GUIDELINES FOR MANAGEMENT OF DOMESTIC SHEEP IN THE VICINITY OF DESERT BIGHORN HABITAT

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The Bureau of Land Management (BLM) requested that the Technical Staff (Tech Staff) of the Desert Bighorn Council (DBC) prepare management guidelines for domestic sheep in the vicinity of desert bighorn habitat. Desert bighorn habitat includes all geographic areas that would provide for the life requisites of desert bighorn sheep, as defined by state wildlife and/or land management agencies. This request followed a meeting of BLM biologists concerned with problems resulting from interactions between bighorn sheep (Ovis canadensis ssp.) and domestic sheep (0. aries).

The Tech Staff understands that 2 additional factors should be considered. First, the BLM has prepared, or is preparing, land use planning documents in several western states (Nev., Ariz., Colo., and Ut.) that would allow reintroduction of desert bighorns (*O.* c. nelsoni, 0. c. mexicana, and 0. c. cremnobates) into suitable historic habitat. Several potential bighorn reintroductions in Nevada have been contested by the livestock industry; e.g., woolgrowers and cattlemen. They contend that bighorn reintroductions will seriously hamper their ability to graze livestock of their choice on public lands. Second, in 1989, the BLM issued a "Rangewide Plan for Managing Habitat of Desert Bighorn Sheep on Public Lands," which states "Livestock grazing on desert bighorn habitats will be managed via land-use or activity plans to mitigate impacts to desert bighorns and their habitats to ensure objectives for desert bighorn are achieved."

The DBC is comprised of state fish and game and federal agency biologists, private research organizations, academia, and the public. The 4 primary objectives of the DBC are to: provide for the exchange of information on the needs and management of desert bighorns; stimulate and coordinate studies in all phases of the life history, ecology, management and protection, recreational, and economic uses of desert bighorns; provide a clearinghouse for information among all agencies, organizations, and individuals professionally engaged in work on the desert bighorn; and function in a professional advisory capacity, where appropriate, on local, national, and international questions involving the management and protection of desert bighorn.

The DBC's Tech Staff is comprised of 7 elected members. One of the functions of the Tech Staff is to answer requests from agencies and organizations such as the BLM, regarding desert bighorn management.

This document describes problems associated with domestic sheep and bighorn interactions, with emphasis on diseases. Recommendations are then provided to minimize interaction, especially physical contact between domestic and bighorn sheep.

The Tech Staff appreciates the opportunity to consider the problems and develop these guidelines, with the underlying goal of eliminating domestic sheep and bighorn conflicts on public lands.

BACKGROUND

Current bighorn numbers are <2% of what they were prior to the coming of European man and his livestock and firearms (Wagner 1978). Following enormous population declines in the late 1800s and early 1900s, bighorn populations did not recover, in contrast to other wildlife species such as mule deer (Odocoileus hemionus) and elk (Cervus elaphus). Bighorns have demonstrated much less tolerance than other native North American ungulates to poor range conditions, interspecific competition, overhunting, and stress caused by loss of habitat. Furthermore, they have shown a much greater susceptibility to diseases (Goodson 1982).

Bighorns have died from a wide variety of diseases that they have contracted from domestic sheep. These include scabies (a major cause of mortality in the 1800s and as late as the 1970s in New Mexico), chronic frontal sinusitis, internal nematode parasites (worms), pneumophilic bacteria, footrot, parainfluenza III, bluetongue, and soremouth (contagious echthyma) (Jessup 1985). Documented bighorn die-offs were recorded as early as the mid-1800s and have continued up to the present (Jessup 1985, Goodson 1982, Foreyt and Jessup 1982, Sandoval 1988, Weaver 1988). Die-off documentation covers not only desert bighorns, but also California bighorns (*O.* c. *californiana*) and Rocky Mountain bighorns (*O.* c. canadensis). Bighorn die-offs have occurred in every state in the western United States.

