



Food habits, range use and relationships of bighorn sheep to mule deer and elk in winter, Gallatin Canyon, Montana
by Kerry John Constan

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in Fish and Wildlife Management
Montana State University
© Copyright by Kerry John Constan (1967)

Abstract:

A study was conducted in Gallatin Canyon, southwestern Montana during January-March, 1967 to obtain quantitative data on range use, food habits and interspecific relationships of bighorn sheep, mule deer, and elk. The physiography of the study area was described. Canopy coverage and frequency of occurrence of plant taxa provided a basis for quantitative descriptions of the vegetation which was divided into five broad types: bunchgrass, sagebrush, Douglas-fir, lodgepole pine and quaking aspen. A total of 1,001 observations of bighorns indicated a ewe-ram ratio of 100:31 and a ewe-lamb ratio of 100:57. The highest total count indicated a mini-, mum of 98 bighorns on the winter range. A mature ram first observed in January with a mixed group traveled 4.3 airline miles before joining two other rams and remaining in an area of 55 acres during the last month of winter. A lamb was observed three times in 10 days in an area of .2 x .6 miles. Four aerial censuses were flown during the winter, over the summer, range and a maximum of 21 bighorn were observed wintering at 9,700-11,000 feet elevation. The estimated minimum mule deer population using the winter range was 113. Classification of 120 observations of mule deer indicated a doe-fawn ratio of 100:62. An estimated minimum elk population of 65 consisted of native elk and elk that migrated onto the study area from -Yellowstone National Park. A total of 3,588, 1,954 and 540 observations of bighorn sheep, mule deer and elk, respectively, were recorded by vegetation type. Percentages of observations on the bunchgrass, sagebrush and Douglas-fir vegetation types for bighorns was 69, 9 and 20; for mule deer, 10, 33 and 48; and for elk, 18, 48 and 34, respectively. Winter food habits data were obtained by examination of 53, 29 and 12 bighorn sheep, mule deer and elk feeding site?, respectively, and by analysis of rumen samples., Grass and grass-like plants, forbs, and browse made up 72, 17 and 8 percent of the plants used by bighorns at feeding sites; 7, 29 and 62 percent by mule deer; and 63, 10 and 30 percent by elk, respectively. *Agropyron spioatim* and *Festuoia iddhoensis* together provided over one-half of the total diet of both bighorns and elk. *Artemisia tridentgta* provided 30 percent of the total diet of mule deer and it was the most used browse plant by both bighorns and elk. Among forbs, *Artemisia, frigida* and *Lupinus spp.* ranked first and second in usage respectively, for both bighorns and elk and first and third for mule deer. Contents of rumen samples from each of 12 mule deer averaged 61, 19 and 16 percent for browse, forbs,-and grass and grass-like plants, respectively. Utilization of bunchgrass and sagebrush as measured along transects indicated 92-96 percent use of bunchgrass and 53 percent use of sagebrush. The data indicated at least some competition between bighorns -and mule deer. Competition between bighorns and elk was slight during the study but the similar food habits of the two animals could cause severe competition if elk increased their use of the bighorn sheep range. Intraspecific competition among the bighorns possibly was existent since the bighorns were restricted to a very small area and their utilization of -*Agropyron spioatum* had reached severe levels. Present ewe-lamb ratios indicated at least average reproduction rates.

FOOD HABITS, RANGE USE AND RELATIONSHIPS OF BIGHORN SHEEP TO
MULE DEER AND ELK IN WINTER, GALLATIN CANYON, MONTANA

by

KERRY JOHN CONSTAN

A thesis submitted to the Graduate Faculty in partial
fulfillment of the requirements for the degree

