Activity patterns and time budgets of grizzly bears in the Swan Mountains of Montana
by Erik Alexander Wenum

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

Abstract:
The continued existence of many grizzly bear populations will depend on their ability to co-exist with man. Studies have indicated that grizzly bears are able to avoid direct conflicts with humans by either avoiding areas of predictable human use or by shifting their activity rhythms to periods of low human disturbance. There is a need for greater understanding of how and when bears alter their activity to avoid these potential conflicts and what role age, sex, reproductive status and season play in their ability or need for these adjustments.

The specific objectives of this study were: 1) determine seasonal activity budgets and patterns of 6 adult female grizzly bears, 2) determine, as possible, activity budgets and patterns among various age, sex and reproductive classes by season.

Activity data were collected using a LOTEK SRX400 telemetry scanner/receiver unit. Data were collected over 3 seasons, spring, summer and fall, during 1992, 1993 and 1994. A total of 5384.5 hours of activity data were collected from 19 different bears.

Following a period of post-denning lethargy, bears gradually increase the amount of time spent in an active state, reaching a spring mean percent time active (PTA) of 75.3%. Bears were most active during the summer season with mean PTA's as high as 88.3% The high level of activity by all age, sex and reproductive classes is indicative of the hyperphagic activity bears enter during the berry season. In the early fall, bears continued this high level of activity, but this sharply declined as bears prepared for the upcoming denning season, with mean activity levels as low as 38%.

During the spring and summer seasons, bears began their active period at or near sunrise and were active through the day, with activity ending approximately 1.5 hours after sunset. During the fall, bears began their active period 1 -1.5 hours before sunrise, with near continuous activity ending 2 hours after sunset.

Although there were some differences by age, sex, reproductive status and season, grizzly bears in the South Fork were very active and highly diurnal in their activity patterns.

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APPROVAL

of a thesis submitted by

Erik Alexander Wenum

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.

Dr. Harold Picton _____ 12/9/98
Date

Approved for the Department of Biology

Dr. Ernie Vyse _____ 12/9/98
Date

Approved for the College of Graduate Studies

Dr. Joseph J. Fedock _____ 12/14/98
Date

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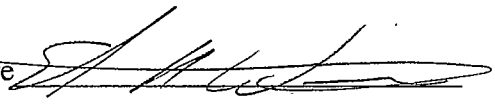
Signature 

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ABSTRACT

The continued existence of many grizzly bear populations will depend on their ability to co-exist with man. Studies have indicated that grizzly bears are able to avoid direct conflicts with humans by either avoiding areas of predictable human use or by shifting their activity rhythms to periods of low human disturbance. There is a need for greater understanding of how and when bears alter their activity to avoid these potential conflicts and what role age, sex, reproductive status and season play in their ability or need for these adjustments.

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Although there were some differences by age, sex, reproductive status and season, grizzly bears in the South Fork were very active and highly diurnal in their activity patterns.

CHAPTER 1

OVERVIEW

Introduction

Currently, within the 48 contiguous United States, there are only 6 areas that contain remnant or self-perpetuating populations of grizzly bears (*Ursus arctos horribilis*) (Patnode and LeFranc 1987). All of these areas are experiencing a loss or degradation of habitat through resource extraction and/or human disturbance and development. Of these areas the Northern Continental Divide Ecosystem (NCDE) stands the best chance of retaining grizzly bears in the future. The NCDE includes parts of 5 National Forests (Flathead, Helena, Kootenai, Lewis and Clark, and Lolo), 4 designated wilderness areas (Bob Marshall, Great Bear, Mission Mountains, and Scapegoat), Glacier National Park (GNP), and state and private lands. While a large portion of the NCDE is protected from resource extraction (GNP and the wilderness areas), all of it is subject to the pressures of an increasing human population and human recreational pursuits.

With this increasing demand, the survival of many grizzly bear populations will depend on their ability to coexist with humans. Previous studies have indicated that grizzly bears are able to avoid direct conflicts with humans by either avoiding areas of predictable human use or by shifting their activity rhythms to periods of low human disturbance (Gunther 1991, McCann 1991, Aune and Kasworm 1989, McLellen 1989a,

1989b, 1989c, McLellen and Shackleton 1989a, 1989b, 1988a, 1988b).

There is a need for greater understanding of how and when bears alter their activity rhythms to avoid these potential conflicts and what role age, sex, reproductive status, and season play in the ability or need for this adjustment. Additionally, it is uncertain what cost these behavioral shifts may impose either from an energetics or forage efficiency and, ultimately, a reproductive fitness standpoint. This question is of importance for a wide variety of species due to the difficulty in associating behavioral disruptions to demographic consequences (Shank 1979).

