Population ecology of Rocky Mountain bighorn sheep in the upper Yellowstone River drainage, Montana/Wyoming
by Kimberley Alan Keating

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in Fish and Wildlife Management
Montana State University

Abstract:
A study was conducted in the upper Yellowstone River drainage of Montana and Wyoming between December 1979 and October 1981 to evaluate the history and possible causes related to an instance of natural recolonization of historic bighorn winter range and to provide baseline data on the current bighorn population. Seasonal ranges and movements were determined from 210 radio-relocations and 3,235 visual observations. Historical records indicated that current use of the Cinnabar Mountain winter range represents a natural recolonization, beginning about 1965, following extirpation of bighorns from that area during the late 1800's. Dispersal from the Mount Everts winter range population was postulated as the mechanism for recolonization. Census data on the Cinnabar Mountain winter range showed an exponential trend with a mean annual rate of increase per individual of 0.18 between 1967 and 1980. Census data for the Mount Everts winter range showed an exponential trend with a mean annual rate of increase per individual of 0.12 between 1965 and 1973, while numbers remained relatively stable at about 200 since 1974. Comparison of observed rates of increase per individual bighorn with estimated elk numbers on the northern Yellowstone winter range four years previously, suggested that elk numbers negatively impacted bighorn numbers on the Mount Everts winter range. Possible reasons for the observed time lag and the potential importance of this relationship to bighorn dispersal and ecesis were discussed. Bighorn winter food habits indicated a high potential for competition between elk and bighorns during conditions of severe winter weather and high elk numbers. Lamb:adult ewe ratios of 88:100 in 1979 and 71:100 in 1980, a mean suckling time of 26.4 seconds, and a log-normal mean lungworm larval output of 16 larvae per gram of dry fecal material were all suggestive of a high quality population, These factors were thought to be highly influenced by the mild weather during the study. Rapid ram maturation rates were also indicative of a high quality population and were thought to be less subject to immediate climatic conditions. Population responses following the recent mortality resulting from a Chlamydia outbreak on the Mount Everts winter range were suggested as a means of evaluating hypotheses on elk-bighorn relations.

STATEMENT OF PERMISSION TO COPY

In presenting this thesis in partial fulfillment of the requirements for an advanced degree at Montana State University, I agree that the Library shall make it freely available for inspection. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by my major professor, or, in his absence, by the Director of Libraries. It is understood that any copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Signature Kimberly A. Kersting

Date March 17, 1982

POPULATION ECOLOGY OF ROCKY MOUNTAIN BIGHORN SHEEP IN THE UPPER YELLOWSTONE RIVER DRAINAGE, MONTANA/WYOMING

by

Kimberly Alan Keating

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Fish and Wildlife Management

Approved:

Chairperson, Graduate Committee

Head, Major Department

Graduate Dean

MONTANA STATE UNIVERSITY
Bozeman, Montana

March, 1982

ACKNOWLEDGMENTS

To the following, among others, the author wishes to express his appreciation for their contributions to this study: Dr. Lynn R. Irby, Montana State University, who directed the study and aided in preparation of the manuscript; Drs. Richard J. Mackie and Harold D. Picton, Montana State University, for reviewing the manuscript; Mr. Glenn Erickson, Montana Department of Fish, Wildlife and Parks, for field assistance and technical advice; Dr. David E. Worley, Montana State University, for use of facilities and technical advice; Mr. Wayne F. Kasworm, Montana State University, for food habits analysis; Dr. Daniel Goodman, Montana State University, for assistance in data analysis; Dr. Mary Meagher, Yellowstone National Park, for assistance and technical advice; Dr. Douglas B. Houston, Olympic National Park, for use of his data and free exhange of ideas; Bill and Doris Whithorn, for use of the historic photos in their collection; and to the Rob and Bessie Welder Wildlife Foundation, the Montana Department of Fish, Wildlife and Parks, and the National Rifle Association for financial support. The author would also like to extend a special thanks to: Mr. Floyd Gordon, U.S. Forest Service, mentor in field biology, whose lessons and philosophies have proven invaluable; Dr. Robert Moore, Montana State University, whose calm advice and support were often appreciated; and, not least, to his parents, Dr. and Mrs. Eugene Keating, for their continued encouragement and support.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES (CONTINUED)

