

# FACTORS INFLUENCING HUMAN-GRIZZLY BEAR INTERACTIONS IN A BACKCOUNTRY SETTING

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**Abstract:** Interactions between humans and 7 species of wildlife, including grizzly bears (*Ursus arctos horribilis*), were investigated in backcountry areas of the Gallatin Range, Yellowstone National Park, during the summers of 1973 and 1974. Grizzly bear distribution, movements, and behavior and human behavior were examined. Because grizzlies utilized areas with elevations much in excess of the study area's average trail elevation, the likelihood of the off-trail party observing a grizzly bear was 3-4 times greater than that of a trail-traveling party. During the hiking season, grizzlies exhibited an elevational migration. The frequencies of on-trail and combined on- and off-trail observations and sign discoveries per party tended to peak during those periods that grizzlies were found at low elevations. Activity patterns of grizzlies at the point of first observation or after the bears had become aware of the human presence did not indicate behavioral traits likely to accentuate the possibilities of human-bear confrontations. Some backcountry travelers engaged in activities that could increase detrimental encounters with grizzly bears.

Little research has been done on human-wildlife interactions in backcountry settings.

In 1973-74, the National Park Service in cooperation with Montana State University undertook a study of human-wildlife interactions in the Gallatin Range of Yellowstone National Park. Specific objectives were (1) to gather quantitative data on the intensity and kinds of human use in the study area; (2) to gather quantitative data on the distribution, movements, and behavior of wildlife in the study area; (3) to analyze the relationship among these factors to determine the cause and predictability of human-wildlife interactions; and (4) to make recommendations consistent with Park goals concerning humans and wildlife in the backcountry setting. Although 7 species were studied, this paper is primarily concerned with interactions between humans and grizzlies.

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## STUDY AREA

The study area of roughly 1,036 km<sup>2</sup> includes the Gallatin Range in northwestern Yellowstone National Park (Fig. 1). The area consists of a north-south ridge of mountains, with an average crest elevation of 2,876 m. Stream valleys of the Gallatin, Gardner, and Madison River drainages dissect the range. Area elevations vary from 2,049 m to 3,330 m.

The climate of the Gallatin Range is severe with long winters, heavy snowfall, and short summers.

Snow depths dictate the beginning and end of the hiking season (late June to October).

A complex of herbivores and carnivores exist in the area. The most abundant herbivore species is the elk (*Cervus canadensis nelsoni*). Others commonly found include moose (*Alces alces shirasi*), mule deer (*Odocoileus hemionus hemionus*), and bighorn sheep (*Ovis canadensis canadensis*). Major carnivores in the area are coyotes (*Canis latrans*), black bears (*Ursus americanus*), and grizzly bears.

The spruce-fir zone, dominated at climax by Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*), is the predominant vegetation zone within the study area (Despain 1973). According to Despain (1973), this zone lies at an elevation of 2,560 to 3,048 m. An alpine tundra zone, dominated by dense matlike vegetation, occurs above 3,048 m, and a lodgepole pine zone lies between 2,316 m and 2,560 m (Despain 1973). The latter zone consists of dense stands of lodgepole pine (*Pinus contorta*) interrupted by large open areas with sagebrush (*Artemisia* spp.)-grass communities.

The study area is traversed by 4 major east-west trails (Fig. 1). The trails follow stream drainages with the exception of the upper portions of the Fawn Pass west trail. Consequently, they are lower than the surrounding terrain. Twenty-nine wilderness campsites were scattered throughout the area.

## METHODS

Data on the kinds, intensity, and distribution of human use were obtained from backcountry use records of the National Park Service, questionnaires, and personal observations and interviews. Data on bear distribution and behavior were gathered through the return of 258 questionnaires sent to backcountry visitors and by systematically traversing the study area, either on