In broad perspective, when there has been contact between apparently healthy bighorns and domestic sheep, the bighorns die within a few days to a few weeks. While many diseases or stress factors may be involved, bighorns exposed to domestic sheep almost invariably die from pneumonia.

Little is known about the actual mechanism(s) that lead to the demise of bighorns after they have come into contact with domestic sheep. In all of the cases of bighorn die-offs following direct contact with domestic sheep or overlap of grazing in bighorn ranges, 2 things are apparent.

1. There is a preponderance of evidence (Table 1) strongly linking the presence of domestic sheep with the subsequent loss of part or all of the affected bighorn population. Of the 25 documented cases (Table 1) 4 of the situations were in controlled laboratory experiments in 3 states, and 2 were in situations where bighorns were penned in large paddocks.
2. The effects have all been I way—bighorns have died, while domestic sheep never have suffered ill effects because of coming into contact with bighorn. The prevailing theory on why this has occurred can be summed up as follows: New World sheep (bighorns) are so susceptible to diseases of Old World sheep (domestics) because the bighorns did not co-evolve with the above-listed diseases, as did domestic sheep. Bighorns have not developed effective immunity against these diseases. Domestic sheep are inoculated or, through natural selection over hundreds of years, have developed a resistance against some of these diseases, but carry blood titers for most of them. When there is contact between bighorns and domestic sheep, the bighorns have little defense. This theory is analogous to the accepted explanation for the transmission of human diseases carried to the Native Americans by Europeans. The Native American populations had no immunity to Old World diseases and suffered many documented die-offs.

RECOMMENDATIONS

The DBC Tech Staff has reviewed the bighorn sheep problem and developed recommendations for eliminating domestic and bighorn sheep conflicts on public lands. They consist of 1 general recommendation and 4 specific recommendations dealing with buffer strips, livestock supervision, trailing, and reintroductions. Each recommendation is preceded by a statement of the issue, followed by a justification.

General Recommendation

Issue.—Desert bighorn that come into contact with domestic sheep die as a result of the contact.

Recommendation.—Domestic sheep in the vicinity of desert bighorn ranges should be managed so that desert bighorn never come into contact with domestic sheep nor the disease organisms that domestic sheep carry.

Justification.—Evidence (Table 1) indicates that contact with domestic sheep is almost invariably lethal to desert bighorn. The recommendations that follow deal with methods to minimize interaction, especially physical contact between domestic and bighorn sheep.

Table I. Bighorn declines and die-offs resulting from contracts with domestic sheep.

Location	Cause of die-off	Results	Year(s)	Source
Sun River, Mont.		>70 died	1910–35	Goodson (1982)
Upper Rock Ck., Mont.		All died	1965–70s	Goodson (1982)
Thompson Falls, Mont.		All died	1940–60	Goodson (1982)
Kootenay National Park, B.C., Can.	Pneumonia		1939	Goodson (1982)
Bull River, B.C., Can.	Pneumonia	96% died	1965	Bandy (1968) in Goodson (1982)
MacQuire Creek, B.C., Can.	Pneumonia		1981–82	Davidson in Goodson (1982)
Lava Beds National Monument, Calif.[a]	Pneumonia	All died	1980	Blaisdell (1982)
Mormon Mts., Nev.	Pneumonia	50% died	1980	Jessup (1981)
Dinosaur National Monument, Colo.		All died	1950	Barmore (1962) in Goodson (1982)
Rock Creek, Mont.		8 left	1900–20	Goodson (1982)
Rocky Mtn. National Park, Colo.	Pneumonia	All died	1917–30	Packard (1939*a*, 1939*b*) in Goodson (1982)
Methow Game Range, Wash.[a]	Pneumonia	13 of 14 died	1979–81	Foreyt and Jessup (1982)
Warner Mt., Calif.	Pneumonia	All died	1988	Weaver (1988)
Oregon	Scabies		1936	Lange (1980)
California	Scabies		1870–79, 1898	Jones (1900) in Lange (1980)
Grey Bull River, Wyo.			1881	Honess and Frost (1942) in Lange (1980)
Wyo., Mont.			1885	Hornaday (1901 in Lange (1980)
Colo.	Scabies		1859–31	Packard (1946) in Lange (1980)
Rocky Mtn. National Park, Colo.	Scabies		1878–1903	Lange (1980)
Latir Parks, N.M.	Pneumonia	All died	1978–82	Sandoval (1988)
Utah St. Univ., Utah[b]	Pneumonia	All died	1970s	Spillett in Goodson (1982)
Univ. B.C., Can.[b]	Pneumonia	All died	1970s	Hebert in Goodson (1982)
Colorado St. Univ., Colo.[b]	Pneumonia	All died	1970s	Hibler in Goodson (1982)
Utah St. Univ., Utah[b]	Pneumonia	4 of 5 died	1988	T. D. Bunch (Utah State Univ., pers. commun.)

