MONTANA STATE UNIVERSITY

Relationships between activity patterns and foraging strategies of Yellowstone grizzly bears
by Albert L Harting

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Biological Sciences
Montana State University
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Abstract:
Eleven grizzly bears (Ursus arctos horribilis) were radiotracked in Yellowstone National Park and vicinity in 1981 and 1982. Principal objectives of the study were 1: to examine the daily and seasonal activity patterns of Yellowstone grizzlies and to determine what influence certain temporal and environmental factors had on these activity patterns and 2: to examine the interrelationships of food habits, habitat use, movements, and activity patterns. Two methods for rating the quality of a bear's occupied habitat were employed. One method considered the abundance, diversity, and relative value to grizzlies of the vegetation occurring at field-checked relocation sites. The second method utilized existing habitat maps and a spatial information computer package to identify the habitats surrounding relocation points. These habitat types were then rated according to a system of Habitat Importance Values developed by the Interagency Grizzly Bear Study. Theoretical aspects of grizzly bear foraging strategies and predatory habits were also considered.

Environmental factors which had a significant effect on grizzly bear activity patterns were temperature, precipitation, and cloud cover. Some of the influence of environmental variables on bear activity could be explained according to their probable effect on olfactory perception. Temporal factors found to be important were season and time of day (diel period). Grizzlies in this study were primarily crepuscular and . nocturnal but individual bears differed significantly in their activity patterns. Individual differences in grizzly bear food habits and habitat use were reflected in their characteristic activity patterns and movements. Bears which occupied vegetatively poor habitat appeared to be more reliant on "supplemental" food sources (meat or garbage) than bears in rich mesic areas. The use of trained bear dogs to retrace grizzly bear movements proved to be a valuable adjunct to traditional research tactics.

RELATIONSHIPS BETWEEN ACTIVITY PATTERNS AND FORAGING STRATEGIES OF YELLOWSTONE GRIZZLY BEARS

by

Albert L. Harting, Jr.

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

of

Master of Science

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Biological Sciences

MONTANA STATE UNIVERSITY
Bozeman, Montana

March 1985

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Albert L. Harting

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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Date Feb 28, 1985

ACKNOWLEDGEMENT

I am sincerely grateful to the following people for their contributions to this study. My major professor, Dr. H. D. Picton, was the source of many valuable insights which were critical to the success of this project. Dr. R. R. Knight, Interagency Grizzly Bear Study, first proposed the project and provided the research opportunity and funds without which the study would not have been possible. Drs. R. L. Eng and R. E. Moore reviewed the manuscript and made many constructive suggestions. Ms. Georgia Ziemba, MSU Computing Services, was extremely helpful with the statistical analysis aspects of the study. I am especially grateful to Dave Mattson, IGBS, for providing me with his preliminary data pertaining to grizzly bear food habits and habitat use. The fieldworkers who assisted me with data collection, especially Terry Jones and Kevin Rhodes, deserve many thanks for remaining enthusiastic despite the long hours, lack of sleep, and oftentimes dreary conditions. S. R. Vaughan and L. Lobos deserve credit for providing inspiration as only they knew how. Finally, I wish to thank my family for their enduring patience and cooperation throughout this project. My parents and my uncle, Frank Harting, managed to give me ongoing encouragement and financial assistance. My wife, Linda, and son, Aaron, contended with the many long absences and mysterious moods which every graduate student surely knows.

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ABSTRACT

Eleven grizzly bears (Ursus arctos horribilis) were radiotracked in Yellowstone National Park and vicinity in 1981 and 1982. Principal objectives of the study were 1: to examine the daily and seasonal activity patterns of Yellowstone grizzlies and to determine what influence certain temporal and environmental factors had on these activity patterns and 2: to examine the interrelationships of food habits, habitat use, movements, and activity patterns. Two methods for rating the quality of a bear's occupied habitat were employed. One method considered the abundance, diversity, and relative value to grizzlies of the vegetation occurring at field-checked relocation sites. The second method utilized existing habitat maps and a spatial information computer package to identify the habitats surrounding relocation points. These habitat types were then rated according to a system of Habitat Importance Values developed by the Interagency Grizzly Bear Study. Theoretical aspects of grizzly bear foraging strategies and predatory habits were also considered.