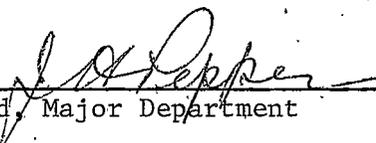
of

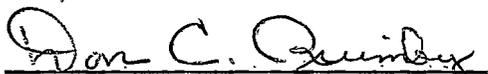
MASTER OF SCIENCE

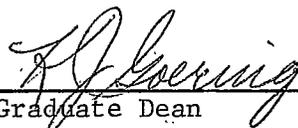
in

Fish and Wildlife Management

Approved:


Head, Major Department


Chairman, Examining Committee


Graduate Dean

MONTANA STATE UNIVERSITY
Bozeman, Montana

December, 1967

ACKNOWLEDGEMENT

To the following, among others, I wish to express sincere appreciation for their contributions to this study: Dr. Don C. Quimby, Montana State University, for technical supervision and guidance in preparation of the manuscript; Dr. Richard J. Mackie, formerly with the Montana Fish and Game Department, for initial project planning; Dr. W. E. Booth, Montana State University, for verification of plant specimens; Mr. Joseph L. Egan, Montana Fish and Game Department, for assistance and cooperation; Mr. J. H. Markley and Mr. Ed Durnam for permission to trespass on their property; Dr. Robert L. Eng and Dr. Richard J. Graham, Montana State University, for critical reading of the manuscript; Mr. Kenneth Greer and Mr. Thomas Mussehl of the Montana Fish and Game Department for assistance in various phases of the study; and to James M. Peek for invaluable encouragement and assistance. During the study, I was supported by the Montana Fish and Game Department under Federal Aid Project No. W-98-R-7 and No. W-98-R-8.

TABLE OF CONTENTS

	Page
VITA	ii
ACKNOWLEDGEMENT.....	iii
TABLE OF CONTENTS.....	iv
LIST OF TABLES.....	vi
LIST OF FIGURES.....	vii
ABSTRACT.....	viii
INTRODUCTION.....	1
DESCRIPTION OF STUDY AREA.....	3
VEGETATION.....	6
Bunchgrass Type.....	6
Sagebrush Type.....	10
Douglas-Fir Type.....	10
Lodgepole Pine Type.....	12
Quaking Aspen Type.....	12
POPULATION CHARACTERISTICS.....	14
Bighorn Sheep.....	14
Mule Deer.....	17
Elk.....	18
USE OF VEGETATION TYPES.....	19
Bighorn Sheep.....	19
Mule Deer.....	19
Elk.....	21
Use of Exposures.....	21

TABLE OF CONTENTS
(continued)

	Page
FOOD HABITS.....	23
Bighorn Sheep.....	23
Mule Deer.....	28
Elk.....	30
BUNCHGRASS AND SAGEBRUSH UTILIZATION.....	33
INTERSPECIFIC COMPETITION.....	34
Bighorn Sheep and Mule Deer.....	34
Bighorn Sheep and Elk.....	35
APPENDIX.....	37
LITERATURE CITED.....	42

LIST OF TABLES

Table	Page
I. CANOPY COVERAGE AND FREQUENCY OF TAXA FOR VEGETATION TYPES AS DETERMINED BY EXAMINATION OF TWENTY 2 X 5 DECIMETER PLOTS ON EACH OF 16 SITES:.....	8
II. CLASSIFICATION OF BIGHORN SHEEP GROUPS BY AGE AND SEX, JANUARY-MARCH, 1967.....	15
III. PERCENT OF OBSERVATIONS OF BIGHORN SHEEP, MULE DEER AND ELK ON FIVE VEGETATION TYPES DURING JANUARY, FEBRUARY AND MARCH, 1967.....	20
IV. PERCENTAGES OF TOTAL BIGHORN SHEEP, MULE DEER AND ELK OBSERVED ON DIFFERENT EXPOSURES, JANUARY-MARCH, 1967.....	22
V. WINTER FOOD HABITS OF BIGHORN SHEEP, MULE DEER AND ELK AS DETERMINED FROM 20,601 INSTANCES OF PLANT USE AT 94 FEEDING SITES, JANUARY-MARCH, 1967.....	24
VI. MULE DEER FOOD HABITS AS DETERMINED FROM THE COMPOSITION OF 12 RUMEN SAMPLES COLLECTED JANUARY-MARCH, 1967.....	31
VII. TAXA WITH LESS THAN 10 PERCENT FREQUENCY AND 1 PERCENT CANOPY COVERAGE IN VEGETATION TYPES AS DETERMINED BY EXAMINATION OF 2 x 5 DECIMETER PLOTS.....	38
VIII. PERCENTAGES OF BIGHORN SHEEP, MULE DEER AND ELK OBSERVED JANUARY-MARCH, 1967, LISTED BY 1/16 SQUARE MILES.....	41

