



Seasonal movements and habitat use of the Highland/Pioneer Mountains bighorn sheep herd of southwest Montana
by William J. Semmens

A thesis submitted to Graduate Faculty in partial fulfillment of the requirements for the degree of Master of Science in Fish and Wildlife Management
Montana State University
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Abstract:

A study of Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) within the Highland and Pioneer Mountains was conducted on a seasonal basis during 1994. Data were collected related to home ranges, sex and age composition, population estimation, site preference, food habits, vegetational cover of feeding sites versus food habits, mineral use, and possible competition with mule deer (*Odocoileus hemionus*) and/or cattle. Winter and summer home ranges for 3 subpopulations were assessed with telemetry data from 36 radio-collared ewes. Home ranges ranged from 6.40 to 32.97 km². Sex and age composition were determined from 5,985 observations of individual sheep (includes multiple observations of the same animal), resulting in 1994 mean lamb:ewe and ram:ewe ratios of 43.6 lambs and 54.4 rams per 100 ewes. Site preferences for ewe-lamb, ram, and mixed groups were determined by 4 parameters: — distance to escape cover, slope, aspect, and ground cover. Winter site preferences in a winter with mild weather conditions indicated bighorn sheep selected not only southfacing aspects, but also east and west aspects. In Spring, ewes and their young selected steeper slopes and sites nearer to escape cover. Summer preferences were influenced by drought conditions in 1994. Ewes evidently selected sites providing access to escape terrain as an anti-predator response. All groups responded to the harsh weather conditions in the fall by using south facing slopes where snow did not cover forage. Feeding site, fecal, and rumen analysis showed that graminoids were the dominant vegetation class in the diet of bighorn sheep during all seasons. Feeding site analysis revealed that grasses were selected in all seasons, but as palatable forbs became abundant during the spring and early summer, sheep increased intake of forbs. Soil mineral content analysis revealed that there were no differences ($P > 0.05$) in calcium, magnesium, potassium, or sodium levels among the 5 areas where bighorn sheep were observed ingesting soil. Hair mineral content revealed that female sodium levels were higher ($P < 0.05$) than males. Mule deer and bighorn sheep diets during the winter showed dissimilarities with bighorn sheep consuming more ($P < 0.05$) graminoids than mule deer. The summer diets of bighorn sheep and cattle were similar in forb and shrub content, but cattle consumed more ($P < 0.05$) graminoids than bighorn sheep. Cattle and sheep maintained spatial separation in summer. This study described seasonal movements and habitat use of the Highland/Pioneer mountains bighorn sheep herd immediately prior to a die-off attributed to a sheep pneumonia complex. At least 75% of the population died between December 1994 and March 1995.

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MONTANA STATE UNIVERSITY
Bozeman, Montana

May 1996

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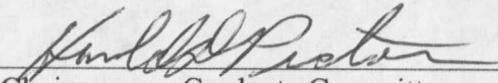
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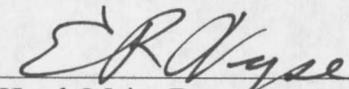
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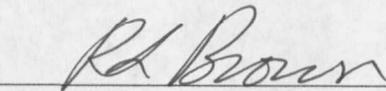
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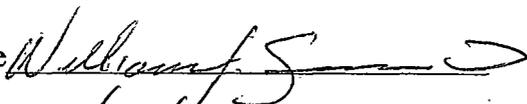