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INTRODUCTION

Prior studies of the grizzly bear (Ursus arctos horribilis) in the Yellowstone ecosystem have contributed a wealth of data pertaining to the food habits, habitat use, and general ecology of this population (Mealey 1975; Graham 1978; Kendall 1981; Knight et al. 1981; Craighead and Mitchell 1982; Knight et al. 1984). These data provided the framework within which present management strategies were developed. But as the welfare of the Yellowstone grizzlies appears less certain, management decisions become increasingly complex and a need for data of still finer resolution becomes apparent.

Recently, expanding emphasis has been placed on bear behavior. Schleyer (1983) examined the activity patterns of Yellowstone grizzlies with respect to temporal and environmental variables. Sizemore (1980) also studied the activity patterns of grizzly bears. Two prior studies dealt partially with grizzly bear foraging strategies. Mealey (1975) found that Yellowstone grizzlies appeared to forage in three physiographically distinct feeding "economies" (lake, mountain, and valley/plateau), and felt that bears mainly occupied a protein food niche. Sizemore (1980) computed the energetic requirements of individual grizzlies and described how these bears maintained an energy balance by utilizing reserve fat to supplement the available foraging opportunity.

None of the studies cited above have attempted to correlate data from bear food habits and habitat use with data on bear activity patterns for individual bears. This study sought to provide an overview of the grizzly bear's activity pattern/foraging strategy complex.

The specific objectives of this study were:

1. To examine the daily and seasonal activity patterns of Yellowstone grizzlies, and to determine how these patterns fluctuated between individual bears and under different environmental conditions.
2. To determine how a given bear's activity patterns, movements, food habits, and habitat use were interrelated, and to contrast individual patterns to see how variation along one parameter appeared to affect the others.
3. To develop a conceptual overview of grizzly bear foraging strategies with reference to established optimal foraging theories.
4. To explore the feasibility of using trained bear dogs in bear research.

STUDY AREA

Administrative Context

The study area was located in the Greater Yellowstone Ecosystem of Wyoming and Montana and included parts of Yellowstone National Park and contiguous National Forest land (Figure 1). All of Yellowstone Park and much of the remainder of the study area have been designated as "Management Situation 1" grizzly habitat in accordance with the grizzlies' threatened status under the Endangered Species Act (87 stat 884, 16U.S.C. 1531-1543). This designation specifies that "grizzly habitat maintenance and improvement... and grizzly-human conflict minimization will receive the highest management priority. Management decisions will favor the needs of the grizzly bear when grizzly habitat and other land use values compete." (USFS and NPS 1979) The Park Service Grizzly Bear Policy stipulates that management policies will be designed to "1. perpetuate wild, free-ranging grizzly bear populations and, 2. minimize conflicts between humans and grizzly bears by reducing man-generated food sources and by regulating visitor distribution."

Geological Background

The present landscape of Yellowstone was produced by repeated episodes of sedimentation, faulting, volcanic activity and, ultimately, glaciation (Keefer 1972). Two major types of bedrock were