[a]Large pen or paddock.
[b]University controlled conditions.

Specific Recommendation 1: Buffer Strips

Issue.—Desert bighorn and domestic sheep must be spatially separated to minimize the possibility of these 2 species coming into contact.

No domestic sheep grazing should be authorized or allowed within buffer strips ≥13.5 km wide surrounding desert bighorn habitat, except where topographic features or other barriers prevent any interaction.

Justification.—Armentrout and Brigham (1988) recommended a 13.5-krn-wide separation strip as optimum, based on 9 cited literature sources. Bighorn and domestic sheep separation distances cited in the literature range from 3.2 to 32 km. The California Department of Fish and Game (1983), in its discussion of conflicting land uses, recommended that domestic sheep grazing be eliminated within 3.2 km of bighorn habitat where feasible. The 3.2-km buffer strip also is included in the Mina Habitat Management Plan in Nevada (U.S. Dep. Interior, BLM 1988*a*) in ≥1 land-use plan in the Boise, Idaho BLM District (Goodson 1982); and in the Winnemucca, Nevada BLM 1978 grazing Environmental Impact Statement for the Sonoma-Gerlach Resource Area. A 9.6-km-wide buffer strip was recommended in the Lahontan Resource Management Plan (RMP) and the Stillwater Habitat Management Plan in Nevada (U.S. Dep. Interior, BLM 1985, 1986*b*). The widest recommended buffer (32 km) was used in Arizona. A 32-km buffer was agreed upon in the original Memorandum of Understanding (MOU) between the BLM and Arizona Game and Fish Department. However, when the master MOU was redrafted in 1976, the section relating to domestic sheep grazing in bighorn habitat was not included (Gallizioli 1980). Situations involving potential bighorn and domestic sheep conflicts in Arizona now are handled on a case-by-case basis.

The reason for the 32-km buffer strip was concern over the chronic frontal sinusitis in desert bighorn. This disease occurs when bot fly (*Oestrous* ovis) larvae enter the sinus cavities of bighorns, grow too large to get out, and die, thus infecting the bighorn (Bunch 1978). Sinus cavities in desert bighorns are much larger than those in domestic sheep. The major unanswered question asked by biologists in the 1970s was "what is the range of the bot fly?" Although the U.S. Department of Agriculture has investigated this question, there is no definitive answer, as it depends upon variables such as temperature, precipitation, and wind. The 32-km buffer strip, however, was felt to be adequate (Gallizioli 1980).

Another problem when considering buffer strips is that young (3–4 yr old) desert bighorn, especially rams, tend to travel extensively (≤64 km). Extensive travel by bighorns increases the potential for nose-to-nose contact with domestic sheep. Nose-to-nose contact and resultant transmission of disease(s) was blamed for the catastrophic loss of penned bighorns at the Lava Beds National Monument, California in 1980 (Blaisdell 1982) and in the total population loss of transplanted bighorns in the Warner Mountains, California, in 1988 (Weaver 1988).

Considering all the evidence presented above and cited in Armentrout and Brigham (1988), the Tech Staff feels that buffer strips of ≥13.5-km are needed to minimize the potential of disease transmission, including chronic frontal sinusitis, and to avert nose-to-nose contact between wandering bighorns and domestic sheep.

