further by issues beyond the control of individual management agencies. For example, Epps et al. (2004) used modeling to infer the probable extinction of additional populations of mountain sheep as a consequence of global warming. Consequences include decreased availability of water sources and changes in vegetation characteristics, both of which have important implications for the persistence of mountain sheep in arid environments. Indeed, other investigators suggest major changes in vegetation composition and structure at the landscape level (Bachelet et al. 2001, Root et al. 2003). Such changes cannot be good for mountain sheep, nor for other species (including our own) inhabiting this planet

called Earth.

Conservation actions on behalf of mountain sheep will, I believe, have important implications for the continuation of the Endangered Species Act (ESA) if they are unwise, economically damaging, or not based on credible science. Mountain sheep conservation efforts have the potential to affect real estate development worth billions of dollars, much of which is owned by politically well-connected individuals who have no desire to incur economic hardship on behalf of "some animal". As a result, implementation of recovery efforts and recommendations for habitat protection should be well founded and cooperative. In my opinion, anything less could jeopardize the ESA as currently written. The effects of mountain sheep conservation on economic development, and vice-versa, will be increasingly important in the future.

Current proposals to modify livestock grazing on lands managed by the U.S. Forest Service and BLM in the eastern Sierra Nevada, no matter how well intentioned, should include some guarantee no threat to the livelihoods of those with grazing privileges. Further, evidence accumulating rapidly in the Sierra Nevada suggests that conservationists must not only be concerned with husbandry of domestic sheep, but also with the behavior of wild sheep (SNBS Recovery Program 2006). Conservation actions should consider the ramifications of restoration efforts relative to other land uses. Indeed, movements by wild sheep in the Sierra Nevada potentially place grazing privileges on hundreds of thousands of hectares of federal land at risk. Those risks have ramifications for grazing of domestic sheep throughout the west and, ultimately,

for the ESA. Recognition of impacts to private enterprise, cooperative approaches to resolving conflicting uses, and some level of compromise will be necessary components of future conservation efforts.

Endangered species advocates should ensure that their recommendations are credible and well-founded. The public and, I suspect, politicians in particular have difficulty tolerating illogical decisions or recommendations. For example, some individuals advocate use of trails in the peninsular ranges be curtailed, or even eliminated, to enhance recovery of mountain sheep. Yet, many of the same individuals strongly advocate research activities that are highly dangerous to individual animals (Turner et al. 2005). I don't believe one can argue that an individual who has been riding a horse up and down a trail for more than 40 years must curtail his/her activities to help conserve sheep, and simultaneously state that using a helicopter and net-gun to capture and collar the last females remaining in the same general area is legitimate because it constitutes a research activity. The public will not accept such logic. Further, continued releases of captive-bred mountain sheep from a facility with a history of diseases (Ostermann et al. 2001) into areas occupied by the endangered sheep in the peninsular ranges (Ostermann et al. 2001, Turner et al. 2005) challenge the credibility of scientists charged with maintaining separation between domestic sheep and the endangered sheep in the Sierra Nevada. In the absence of logic and credibility, restoration and conservation of mountain sheep, and the ESA in particular, will be subjected to intensified scrutiny and potentially devastating political consequences.

Hunters and those opposed to the take of wild animals for sport have long been at odds with respect to what constitutes conservation and acceptable uses of wildlife resources. Both groups have intense interests in the well-being of wildlife populations, but they must learn to work cooperatively to ensure they have the option of disagreeing in the future. Unless all those concerned with the well-being of wild sheep offer concerted effort to ensure that habitat is protected, that movement corridors remain intact, that habitat is managed to enhance conservation objectives, and that bureaucratic ideologies are modified to facilitate maintenance of viable populations, the future of wildlife conservation will be ever more challenging.

There are many successes with respect to the conservation of wild sheep in California, and they came about as a result of the efforts of many people, in many agencies working cooperatively on behalf of the species. Many individuals, including Don Landells and Jim Bicket, with whom I worked closely on innumerable projects to benefit wild sheep, have been a source of encouragement and entertainment, and were the best of companions. Many evenings spent around campfires in the Mojave Desert while we sipped cheap beer or good tequila, and played banjos and guitars, ended with discussions of the future for mountain sheep in the deserts of California. Some of the ideas in this essay had their origins around those campfires. It was our collective opinion that mountain sheep, at least in California and, perhaps, throughout the west, had the potential to instill great controversy and, because of that alone, could have important implications for the future of wildlife conservation. I trust that

others concerned with the conservation of mountain sheep have the foresight to recognize this, and will rise to the many challenges of the future. For this to occur, however, more people must understand and practice a conservation ethic (Tsukamoto 1986). If we are unable to do so, conservation efforts will be less effective, and the future of mountain sheep will be increasingly less certain.

Acknowledgments

I thank J. A. Bailey for many helpful suggestions on this paper, which evolved from a Keynote Address presented at the 40th Annual Meeting of the Idaho Chapter of The Wildlife Society. I drew extensively from previous status reports (Bleich et al. 1990*b*; Torres et al. 1994, 1996; Epps et al. 2003) and management summaries (Wehausen et al. 1987*a*, Bleich and Torres 1994, Bleich et al. 1996*a*) to help provide a relevant history of mountain sheep conservation in California. This paper is dedicated to the memory of Don Landells and Jim Bicket on the 20th anniversary of their untimely deaths, and to our many other colleagues who lost their lives in the performance of their duties (Sasse 2003). Don and Jim died in a tragic accident while conducting an aerial survey at Clark Mountain, California. This is a contribution from the Sierra Nevada Bighorn Sheep Recovery Program, and is Professional Paper 054 from the Eastern Sierra Center for Applied Population Ecology.

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