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ALTERNATE RUTTING STRATEGIES IN MOUNTAIN SHEEP: MANAGEMENT APPLICATIONS

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Abstract: A 10-year closure to ram hunting in the Wrangell-St. Elias National Park, which formerly produced the largest Dall rams in the world, failed to produce more rams that rank among the leaders in Boone and Crockett listings. Based on recollections of sheep hunters who frequented the Wrangell Mountains when record sheep were taken, it was common to find 1 outstanding ram in each geographically distinct area frequented by several ram groups in the fall. These observations are consistent with reports from unhunted bighorn sheep and may be considered supportive evidence for at least 2 alternate rutting strategies among mountain sheep: the "normal" and the "alpha ram" strategies. Experience in Alaska has identified a third rutting strategy, the "immature ram" strategy, which is manifested in populations of Dall sheep where mature, dominant rams are scarce or absent. It appears that sheep managers can select among these rutting strategies by varying harvest management to favor relative frequencies of behavior patterns during rut. This possibility should be recognized because predominant rutting strategies will influence achievement of management goals.

Boone and Crockett (B&C) Club records (1989) indicate more of the unusually large Dall sheep (Ovis dalli dalli) recorded have been harvested from the northern Chugach and southeast Wrangell Mountains of Alaska than from any other area. Most of these rams were harvested between 1955 and the late 1960s. Heimer and Smith (1975) demonstrated that this area has the highest horn growth potential in Alaska, hence its high frequency of larger rams. However, the relatively short time period during which the collection of the unusually large rams occurred requires further explanation.

I suggest these rams were taken due to unique circumstances. Prior to 1955, these sheep habitats had never been hunted intensively for trophy rams. From the mid-1950s to the late 1960s, the human population of Alaska increased as did the number of Dall sheep hunters. This hunter population included a group of highly motivated and competent trophy hunters. Finally, there was concurrent use of high-performance, light aircraft for access into and scouting of sheep habitats. These circumstances resulted in recording 73% of the top 25 Dall rams in the B&C records during this relatively brief period. During the last 20 years, only 2 rams with horns large enough to rank among the top 25 recorded Dall rams have been taken. Many hunters and some biologists have speculated high harvest rates have resulted in few rams old enough to attain maximum growth (Kay 1988).

Based on this speculation, sheep hunters who received congressionally mandated subsistence hunting privileges in the Wrangell-St. Elias National Park (Heimer 1978, 1980, 1985) expected a bonanza of new "book" rams to be available following passage of the Alaska National Interest Lands Conservation Act. They reasoned that because these ranges had been essentially closed to hunting for 10 years, old and unusually large rams should be abundant. However, extensive scouting and high-effort hunting by these extremely selective, "hard-core" trophy hunters have failed to produce a single "high book" ram from the National Park. This raises the question: "Why are rams in these areas living long enough, but not growing big enough to place high in the Boone and Crockett book?"

The purposes of this paper are to propose an answer to this question, to emphasize that harvest management can influence rutting strategy, and to suggest that once managers have defined management objectives, selection of the appropriate harvest plan can increase the likelihood of management success.

METHODS

Literature on rutting strategies among mountain sheep was reviewed. Experience with changes in rutting strategy, inferred from results of varying ram age structures among Alaskan Dall sheep, was evaluated. Two of the more experienced sheep hunters, who participated in harvest of the top 20 B&C Dall rams, were interviewed.

RESULTS

Literature Review

Geist (1968, 1971) described rutting behavior in bighorn (*Ovis canadensis*), Stone (*O. d. stonei*), and Dall sheep. The typical pattern in these populations was for several mature dominant rams to limit rutting participation by immature rams. Mature rams circulated among groups of ewes, identified and courted estrous ewes, guarded them from the advances of subordinate rams, and eventually copulated with them. This pattern is typically considered the "normal" rutting strategy.