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ACKNOWLEDGMENTS

To the following, among others, the author wishes to express his sincere appreciation for their contributions to this study: Dr. Harold D. Picton, Montana State University, who directed the study and aided in preparation of the manuscript; Drs. Lynn R. Irby, Carl L. Wambolt, and Robert G. White, Montana State University, for reviewing the manuscript; Mr. Keith Aune, Montana Department of Fish, Wildlife and Parks Wildlife Laboratory Supervisor, for his input and lab facility usage; Mr. Mike Frisina, Montana Department of Fish, Wildlife and Parks Region 3 Biologist, for project planning, fund raising, field assistance and essential advice during the study; numerous personnel from the Montana Department of Fish, Wildlife and Parks Region 3 headquarters in Bozeman, Montana for their unending cooperation during this study; Mr. Jack Jones, Bureau of Land Management Biologist (retired)-Butte District, for his input, fund raising and assistance in identifying plant species; Mr. Larry Rowe, Bureau of Land Management Biologist-Butte district, for his cooperation and fund raising efforts; Mr. Roger Stradley, pilot, for his flying expertise and uncanny ability to spot animals from the air; Kari Rogers for field assistance; the National Forest Service-Wise River Ranger Station for their cooperation and supplying housing during the winter months; Robert E. Kissell, for statistical assistance; area landowners, Jim Eighorn and family, John Peck, Wayne Johnson, and John Hoffman for their cooperation and land access; Bureau of Land Management, Montana Department of Fish, Wildlife and Parks, Foundation for North American Wild Sheep, and 'Atcheson's Taxidermy for funding the study; my family for their encouragement and support throughout this study.

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ABSTRACT

A study of Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) within the Highland and Pioneer Mountains was conducted on a seasonal basis during 1994. Data were collected related to home ranges, sex and age composition, population estimation, site preference, food habits, vegetational cover of feeding sites versus food habits, mineral use, and possible competition with mule deer (*Odocoileus hemionus*) and/or cattle. Winter and summer home ranges for 3 subpopulations were assessed with telemetry data from 36 radio-collared ewes. Home ranges ranged from 6.40 to 32.97 km². Sex and age composition were determined from 5,985 observations of individual sheep (includes multiple observations of the same animal), resulting in 1994 mean lamb:ewe and ram:ewe ratios of 43.6 lambs and 54.4 rams per 100 ewes. Site preferences for ewe-lamb, ram, and mixed groups were determined by 4 parameters: distance to escape cover, slope, aspect, and ground cover. Winter site preferences in a winter with mild weather conditions indicated bighorn sheep selected not only south-facing aspects, but also east and west aspects. In Spring, ewes and their young selected steeper slopes and sites nearer to escape cover. Summer preferences were influenced by drought conditions in 1994. Ewes evidently selected sites providing access to escape terrain as an anti-predator response. All groups responded to the harsh weather conditions in the fall by using south facing slopes where snow did not cover forage. Feeding site, fecal, and rumen analysis showed that graminoids were the dominant vegetation class in the diet of bighorn sheep during all seasons. Feeding site analysis revealed that grasses were selected in all seasons, but as palatable forbs became abundant during the spring and early summer, sheep increased intake of forbs. Soil mineral content analysis revealed that there were no differences ($P > 0.05$) in calcium, magnesium, potassium, or sodium levels among the 5 areas where bighorn sheep were observed ingesting soil. Hair mineral content revealed that female sodium levels were higher ($P < 0.05$) than males. Mule deer and bighorn sheep diets during the winter showed dissimilarities with bighorn sheep consuming more ($P < 0.05$) graminoids than mule deer. The summer diets of bighorn sheep and cattle were similar in forb and shrub content, but cattle consumed more ($P < 0.05$) graminoids than bighorn sheep. Cattle and sheep maintained spatial separation in summer. This study described seasonal movements and habitat use of the Highland/Pioneer mountains bighorn sheep herd immediately prior to a die-off attributed to a sheep pneumonia complex. At least 75% of the population died between December 1994 and March 1995.

INTRODUCTION

The native herd of Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) that originally inhabited the Highland Mountains area south of Butte, MT, was extirpated in the early 1900's (Couey and Schallenberger 1971). In the late 1960's, 51 bighorn sheep were relocated to the Camp Creek area within the Highland Mountains complex via 2 transplants from the Sun River bighorn sheep herd. The first transplant occurred in 1967 with 21 sheep, and the second transplant occurred in 1969 with an additional 30 sheep.

In the early 1970's, bighorn sheep began expanding their range, branching out from the Camp Creek area in both northerly and northwesterly directions. The sheep population continued to expand its range throughout the 1970's and 80's forming the 3 subpopulations present today. One subpopulation remains in the Camp Creek area; the second subpopulation settled north of Camp Creek in the Moose Creek area; and the third subpopulation settled in the Maiden Rock area of the east Pioneer Mountains (Weigand 1994). The 3 subpopulations will be referred to as Camp Creek Subpopulation (CCS), Moose Creek Subpopulation (MCS), and East Pioneer Mountains Subpopulation (EPMS).