The activity rhythms of a species are of interest for several reasons (Roth 1983). Once activity rhythms have been quantitatively described, they may be used to interpret the level of stress the population is experiencing. There are 2 aspects of an activity rhythm, activity budgets and activity patterns. Activity budget refers to the amount of the diel period spent in an active state. Activity pattern refers to the diel rhythms of activity.

Research on grizzly bear populations has been hampered by biological and logistical constraints. Grizzly bears exhibit complex individual and intraspecific behavioral patterns, have secretive habits, an aggressive temperament, and the ability to move long distances in a short period. They also inhabit mountainous and densely vegetated habitats which hampers observation. Grizzly bears also have lower reproductive rates and population levels relative to other species.

The Montana Department of Fish, Wildlife and Parks initiated the South Fork of the Flathead River Grizzly Bear Project (SFGP) in 1987 as a 10-year population dynamics and habitat selection study. A primary objective of the SFGP was to determine if current

ecological conditions within the study area are adversely affecting grizzly bear survival and, thus, population growth.

The specific objectives of this study were to:

1. Develop and validate a technique for the collection of continuous activity data.
2. Determine seasonal activity budgets and patterns of 6 focal adult female grizzly bears.
3. Determine activity budgets and patterns among various age, sex, and reproductive classes.
4. Determine if differences exist between activity budgets and patterns of 6 focal adult female grizzly bears when using roaded and unroaded habitats.

Study Area

The study area was located in the South Fork of the Flathead River drainage in northwestern Montana (48° 1' N 113° 43' W) and encompasses approximately 938 km² (Figure 1). The area extended from Pioneer Ridge south to the Bob Marshall Wilderness area boundary. The western and eastern boundaries were the Swan Valley and Hungry Horse Reservoir, respectively. The study area was primarily within the boundaries of the Flathead National Forest and was administered by Hungry Horse, Spotted Bear, and Swan Lake Ranger Districts.

Northwest Montana is influenced by Pacific maritime weather patterns, with average annual precipitation in excess of 80 cm, > 50% in snow. Temperature and precipitation, collected at the Hungry Horse Dam weather station, varied by season. Spring (8 May - 15 July) temperatures ranged from 2.8°C to 31.7°C with a mean of 14.8°C. Summer (16 July - 15 September) temperatures ranged from 1.1°C to 36.1°C with a mean of 19.1°C. Fall (16 September - 15 November) temperatures ranged from -6.1°C to 27.2°C with a mean of 6.8°C. Total precipitation for spring, summer and fall were 18.4 cm, 5.0 cm, and 17.4 cm respectively (NOAA 1994). At higher elevations weather conditions were more severe, with an average annual precipitation in excess of 250 cm (Manley and Mace 1992).

The South Fork of the Flathead is characterized by rugged mountainous topography, and elevations vary from 914 m in the Flathead Valley to over 2,736 m along

the Swan Mountain Divide. Complex local climates and the rugged topography create a mosaic of vegetation. Over 50% of the study area was closed timber, with the remainder broadly classified as cutting units, open ridges, parks, avalanche chutes, and rock land. The alpine zone of the Swan Mountains is of severely broken and jagged topography, resulting in the true alpine flora being dispersed with large expanses of intervening bedrock (Mace and Aune 1988).

Nearly every drainage in the western portion of the study area has a primary, secondary or tertiary road. Many of these roads are seasonally or permanently closed to vehicular traffic. Recreational activities in the study area include big game hunting, fishing, hiking, camping, wood cutting, berry picking, snowmobiling, and riding all terrain vehicles (ATV's).

Daily human intrusion during the spring and summer seasons is best characterized as light with the exception of the Jewel Basin Hiking Area and it's access points, which experienced moderate recreational use, particularly during the summer season. During the fall, season human intrusion into the area is best characterized as moderate to heavy due to an increase in vehicular traffic, hiking, and stock use during the big game hunting season.