LIST OF FIGURES (CONTINUED)

ABSTRACT

A study was conducted in the upper Yellowstone River drainage of Montana and Wyoming between December 1979 and October 1981 to evaluate the history and possible causes related to an instance of natural recolonization of historic bighorn winter range and to provide baseline data on the current bighorn population. Seasonal ranges and movements were determined from 210 radio-relocations and 3,235 visual observations. Historical records indicated that current use of the Cinnabar Mountain winter range represents a natural recolonization, beginning about 1965, following extirpation of bighorns from that area during the late 1800's. Dispersal from the Mount Everts winter range population was postulated as the mechanism for recolonization. Census data on the Cinnabar Mountain winter range showed an exponential trend with a mean annual rate of increase per individual of 0.18 between 1967 and 1980. Census data for the Mount Everts winter range showed an exponential trend with a mean annual rate of increase per individual of 0.12 between 1965 and 1973, while numbers remained relatively stable at about 200 since 1974. Comparison of observed rates of increase per individual bighorn with estimated elk numbers on the northern Yellowstone winter range four years previously, suggested that elk numbers negatively impacted bighorn numbers on the Mount Everts winter range. Possible reasons for the observed time lag and the potential importance of this relationship to bighorn dispersal and ecesis were discussed. Bighorn winter food habits indicated a high potential for competition between elk and bighorns during conditions of severe winter weather and high elk numbers. Lamb:adult ewe ratios of 88:100 in 1979 and 71:100 in 1980, a mean suckling time of 26.4 seconds, and a log-normal mean lungworm larval output of 16 larvae per gram of dry fecal material were all suggestive of a high quality population. These factors were thought to be highly influenced by the mild weather during the study. Rapid ram maturation rates were also indicative of a high quality population and were thought to be less subject to immediate climatic conditions. Population responses following the recent mortality resulting from a *Chlamydia* outbreak on the Mount Everts winter range were suggested as a means of evaluating hypotheses on elk-bighorn relations.

INTRODUCTION

If one applies the traditional criteria of wide geographic distribution, numerical strength, and extensive temporal distribution, the genus *Ovis* must be regarded as historically among the most successful of the large Pleistocene mammals (Geist 1971). This characterization implies an ability to readily disperse into and colonize available habitat (Flerow 1967). Paradoxically, however, extirpation of bighorn sheep (*O. canadensis*) populations during historic times has not generally been followed by recolonization (Buechner 1960), despite the continued suitability of most historic habitat and periodic expansion of local populations (Geist 1971). The lack of documented instances of natural recolonization by bighorns has previously precluded empirical analysis of current hypotheses regarding this problem.

The purpose of this thesis is to: 1) document an instance of natural recolonization of historic bighorn range adjacent to Yellowstone National Park, 2) examine selected factors which may have been important in stimulating this recolonization, and 3) provide baseline data on current bighorn distribution and movements in the area and on current population status.

STUDY AREA

This study was conducted in the upper Yellowstone and Gallatin River drainages of Montana and Wyoming. The study area encompassed the southern portion of the Gallatin Range from Fortress Mountain south to Bighorn Pass (Figure 1). Movements of bighorns from previously known wintering areas (Figure 2) in Tom Miner Basin and on Cinnabar Mountain defined the extent of the study area. Both the Cinnabar (CWR) and Mount Everts (EWR) winter ranges are subunits of the northern Yellowstone winter range (NYWR) described by Houston (1980).

Land ownership is a mixture of National Park Service (Yellowstone National Park), U.S. Forest Service (Gallatin National Forest), and private lands, with minor areas in Tom Miner Basin controlled by the Bureau of Land Management.