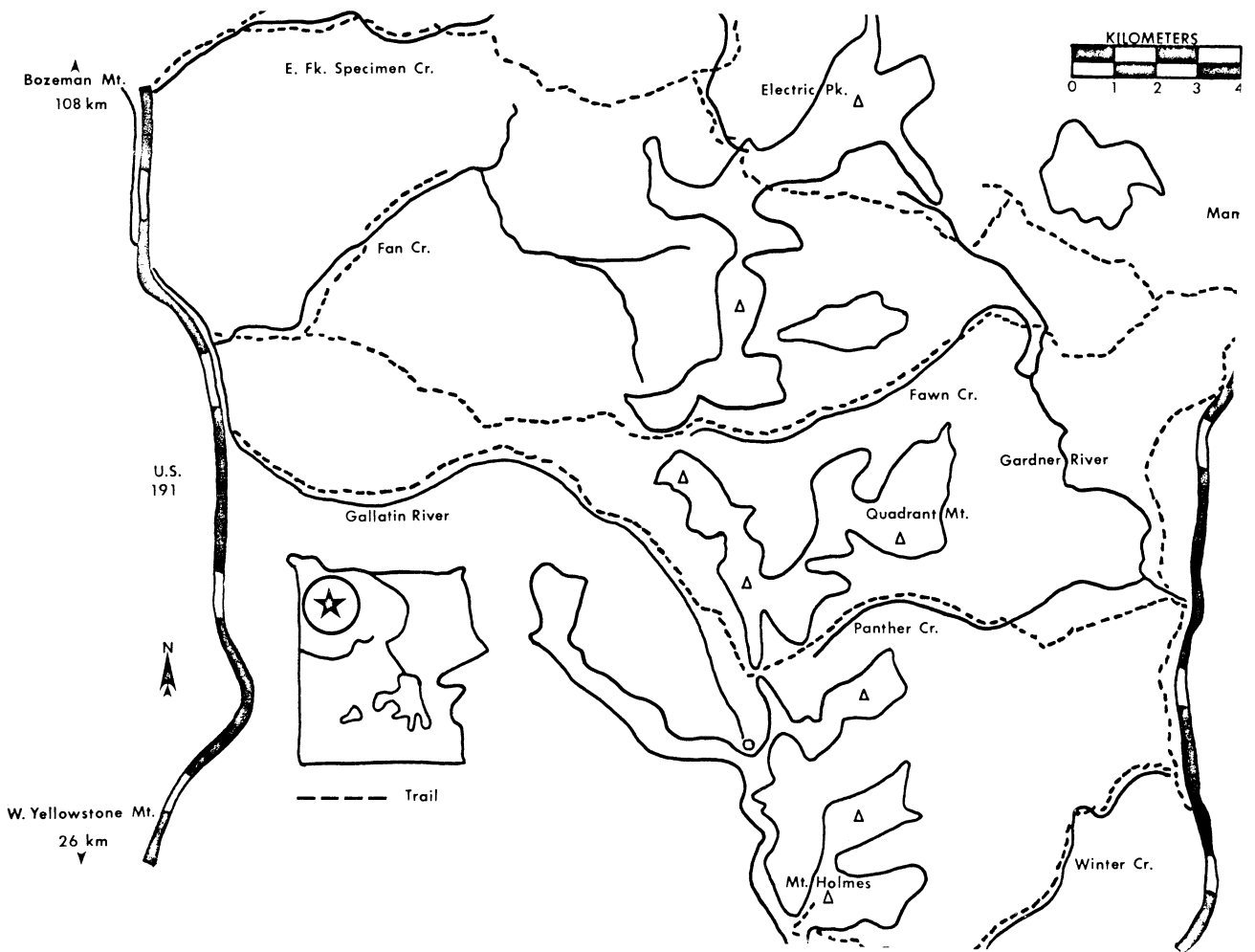


Fig. 1. The Gallatin Range, Yellowstone National Park.

foot or horseback (Chester 1976). The area was traversed 6 times at 2-week intervals in 1973 (30 June-29 September) and 1974 (4 July-7 October) for a total of 127 field days. Circuits consisted of relatively fixed routes that included established trails as well as areas seldom visited by humans. In 1974, supplemental information was obtained during 3 aerial flights.

In 1974, a record was maintained of all bear sign, following procedures used by Knight (1974). Species determinations from scats and tracks were made by a combined evaluation of the locality where the sign was found and of the measurements of the sign (Murie 1954, Greer and Craig 1971). Ages of scats were estimated by moisture content, freshness of constituents, and decomposer activity. Tracks were aged by the clarity and sharpness of impression in relation to the substrate. It was often possible to calculate a maximum age of sign since it had been left subsequent to the last trip through the study area. To calculate discovery frequencies, only sign left within 2 weeks of discovery was used.

## RESULTS

### Elevation of Human-Grizzly Bear Interactions

In the Gallatin Range, trail elevations, elevation of the area as a whole, and elevational distribution of wildlife combined to influence the nature of actual or potential human-wildlife interactions. Since the trails follow stream drainages, most sections of the trails lie far below the average Gallatin crest elevation (2,876 m), and the average elevation of the trails, 2,419 m, is

nearly 61 m less than that of the area as a whole. Consequently, off-trail travel in a given area usually involves higher-elevation travel than does on-trail travel.