LIST OF FIGURES

Figure	Page
1. Study area showing vegetation types. Insert shows location of study area.....	2
2. Cliffs along Gallatin River.....	5
3. Bunchgrass vegetation type.....	5
4. Aerial photograph showing interspersions of open and forested types on the study area.....	7
5. Sagebrush vegetation type.....	11
6. Douglas-fir vegetation type.....	11
7. Lodgepole pine vegetation type.....	13
8. Quaking aspen vegetation type.....	13
9. Grid map of study area for use with Table VIII in showing locations of animal observations. Locations of observations of a recognizable mature ram and a lamb are shown.....	40

ABSTRACT

A study was conducted in Gallatin Canyon, southwestern Montana during January-March, 1967 to obtain quantitative data on range use, food habits and interspecific relationships of bighorn sheep, mule deer and elk. The physiography of the study area was described. Canopy coverage and frequency of occurrence of plant taxa provided a basis for quantitative descriptions of the vegetation which was divided into five broad types: bunchgrass, sagebrush, Douglas-fir, lodgepole pine and quaking aspen. A total of 1,001 observations of bighorns indicated a ewe-ram ratio of 100:31 and a ewe-lamb ratio of 100:57. The highest total count indicated a minimum of 98 bighorns on the winter range. A mature ram first observed in January with a mixed group traveled 4.3 airline miles before joining two other rams and remaining in an area of 55 acres during the last month of winter. A lamb was observed three times in 10 days in an area of .2 x .6 miles. Four aerial censuses were flown during the winter over the summer range and a maximum of 21 bighorns were observed wintering at 9,700-11,000 feet elevation. The estimated minimum mule deer population using the winter range was 113. Classification of 120 observations of mule deer indicated a doe-fawn ratio of 100:62. An estimated minimum elk population of 65 consisted of native elk and elk that migrated onto the study area from Yellowstone National Park. A total of 3,588, 1,954 and 540 observations of bighorn sheep, mule deer and elk, respectively, were recorded by vegetation type. Percentages of observations on the bunchgrass, sagebrush and Douglas-fir vegetation types for bighorns was 69, 9 and 20; for mule deer, 10, 33 and 48; and for elk, 18, 48 and 34, respectively. Winter food habits data were obtained by examination of 53, 29 and 12 bighorn sheep, mule deer and elk feeding sites, respectively, and by analysis of rumen samples. Grass and grass-like plants, forbs, and browse made up 72, 17 and 8 percent of the plants used by bighorns at feeding sites; 7, 29 and 62 percent by mule deer; and 63, 10 and 30 percent by elk, respectively. *Agropyron spicatum* and *Festuca idahoensis* together provided over one-half of the total diet of both bighorns and elk. *Artemisia tridentata* provided 30 percent of the total diet of mule deer and it was the most used browse plant by both bighorns and elk. Among forbs, *Artemisia frigida* and *Lupinus* spp. ranked first and second in usage, respectively, for both bighorns and elk and first and third for mule deer. Contents of rumen samples from each of 12 mule deer averaged 61, 19 and 16 percent for browse, forbs, and grass and grass-like plants, respectively. Utilization of bunchgrass and sagebrush as measured along transects indicated 92-96 percent use of bunchgrass and 53 percent use of sagebrush. The data indicated at least some competition between bighorns and mule deer. Competition between bighorns and elk was slight during the study but the similar food habits of the two animals could cause severe competition if elk increased their use of the bighorn sheep range. Intraspecific competition among the bighorns possibly was existent since the bighorns were restricted to a very small area and their utilization of *Agropyron spicatum* had reached severe levels. Present ewe-lamb ratios indicated at least average reproduction rates.