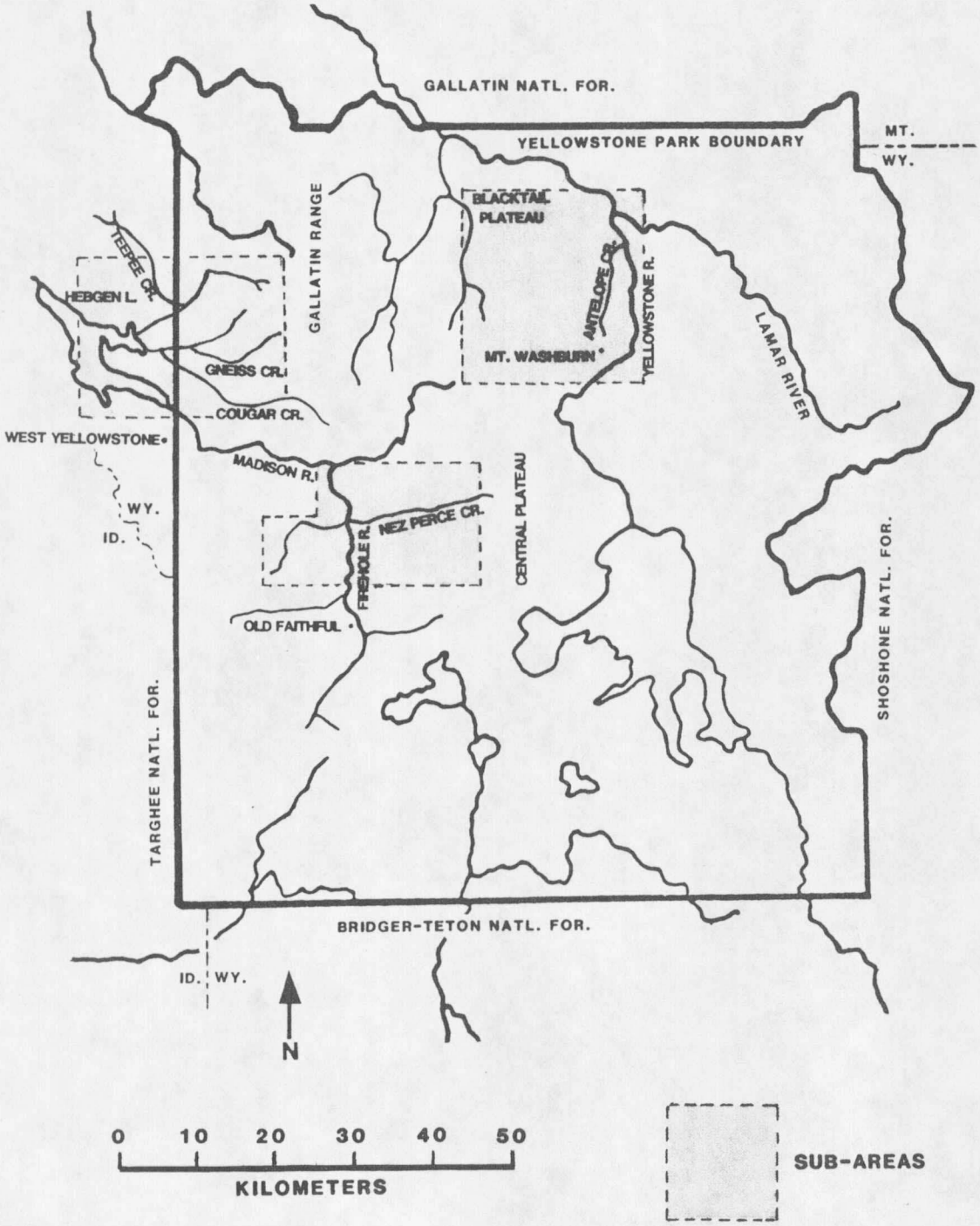

Figure 1. Map of the study area.

formed during periods of exceptional volcanic action in the Cenozoic era. The Absaroka bedrock was formed from major eruptions in the early Eocene which buried Yellowstone beneath thousands of feet of ash and lava. The Absaroka rocks were primarily andesite and basalt. The other major bedrock type- the Yellowstone volcanics- was deposited during three cycles of intense pyroclastic activity in the Quaternary period. The most recent of these cycles climaxed about 600,000 years ago with a major eruption of rhyolitic pumice and ash and the accompanying formation of the 2600 square kilometer Yellowstone caldera in the central portion of the Park. Lava continued to flow from ring fracture zones encircling the caldera until roughly 75,000 years ago. These flows were principally rhyolite, the so-called Plateau Rhyolite, but some basalt flows have also been identified. Eaton et al. (1975) suggested that the present hydrothermal activity in Yellowstone may be the seminal stage of a fourth volcanic cycle rather than the final phase of the third.

Yellowstone was glaciated at least three times. The most recent of these, the Pinedale glaciation, occurred 25,000 to 8,500 years ago and covered up to 90% of the present Yellowstone Park. Dams formed by the receding Pinedale glaciers eventually burst causing catastrophic flooding, the results of which are still evident in many areas.