Topography is characterized by a single major north-south divide which forms the crest of the Gallatin Range. Elevations in the area range from 1,575 meters at the Yellowstone River to 3,330 meters on Electric Peak.

Chester (1976) characterized the climate of the Gallatin Range as "severe with long winters, heavy snowfall, and short summers. Considerable snow usually remains on the higher portions of the area into July, while fall accumulations generally begin in October and November." During this study, winters were unseasonably warm and dry,

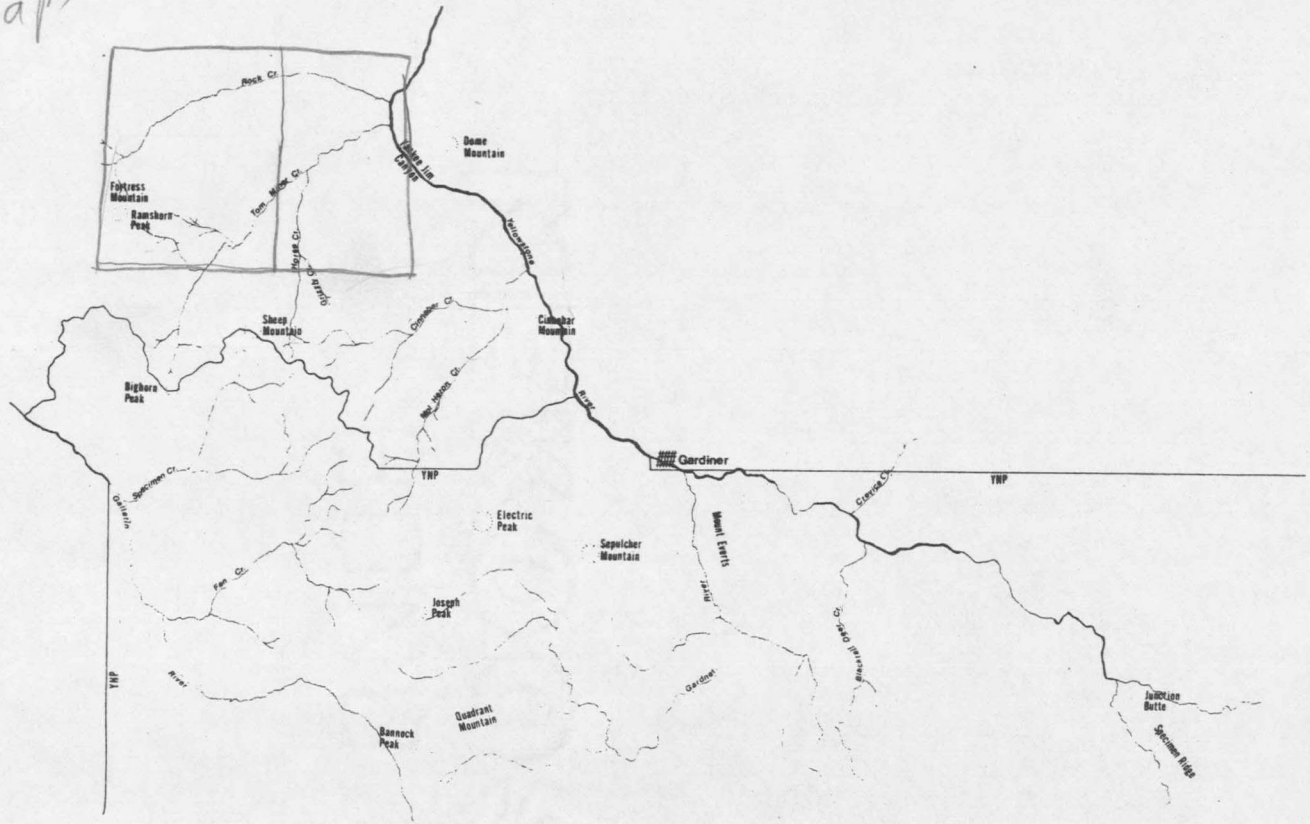

Figure 1. Map of areas and features mentioned in the text.