Hogg (1984, 1987) described a rutting system in which use of a central rutting area by estrous bighorn females enhanced their opportunities for mate selection. This system distinctly favored the largest horned, or alpha ram. This ram was sought by ewes, and due to his status he was able to engage in sperm competition with subordinate rams that obtained opportunistic copulations from ewes they intercepted, blocked, and tended as these ewes traveled toward the alpha ram on the rutting area (Hogg 1988). Dispersion of ewes from the geographic center of the tending area varied coincident with the presence of super-dominant rams (Hogg 1987). Greater mating success by rams of lower rank attended greater dispersion of ewes from the center of tending. Because of the apparent advantages in reproductive fitness which accrue to the dominant ram, I call this the "alpha-ram" strategy.

Ram Age Structure in Alaskan Dall sheep

A third rutting strategy has been identified among heavily hunted populations of Dall rams. I call this the "immature ram" strategy. In some Alaska populations, virtually all rams above 3/4-curl development were removed under hunting regulations in effect before 1979 (Heimer 1980). In these populations, Class II rams, having less then 3/4-curl horns (Geist 1968), became active breeders (Nichols 1972). These young rams behaved differently than mature rams, and their behavior was part of a maladaptive syndrome involving decreased ewe fecundity and unusually high mortality among young rams (Heimer et al. 1984, Heimer and Watson 1986a,b).

Interviews With Sheep Hunters

Anecdotes from 2 experienced sheep hunters who were active in the Wrangell/Chugach Mountains during the heyday of trophy sheep harvest suggested it was typical to find 1 unusually large ram in a discrete mountain block which contained several ram bands in the fall. One hunter (F. Cook, #2 B&C ram, 1956, pers. commun.) covered the Chugach Mountains extensively on foot. The other (J. Harrower, #16 B&C ram, 1961, pers. commun.) flew in, guided in, and hunted the Wrangell Mountains extensively. The unusually large rams, colloquially called "herd rams" were often clearly larger than the accompanying rams which were also uncommonly large by today's standards.

DISCUSSION

Past harvest of virtually all "high book" Dall rams from the Wrangell and Chugach Mountains coupled with the failure of these sheep ranges to produce rams of similar size in recent years suggest that "180-point" rams are scarce there today. Closure of this area to open hunting more than 10 years ago has certainly allowed time for several cohorts of rams to realize their maximum horn growth potentials. Still, the few dedicated sheep hunters who have expended their efforts in search of new records have been disappointed.

In any study, definition of ram rutting strategy is determined by the preponderance of a recorded behavior pattern. The spectrum of normal but differing behaviors ranges from those exhibited by the highest to the lowest ranking rams in any ram band. If the age structure of a ram band changes, the frequency distribution of observable behaviors will reflect the change in age structure.

If the "alpha-ram" strategy, as I interpret it from Hogg (1984, 1987), represents a predictable result of social ascendancy to alpha status by an unusually large ram, it should occur among unhunted Dall sheep. Furthermore, if it selects for larger males, it should favor an overall increase in horn size. However, the "alpha-ram" strategy is unlikely to occur in hunted populations. If trophy hunting removes individuals with alpha-ram potential before it is fully expressed (because hunters shoot the larger rams), the "alpha-ram" strategy cannot develop. Hence, I suggest the "alpha-ram" strategy was not unusual in the Wrangell/Chugach Mountains (and across Alaska) before the alpha rams were removed by trophy hunters. Once this rutting system was disrupted

by removing alpha rams and the "normal" rutting strategy prevailed (along with open hunting for rams of a minimum legal horn size), reestablishment of the "alpha-ram" strategy became improbable.

Reestablishment of the "alpha-ram" strategy requires several sequential events. The first requisite is production of an unusually superior male through chance recombination of genetic material. The chance occurrence of an occasional "super ram" in populations where very large rams are not typical is demonstrated by the Summar (B&C #8) and the Johnson-Brennan (B&C #21) rams. These rams are the only Alaska Range rams in the top 100 B&C records, yet they rank highly. Another demonstration of this chance occurrence was the recent harvest of 2 rams which will rank among the top 10 B&C list from the Brooks Range.

Once a "super ram" is produced, he must survive to realize his potential. When his physical potential is realized, this ram must either attract ewes to a tending area (if one was not maintained through traditional ewe movements), or so dominate subordinates on the tending area that his reproductive fitness greatly exceeds theirs. Following this sequence, mate selection for this ram by ewes should occur with increased frequency.