Average observation elevations for all species studies except moose exceeded the area's average trail elevation, indicating the need for off-trail travel if frequent observations of most area species are to occur (Table 1). Those species occupying the highest elevations generally had the lowest ratios of on- to off-trail observation frequencies (Table 1). Since the average observation elevations of grizzly bears exceeded those of all other species, except bighorn sheep, the ratio of on- to off-trail observation frequency for this species was among the lowest of any studied. Off-trail travelers observed grizzlies 3-4 times as frequently as on-trail travelers (Table 1).

During the course of the hiking season, grizzlies exhibited an elevation migration, moving from low (May-June) to high elevations and back to low elevations (September-October) (Table 2). This migration was also observed by Mealey (1975). The average observation and discovery elevations exceeded the average trail elevation during all phases of the migration, resulting in frequencies of off-trail observation and sign discovery generally exceeding the corresponding on-trail frequencies throughout the study period (Tables 2, 3). However, during those periods when grizzlies were at relatively low elevations, the frequencies of on-trail and combined on- and off-trail observations and sign discoveries tended to peak, indicating a convergence in

**Table 1.** The relationship between the average observation elevation of each species and the frequency of on- and off-trail observations of these species in the Gallatin Range, Yellowstone National Park, 1973-74. Average observation elevations are based upon personal ground and aerial observations.

Species	Average observation elevations (N)	Personal observations			Questionnaire observations		
		On-trail observations per hour	Off-trail observations per hour	On/off-trail ratio	On-trail observations per hour	Off-trail observations per hour	On/off-trail ratio
Bighorn sheep	2,833 m (14)	<0.002	0.015	0.13	0.002	0.013	0.15
Grizzly bear	2,824 m (13)	0.005	0.021	0.24	0.003	0.011	0.27
Elk	2,642 m (421)	0.220	0.501	0.44	0.046	0.099	0.46
Black bear	2,637 m (10)	0.007	0.015	0.47	0.004	0.009	0.44
Mule deer	2,590 m (46)	0.047	0.067	0.70	0.011	0.019	0.58
Coyote	2,539 m (19)	0.021	0.024	0.88	0.008	0.028	0.29
Moose	2,386 m (42)	0.073	0.028	2.61	0.035	0.026	1.35

**Table 2.** Average elevations, by month, of observations and sign discoveries of grizzly bears in the Gallatin Range, Yellowstone National Park, 1973-74. Average elevations are based upon personal ground and aerial observations.

	Month			
	May-June ( <i>N</i> )	July ( <i>N</i> )	August ( <i>N</i> )	September- October ( <i>N</i> )
Observation	2,979 m (1)	2,819 m (5)	2,846 m (5)	2,703 m (2)
Sign discovery	2,562 m (9)	2,780 m (39)	2,601 m (45)	2,560 m (36)

the areas of human and grizzly bear activity (Tables 2, 3). Notable exceptions to the above statement are observation frequencies by the writer, which were highest during the period when grizzly bears were using the highest elevations. This exception probably reflects the combination of personal off-trail travel at high elevations and the increased high-elevation observability of grizzly bears because of sparse vegetation.

### Bear Activity Patterns

To examine the nature of human-grizzly encounters, data were gathered on bear encounter distances, initial bear activity upon observation or encounter, and bear response to the human presence. Encounters are defined as an interaction between humans and bears; an observation did not necessarily involve interaction. The average personal encounter distance for 6 grizzlies was 119 m, which was exceeded only by the average for black bears. One-third of the encounters occurred at distances greater than 152 m. The most commonly observed grizzly bear activity immediately upon observation or encounter was feeding (Fig. 2). No grizzlies were observed while resting. The level of alertness (including stationary alert and running reactions) was comparable to or exceeded that of 4 of the other species studies (Fig. 2). In examining wildlife response to the human presence, the ratio of the percent of occurrence of alert stationary response to alert flight response is

**Table 4.** Species comparison of the percentages of occurrence of alert flight and stationary alert responses to the presence of humans, Gallatin Range, Yellowstone National Park, 1973-74. Percentages for moose, coyote, elk, mule deer, and bighorn sheep are based only upon backcountry visitor results.

Species	Total number	Percentage of occurrence		Stationary-flight ratio
		Stationary alert (%)	Alert flight (%)	
Grizzly bear				
Visitor	7 <sup>a</sup>	0.0	85.7	0.00
Personal	6	0.0	100.0	0.00
Black bear				
Visitor	17	5.9	94.1	0.06
Personal	3	0.0	100.0	0.00
Coyote	32	9.4	90.6	0.10
Mule deer	39	12.8	87.2	0.15
Bighorn sheep	12	16.7	83.3	0.20
Elk	121	28.1	71.9	0.39
Moose	96	41.7	58.3	0.72

<sup>a</sup>One visitor group encountering a grizzly bear failed to report the bear's response.

lowest for the grizzly bear, suggesting that the grizzly is more wary of the human presence than most other species (Table 4).