Specific Recommendation 2: Livestock Supervision

Issue.—Domestic sheep must be closely and carefully herded to prevent them from straying into desert bighorn range.

Recommendation.—Domestic sheep that are trailed or grazed outside the 13.5-km buffer, but in the vicinity of desert bighorn ranges, should be closely supervised by competent, capable, and informed herders.

Justification.—There is virtually no practical way to control movements of young bighorns, but control of domestic sheep is possible. The key to minimizing impacts by domestic sheep upon bighorns is very close supervision of domestic bands by herding, both while trailing and grazing. Both the Warner Mountains and Lava Beds bighorn die-offs were attributed to stray domestic sheep. Had domestic sheep herding been more intensive, neither of these catastrophes probably would have occurred.

Sheep herders and their control of domestic sheep bands vary considerably. Many herders come to the United States from other countries,

especially South America. Many have never herded sheep before their amval in the U.S. Permittees who graze domestic sheep on public lands should ensure that their herders are competent and capable and that herders understand the potential problems that may be caused by straying domestic sheep.

The Tech Staff recognizes that the BLM's grazing regulations may need modification to further implement this recommendation. Existing regulations provide that the authorized officer can require herders. The regulations also could be strengthened to allow impoundment of stray domestic sheep, whenever they are found in occupied bighorn habitat. This recommendation could be partially implemented by directives requiring that BLM area managers, range conservationists, and wildlife biologists meet with the permittees and their herders to explain the importance of close supervision by the herders and what could result if domestic sheep are allowed to stray.

Specific Recommendation 3: Trailing

Issue.—Domestic sheep being trailed near desert bighorn range are likely to transmit diseases to bighorns, especially when ewes are in estrus.

Recommendation.—Domestic sheep should be trucked rather than trailed, when trailing would bring sheep closer than 13.5 km to bighorn range. Trailing should never occur when domestic ewes are in estrus.

Justification.—Many domestic sheep are still trailed between grazing allotments. The Tech Staff recommends that domestic sheep be trucked whenever possible to minimize possible contact with bighorns. Close supervision by herders is essential. The time of trailing also is important. When domestic ewes are in estrus, they will attract bighorn rams from distances >3.2 km. The Tech Staff recommends, therefore, that domestic sheep not be trailed closer than 13.5 km to occupied bighorn habitat. Domestic sheep also should not be trailed when ewes are in estrus, to reduce potential for bighorn sheep contact. This prescription should be included in BLM grazing regulations as part of the supervision and husbandry requirements.

Specific Recommendation 4: Reintroduction

Issue.—Ranges formerly occupied by domestic sheep can harbor diseases detrimental to desert bighorn.

Recommendation.—Bighorn sheep should not be reintroduced into areas where domestic sheep have grazed during the previous 4 years.

Justification.—Our concern involves bighorn reintroductions into habitats formerly occupied by domestic sheep. The Tech Staff does not advocate the co-use of bighorn habitat by both bighorn and domestic sheep. Two diseases that could be transmitted to bighorn after domestic sheep have been removed are footrot and soremouth (Jessup 1985, Kistner 1982). Both of these diseases can lie in the soil and, when conditions are right, be transmitted to bighorns. The soremouth virus can remain viable in the soil for 10 to 20 years (Jessup 1985, Lance 1980).

SUMMARY

The DBC Tech Staff herein has identified some of the problems associated with bighorn and domestic sheep interactions, and has recommended procedures that should eliminate or reduce contact between domestic and desert bighorn sheep. These recommendations include: no nose-to-nose contact between bighorn and domestic sheep; a minimum of a 13.5-km-wide buffer strip between ranges used by domestic sheep and bighorns; trucking of domestic sheep in preference to trailing, and no trailing when domestic ewes are in estrus; and no bighorn reintroductions onto areas that have been grazed by domestic sheep during the previous 4 years.

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