Vegetation Zones

Although glaciation and erosion have redistributed and altered the composition of the original Absaroka and Yellowstone deposits, the

present vegetation appears to depend in large part on the underlying bedrock type. Despain (1973) described three major vegetation zones within Yellowstone National Park. The lodgepole pine (Pinus contorta) zone appears to be strongly associated with poor soils of Quaternary rhyolite origins. It is dominated by climax lodgepole pine with occasional spruce (Picea) and fir (Abies) occurring in favorable sites. This zone typically occurs at elevations of 2320-2560 meters (m) and receives relatively low (51-102 centimeters, cm) annual precipitation.

The spruce-fir zone is positively associated with the richer Absaroka (andesitic) volcanic soils. Mature stands may be dominated by either spruce or fir or, near timberline, whitebark pine (Pinus albicaulis). Successionally young stages include both spruce and fir in the understory and, frequently, vigorous stands of lodgepole pine. This zone occurs above 2560 m and generally receives greater than 102 cm annual precipitation.

The third major vegetation zone is the Douglas-fir (Pseudotsuga menziesii) zone. This zone is characterized by Douglas-fir as the dominant forest overstory with some spruce, fir, lodgepole, and aspen (Populus tremuloides) in favorable sites. Big sagebrush (Artemesia tridentata) and mixed grasses are common in open areas. This zone overlies mixed depths of glacial till and a bedrock of Quaternary sediments and granite at elevations of 1830-2320 m. Annual precipitation is generally less than 51 cm.

Study Area Sub-Units

Grizzly bears were radiotracked throughout much of the western and northcentral portions of Yellowstone Park at various times during this study. However, many of the data were collected in three principal subareas (Figure 1). Habitat types described below follow the classification of Mueggler and Stewart (1980) for grassland and shrubland and Steele et al. (1979) for forested areas as identified by Despain (1984) in Yellowstone Park (Table 1).

Table 1. Scientific names and abbreviations for habitat types referred to in the text. Habitat types follow the systems of Mueggler and Stewart (1980) for grassland and shrubland and Steele et al. (1979) for forest types.

Forest habitat types:	
ABLA/VASC-VASC	*Abies lasiocarpa* / *Vaccinium scoparium-V.scoparium*
ABLA/VASC-CARU	*A. lasiocarpa* / *V. scoparium-Calamagrostis rubescens*
ABLA/VASC-PIAL	*A. lasiocarpa* / *V. scoparium-Pinus albicaulis*
ABLA/CACA	*A. lasiocarpa* / *Calamagrostis canadensis*
PIEN/EQAR	*Picea engelmannii* / *Equisetum arvense*
ABLA/THOC	*A. lasiocarpa* / *Thalictrum occidentale*
ABLA/CAGE	*A. lasiocarpa* / *Carex geyeri*
ABLA/LIBO-VASC	*A. lasiocarpa* / *Linnea borealis-V.scoparium*
ABLA/VAGL-VAGL	*A. lasiocarpa* / *V. globulare-V.globulare*
ABLA/CARU	*A. lasiocarpa* / *C. rubescens*
PICO/CARO	*Pinus contorta* / *Carex rossii*
PICO/PUTR	*P. contorta* / *Purshia tridentata*
PSME/SYAL	*Pseodotsuga menziesii* / *Symphoricarpos albus*
PSME/CARU	*P. menziesii* / *C. rubescens*
PIAL/VASC	*P. albicaulis* / *V. scoparium*
Non-forest habitat types:	
FEID/AGSP	*Festuca idahoensis* / *Agropyron spicatum*
FEID/AGCA	*F. idahoensis* / *A. caninum*
FEID/AGCA-GEVI	*F. idahoensis* / *A. caninum-Geranium viscosissimum*
FEID/DECE	*F. idahoensis* / *Deschampsia caespitosa*
DECE/*Carex* spp.	*D. caespitosa* / *Carex* spp.
ARTR/FEID	*Artemisia tridentata* / *F. idahoensis*
ARTR/FEID-GEVI	*A. tridentata* / *F. idahoensis-G. viscosissimum*