### Backcountry Traveler Activities

Backcountry travelers were observed in, or reported, activities that could increase confrontations with grizzly bears. The percentages given below are based upon numbers of groups responding to a given question rather than on numbers of questionnaires returned. Twenty-one percent of the parties ( $N=197$ ) reported their groups were fragmented into subgroups of 1-2 persons during at least part of their trip. Table 5 suggests that groups of this size are more prone to observe wildlife than are larger parties. One hundred percent of the grizzly bear encounters reported by backcountry visitors ( $N=7$ ) involved 1-2 persons.

In grizzly country, proper handling of food is important. Herrero (1976) tentatively holds poor management of garbage and food responsible for 49 of the

**Table 3.** Frequencies of on- and off-trail and combined on- and off-trail grizzly bear observations and sign discoveries during the course of the field period, Gallatin Range, Yellowstone National Park, 1973-74. Sign discovery frequencies are for 1974 only.

Form of interaction	Observations or discoveries per hour											
	Combined on- and off-trail				On-trail				Off-trail			
	May-June	July	August	September-October	May-June	July	August	September-October	May-June	July	August	September-October
Personal observation	-	0.017	0.008	0.009	-	<0.007	0.007	0.008	-	0.036	0.011	0.010
Sign discovery	-	0.201	0.260	0.281	-	0.132	0.306	0.235	-	0.289	0.181	0.343
Visitor observation	0.009	0.003	0.003	0.005	0.010	0.003	<0.001	0.004	<0.014	0.006	0.024	0.010