INTRODUCTION

A segment of the West Gallatin bighorn sheep (*Ovis canadensis canadensis* Shaw) herd as defined by Couey (1950) winters at relatively low elevations in Gallatin Canyon, southwestern Montana. According to local reports, bighorns were formerly more abundant than at present and wintered in at least four areas at low elevations: Squaw Creek, mouth of Taylor Fork, West Fork, and Deer Creek-Asbestos Creek (Figure 1). Except for a few scattered individuals, only the latter range is used extensively by bighorns at present. This winter range is also used by mule deer (*Odocoileus hemionus*) and elk (*Cervus canadensis*). Recent usage by livestock has apparently been non-existent. According to Venrick (1967), records of the Gallatin National Forest reveal no official grazing permits for domestic livestock during this century.

Gallatin Canyon has been the site of numerous big game investigations in the past with emphasis primarily on elk. I conducted full time field studies during the summer of 1966 and from January 5 to March 26, 1967, as well as part time studies during April, May and June of 1967. My objective was to obtain quantitative data on range-use, food habits, population characteristics and interspecific relationships of bighorn sheep, mule deer and elk on the Deer Creek-Asbestos Creek winter-spring range. Bighorn sheep, mule deer and elk relationships have been studied previously in Montana by Couey (1950) and Schallenberger (1966). Buechner (1960) discussed competition between bighorn sheep and other hoofed mammals including mule deer and elk in various parts of the Western United States. Cowan (1947) in Alberta and McCann (1956) in Wyoming also studied these relationships.