I suggest the probability that these events will occur in the required sequence is small. However, once an alpha ram system develops, it should accelerate selection for large horns and be self sustaining so long as a succession of alpha rams dominate the geographic center of reproductive activity. Any mortality removing the alpha ram or his immediate successors would select forcefully for the "normal" rutting strategy. It should be emphasized that mortality other than trophy hunting could easily disrupt the "alpha-ram" strategy. Such mortality includes uncommonly difficult weather (Watson and Heimer 1984) and surplus killing of entire ram bands by wolves (R. Tobey, ADF&G, pers. commun.). Harvest by humans is the single mortality factor managers can easily control.

Hence, managers choosing to favor selection for or maintenance of the "alpha-ram" strategy must be prepared to eliminate or strictly regulate harvest of the alpha ram by humans and predators. Conversely, aggressive selection for this rutting strategy to attain nonconsumptive use goals may require culling of subdominant rams with low horn growth potential. If hunting is to be maintained along with the "alpha-ram" strategy, harvest must be strictly controlled and limited, perhaps to the sustained culling of designated individuals from the subdominant ram pool, although harvest of the largest ram could be allowed once he was nearing the end of his probable life expectancy and a successor was present.

Selection for the "normal" rutting strategy requires the effective presence of mature (Class IV) rams. These mature rams limit social and reproductive behavior by immature rams (Geist 1971, Nichols 1972, Heimer and Watson 1986a,c, 1990). Managers can produce this effect by ensuring a suitable age structure through eliminating hunting for rams, or by managing harvest to protect mature rams. Protecting mature rams can be accomplished by carefully controlling harvest from all ram age/size

categories or, paradoxically, by limiting harvest to the Class IV (full-curl) segment of the ram population. In Alaska, where vast areas with large populations of sheep are used by hunters who prefer to take mature males, the latter strategy has proven effective (Heimer and Watson 1990).

Results of 6 years of full-curl ram hunting in a heavily hunted portion of interior Alaska indicate that selection for the "normal" rutting strategy has raised the abundance of Class IV rams to the point that, even with comparatively low sheep per hunter ratios, hunters appear incapable of harvesting all the Class IV rams recruited annually. During the 6 years of full-curl management, the total number of sheep per hunter in these populations has averaged 15. Still, there has been no decrease in sustainable harvests using a full-curl regulation to cultivate the "normal" rutting strategy in Alaska. In fact, harvests have increased (Heimer and Watson 1990) as predicted by Heimer and Watson (1986a). Hence, I suggest that selecting for the "normal" strategy is the most appropriate and practical means of maximizing ram harvests.

The Alaskan experience suggests that a third rutting strategy results from the social disruption accompanying nearly complete removal of Class III and Class IV rams from populations which previously evidenced the "normal" rutting strategy. In populations where the "immature ram" strategy became operative, rut was prolonged and was characterized by excessive courting and chasing behaviors on the part of immature rams (Nichols 1972, 1978). These rams would otherwise have been inactive.

The results of this rutting strategy in the Alaska Range were maladaptive. Low ewe fecundity and increased mortality among young rams were implicated as results of the "immature ram" strategy (Nichols 1978; Heimer and Watson 1982, 1986a,b,c; Heimer et al. 1984). Reestablishing an abundance of Class III and IV rams through progressively more restrictive hunting regulations was associated with selection for the "normal" rutting strategy, restoration of typically high ewe fecundity, and increased ram survival. Alaskan experience suggests the maladaptive symptoms associated with the "immature ram" strategy will become apparent when Class II-IV rams:100 "ewes" (as classified from aircraft when yearlings cannot be distinguished from ewes) ratios fall below 30:100 (Heimer and Watson 1986b).

The population survey and hunter-control effort required to select for establishing the "alpha-ram" strategy may render it an impractical management alternative except in aggressive attempts to increase ram horn size or pursuit of management goals which are primarily nonconsumptive. The "normal" strategy currently appears to be the most cost-effective strategy managers can select to maximize ram harvests. Selection for the "immature ram" strategy should be limited to situations where population reductions are desired. Sheep managers may find progress is more readily attainable if they shift their thinking toward conscious selection of rutting strategies designed to achieve management goals rather than selecting rutting strategies "by default"

as unconsidered results of traditional consumptive or nonconsumptive management programs.

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