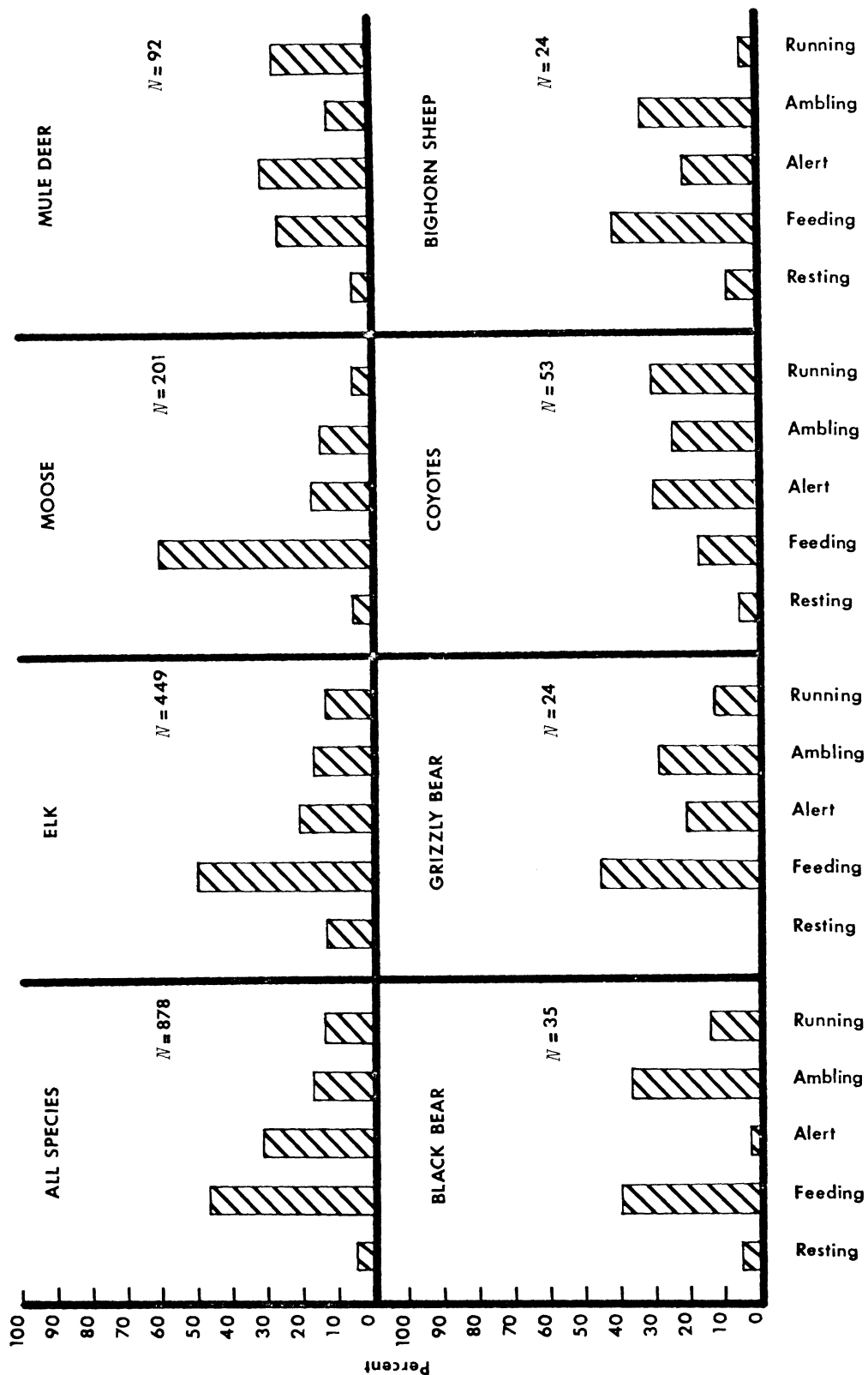


Fig. 2. The initial activities of all species combined and of each species upon encounter or observation by the investigator and the backcountry visitor.

**Table 5.** Frequencies of wildlife observations by parties of various sizes, Gallatin Range, Yellowstone National Park, 1973-74.

	Party size					
	1 (N)	2 (N)	3 (N)	4 (N)	5 (N)	(N)
Observations per hour	0.11 (50)	0.14 (91)	0.15 (27)	0.09 (19)	0.02 (3)	0.06 (6)

54 camping-related human-grizzly bear incidents that occurred from 1872 to 1973 in North America's national parks. Relevant factors are the types of food used, ultimate disposition of excess food, and methods used for securing food. The use of fresh and canned food as opposed to dried food probably increases the potential for attracting grizzly bears into camps. The fact that nearly 60 percent ( $N=248$ ) used fresh and/or canned food at one time or another points out a potential problem.

Less than 5 percent of the parties ( $N=170$ ) reported dumping or burial of excess food. Thus, there seemed to be general knowledge of the correct procedures for handling leftover food. Whether this knowledge is translated into action is questionable. Seventy-five searches of camps for food and food-related items were made. Food was found in 21 percent of the searches and major food items in 8 percent.

On a number of occasions, backcountry parties were encountered who either had not secured their food or secured it in or very near their camps. Ninety-one percent ( $N=249$ ) of the groups stated that they secured their food before sleeping. Only 83 percent ( $N=246$ ) secured food before absences from camp. Although most groups were aware of the necessity for securing their food, the distances from camp at which they did so seem to indicate naiveté toward the potential danger of bear encounters. Eighty-two percent ( $N=225$ ) secured their food within 92 m of camp and over 90 percent ( $N=225$ ) within 137 m. Because of short-distance speed of bears, food cached at these distances may invite problems. Herrero (1970:596) pointed out that "Even at 100 yards [92 m] a person has little time to

think or maneuver if a grizzly suddenly finds its individual distance violated and is startled into making an attack."

## DISCUSSION

Backcountry use in the Gallatin Range was highest during July and August (1973-74), totaling 76 percent of the May-through-October use. During periods of peak human use, grizzly bears were using high-elevation off-trail areas. During those periods when the bears were found in the lower-elevation trail areas, human use was minimal. Thus, there appear to be natural checks to human-grizzly bear confrontations in the Gallatin Range provided that the numbers of people in the backcountry areas remain low in May-June and September-October and that people remain on the trails. Since the grizzly bear is a high-elevation species in these areas, campsite confrontations can probably be minimized by limiting camping to areas below 2,591 m.

Activity patterns of grizzlies at the point of first observation and after bears had become aware of the human presence did not suggest aggressive behavioral traits likely to increase the possibilities of human-bear encounters. Grizzlies were encountered at greater distances than most other species (possibly because they use areas of open vegetation). They are an alert species, and there was no indication of innate aggressiveness in those cases where bears were able to flee without molestation.

A considerable number of backcountry travelers reported engaging in activities that could increase detrimental encounters with grizzly bears. The reported figures are probably conservative since some visitors would not report activities considered unsafe. Some unsafe activities can be eliminated by better education of the backcountry traveler. In areas where there are permit systems, the permit briefings should be used to refresh the visitor's knowledge of camping and traveling procedures in grizzly bear country, and the information system should be extended into backcountry areas by backcountry rangers.

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