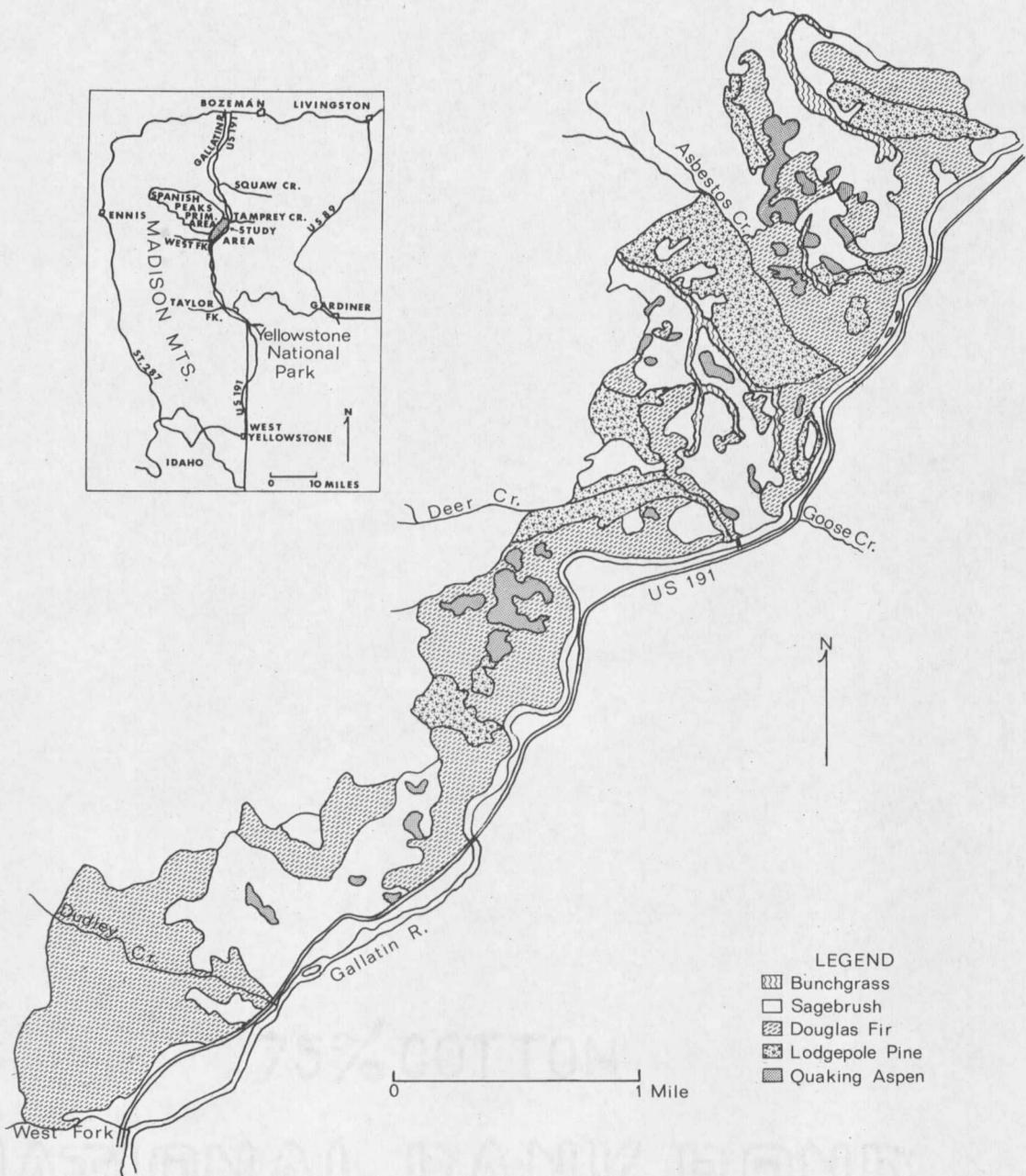


Figure 1. Study area showing vegetation types. Insert shows location of study area.

DESCRIPTION OF THE STUDY AREA

The Madison Mountain Range is about 60 miles long and 20-25 miles wide along a north-south axis with its north end approximately 20 miles southwest of Bozeman. The Spanish Peaks Primitive Area (51,026 acres) occupies the northern part. It is composed of a high, mountainous complex of 25 peaks 10,000-11,015 feet in elevation which slope to 6,000 feet. The study area, a 1-mile wide strip at an elevation of 5,800-7,900 feet, is located along and within the southeast corner of the primitive area. It is west of and parallels the Gallatin River and U.S. Highway 191 from the mouth of Tamprey Creek for about 6 miles to West Fork Creek which forms the south boundary (Figure 1).

Interpolation of data from U. S. Weather Bureau stations within 20 miles of the area indicated an average mean temperature of about 35 degrees F. with short cool summers and long cold winters with usually constant snow cover. Extremes were near 100 degrees F. and -55 degrees F. Annual precipitation was more or less evenly distributed throughout the year and averaged about 15-20 inches. Annual snowfall was approximately 120 inches but frequent southwesterly winds and "chinooks" kept the ridges blown clear and also prevented deep snow accumulation on the study area. The winter of 1967 had above average snowfall, above average temperatures in January and February, and below average temperatures in March and April. The result was a record snow pack at high elevations and 1-2 feet of snow

on the level at 6,000 feet throughout the winter.

McMannis and Chadwick (1964) described the study area as composed of Precambrian metamorphic rocks except for the ridge between Dudley Creek and West Fork Creek which is Paleozoic sediments. The area is a series of approximately parallel southeast trending drainages with some of the ridges ending in cliffs along the Gallatin River (Figure 2). The topographic features are a result of stream erosion, glaciation and mass gravity movements and the most prominent feature, the cliffs along the Gallatin River, was caused by the river incising through Recent terrace deposits.