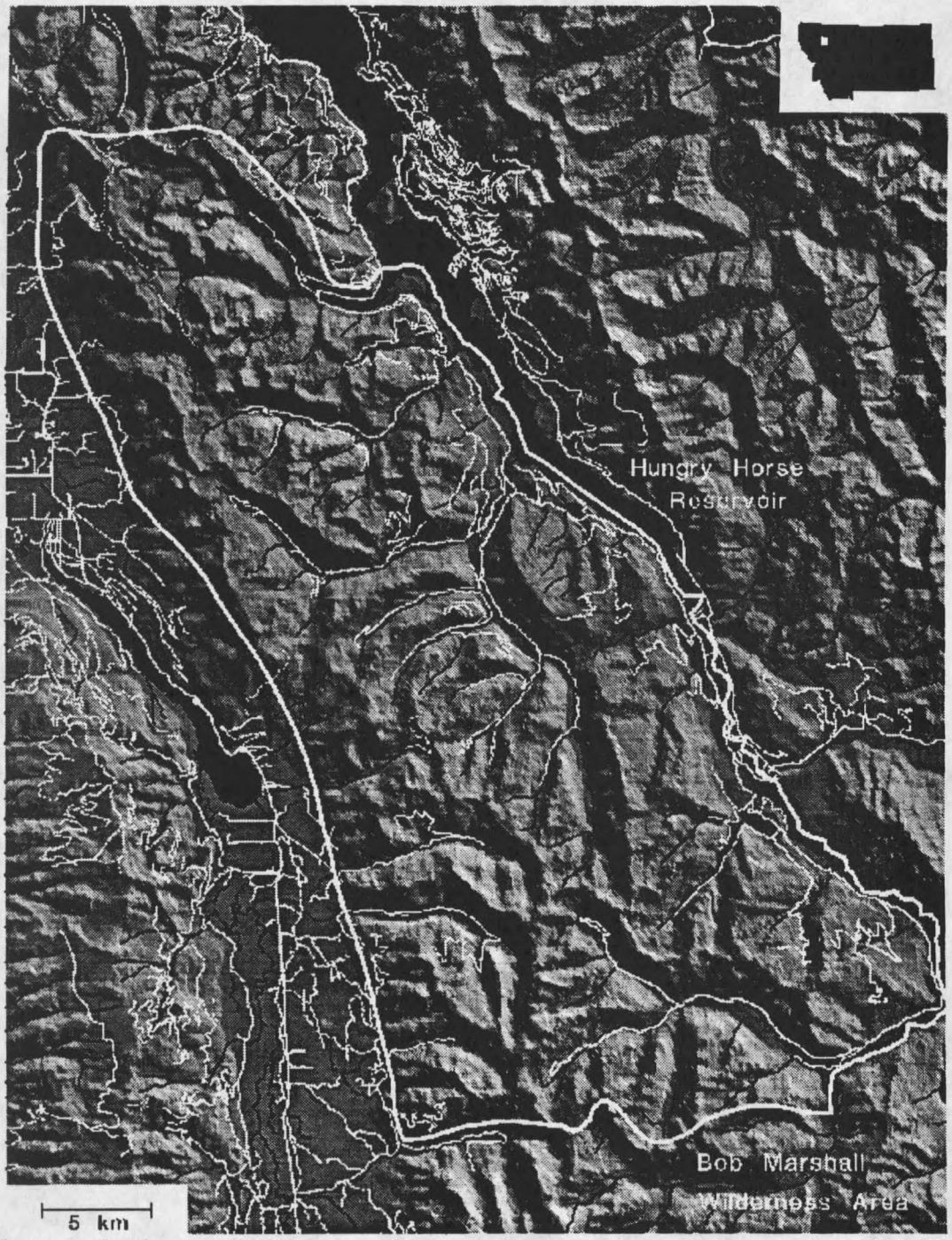

Figure 1. Study Area Map

Methods

There have been many studies using biotelemetry techniques to document activity rhythms of grizzly bears in both the United States and Canada and the brown bear of Europe (i.e. McCann 1991, Clevenger et al. 1990, Aune and Kasworm 1989, Bjarvall and Sandegren 1987, Harting 1985, Schleyer et al 1984, Aune and Stivers 1983, Roth 1983, Roth and Huber 1986, Schleyer 1983).

Advantages to remote sensing techniques include; 1) increased observer safety when studying potentially dangerous animals, 2) elimination of observer effects on the study subject, 3) elimination of the need for direct observation, which can be compromised by darkness, dense vegetation, inclement weather, topography, and the subject's mobility (McCann 1991). Disadvantages of remote sensing result from uncertainty in classifying an activity state based on a monitored variable. Some degree of uncertainty is often associated with the variable (i.e. signal strength or pulse rate) due to sudden changes in it's character. Additional uncertainty may result from procedural or system biases that favor a particular activity state (Jacobsen and Wiggins 1982).

Previous studies used either signal strength fluctuations of fixed pulse rate radio collars (Bjarvall and Sandegren 1987, Roth and Huber 1986, Harting 1985, Roth 1983) or radio collars equipped with tip switches that alternated the pulse between 2 rates depending on the vertical orientation of the collar (McCann 1991, Clevenger et al. 1990, Aune and Kasworm 1989, Harting 1985, Schleyer et al. 1984, Aune and Stivers 1983,