By the early 1970's the bighorn sheep population in the Highland/Pioneer mountains had grown to a size that allowed limited hunting opportunities (Janson 1974). By the mid-1980's, the Highlands bighorn sheep herd had become one of the premiere herds in the United States for trophy rams, with many rams reaching trophy status by 4 years of age. From 1983-93, 24 rams taken by hunters in Hunting District 340 (HD 340)

made the Boone and Crockett record book (minimum score = 180) (Karwaski 1994). Included in these trophy rams is a dead ram found by Jack Atcheson, Jr. in 1992 that scored 203 5/8 and is currently ranked #2 in Montana and #5 in the world (Reneau and Reneau 1993).

In 1994, 70 bighorn sheep hunting permits were issued for this sheep herd, the most bighorn sheep permits issued in a single hunting district in Montana that year, excluding the unlimited areas. Twenty-five either-sex permits were issued on the west side of Interstate 15 (HD 340-01), 10 either-sex permits on the east side of Interstate 15 (HD 340-02) and 35 ewe permits (HD 340-03) were issued for anywhere in HD 340.

The Highland/Pioneer Mountains bighorn sheep herd lived in close proximity to domestic sheep for over 20 years and remained healthy. Research has shown that domestic sheep may carry a bacterium, *Pasteurella haemolytica*, which causes a pneumonia fatal to Rocky Mountain bighorn sheep (Foreyt and Jessup 1982, Coggins 1988, Foreyt 1989 and 1990). Disease attributed to *Pasteurella haemolytica* is often so acute in bighorn sheep that no clinical signs are observed before death (Thorne et al. 1982).

Due to the enormous success and value of this herd, the Bureau of Land Management (BLM) and the Montana Department of Fish, Wildlife and Parks (MDFWP) wanted to obtain more information about this bighorn sheep herd to help with future management decisions. This study was developed to document the status of the Highland/Pioneer Mountains bighorn sheep herd by monitoring range use, movements,

and possible competition between other wild ungulates or livestock. This report covers monitoring efforts in 1994 and is a continuation of the study by Weigand (1994).

In early December of 1994, a die-off began within this herd. The die-off has been attributed to a sheep pneumonia complex. Only the initial report of this die-off will be included in this thesis because field work ended prior to the final analysis of data from the die-off.

OBJECTIVES

1. To document the seasonal ranges of the 3 primary wintering segments of bighorn sheep.
2. To document any seasonal interaction of various herd segments, especially in winter.
3. To delineate the degree of overlap of range use among mule deer, elk, and bighorn sheep, and between livestock and bighorn sheep, and to develop a program for monitoring interaction among these ungulates in HD 340.
4. To document habitat use by bighorn sheep and livestock by season.
5. To document minerals utilized by bighorn sheep.

STUDY AREA

Boundaries

The study area was located south of the town of Butte in southwestern Montana. The boundaries of HD 340 (MDFWP Legal Descriptions 1994), within MDFWP's Region 3, also served as the boundaries for the study unit. Bighorn sheep have been documented to occupy approximately 400 km² of the 2335 km² of land area that lies within HD 340 (Figure 1). The study area was divided into east and west sides by Interstate 15.

Geology and Topography

The east side of the study area was made up of the Highland Mountain Range and adjacent southwestern foothills. The northern section of the Highland Mountains Range comprises the area around Red Mountain (3,071 m), East Peak (3,013 m), and Table Mountain (3,118 m). Formed by the 70 million year old granite of the southern end of the Boulder batholith (Alt and Hyndman 1990), these were the highest peaks in the study area that have been documented to support bighorn sheep. The Boulder batholith is a large granitic intrusion running from north of Helena, Montana to the Hells Canyon area within the Highland Mountain complex (Sahinen 1950). The Moose Creek area constitutes a separate mass of granite, composed of a satellite of the Boulder batholith, that forms the Humbug Spires. The southern section of the Highland Range, Hells Canyon to McCartney Mountain, consists of a sedimentary formation, deposited 350

