

BLACK BEAR AGGRESSION IN THE BACKCOUNTRY OF YOSEMITE NATIONAL PARK

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Abstract: Nine hundred and ninety-two interactions were recorded between black bears (*Ursus americanus*) and visitors in the backcountry of Yosemite National Park during 1978–79. Ursid aggression was observed in less than 6% of the interactions and less than 2% of the total bear behaviors recorded during those interactions. Running toward and jumping toward visitors constituted more than half of these aggressive behaviors. Age of visitors and distance between bears and people were 2 of the few factors correlated with bear aggression. Visitors usually responded to bear aggression with fear or neutrality. Understanding the circumstances in which black bears become agonistic can help park managers better prepare visitors for encounters.

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Bears may be the most feared of North American mammals. The association of grizzly (*U. arctos horribilis*) and Alaskan brown bears (*U. a. middendorffi*) with American black bears has caused many people to dread any bear. This confusion is particularly notable in western parks, where black bears are often not black in color. These factors, coupled with a history of black bears injuring and even killing people in some areas of North America (McCullough 1982), have made bear aggression worthy of closer study.

Black bear aggression has usually been studied by observing captive bears, often in intraspecific interactions. For example, Henry and Herrero (1974) documented social play between captive cubs and described differences between play fighting and adult aggressive behavior. Pruitt (1976) also studied play and agonistic behavior in captive black bears and developed a model of intraspecific interactions. Jordan (1976) documented a sequence of somewhat predictable behaviors during offensive threats toward conspecifics and humans, a few of which were recorded for free-ranging bears in the backcountry of Great Smoky Mountains National Park (GSMNP). Petko-Seus (1985) documented 26 human-bear interactions in the backcountry of the Smokies, and Chester (1980) reported 35 observations of black bears and people interacting in the backcountry of Yellowstone National Park. Herrero (1983) collected data on both intraspecific and interspecific relationships at a garbage dump in Jasper National Park. However, the most detailed investigation of human-bear interactions was conducted at several front-country locations of GSMNP (Tate and Pelton

1983). Tate and Pelton (1983) reported several factors that appeared to make free-ranging bears aggressive toward human visitors. The purpose of this paper is to discuss agonistic behavior of black bears observed during a human-bear interaction study in the backcountry of Yosemite National Park.

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STUDY AREA

The study was conducted in Yosemite National Park in east-central California on the western slope of the Sierra Nevada. Yosemite's vegetation runs in broad belts, which are determined largely by the temperature and precipitation characteristic of the specific location and elevation (Hood and Hood 1969). Elevations range from 648 to 3,997 m. In general, the climate is Mediterranean, with hot, dry summers and cool, moist winters. Much of the Park is not prime black bear habitat, particularly at higher elevations (Graber and White 1983), but bears have been ranging in recent years as high as the subalpine areas (Keay and van Wagten-donk 1983).

Yosemite encompasses over 308,000 ha; about 277,000 ha are located in the backcountry (Keay and van Wagten-donk 1983). "Backcountry" is defined as any portion of the park > 1.61 km from a road; thus,

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the remainder of the park is considered "front-country." There are 1,159 km of maintained trails. About two-thirds of backcountry use occurs during the 100-day summer season between Memorial Day and Labor Day, and about 40% occurs in only 19% of the travel zones (van Wagendonk 1981). Annual backcountry visitation averaged over 70,000 in the late 1970s (Keay and van Wagendonk 1983).

We observed human-bear interactions in 9 distinct areas, although 5 of these sites contributed over 99% of the data. Only 1 site was considered a day-use area, but numerous backpackers stopped there to rest and enjoy the scenery. All sites were characterized by relatively sparse vegetation, which allowed researchers to observe visitors and bears without becoming involved in the interactions.

METHODS

Twenty-two bears were sedated and each was marked with a lip tattoo and a vinyl streamer attached to a numbered cattle tag placed in the ear. Streamers were 5 by 7 cm and pattern/color-coded for quick field identification. Interaction data were recorded for 17 marked bears and numerous unmarked bears; some unmarked animals could be recognized as belonging to specific sex and age class (e.g., a female with cubs). We believe that these bears were representative of Yosemite problem bears that entered backcountry campgrounds during daylight hours. Because we were unable to record many interactions at night, we do not know how representative our data are for nocturnal problem bears.

We observed a variety of backcountry users. We recorded interactions for backpackers making both long trips and overnight visits. We also observed some day users interacting with bears.

We observed interactions in campgrounds noted for bear activity June–September, 1978, and May–October, 1979. Normally, entire interactions were recorded, although a few were in progress when documentation began. When a bear interacted with a party of several people, usually 1 person did most of the interacting with the bear, and the data largely describe the actions of that 1 person and the bear.

Observations of sequential behaviors usually were recorded on cassette tapes and later transferred to data sheets. We later categorized each behavior of each species into 1 of 4 major classes: fear/avoidance, neutrality, approach, and aggression. Fear/avoidance is referred to as fear in the text. The most com-

mon fear behaviors were bears walking away and running away from people, and visitors walking away from bears. Neutrality was manifested in behaviors that we considered inappropriate for other categories, such as bears watching people and walking around them, and visitors watching bears and talking to each other. Approach was almost always walking toward the other species. Bear aggression usually involved running and jumping toward people; human aggression usually involved yelling or throwing objects at bears.

Hastings and 2 assistants collected most interaction data. Hastings intensively trained assistants before retaining their data, observed them collecting initial usable data, and periodically examined their data collection procedures to ensure reliability.

Statistical relationships were usually investigated with the chi-square goodness of fit test. The G-test, which employs the critical values of the chi-square distribution, was used when low sample sizes made the chi-square test inappropriate (Sokal and Rohlf 1973). A conservative level of $P < 0.01$ was maintained for significance throughout the paper because the authors were dealing with the sensitive issue of bear aggression. Degrees of freedom in all tests were $df = 1$.

RESULTS AND DISCUSSION

Aggressive Behavior and Interactions

We defined aggressive bear behavior as any action we interpreted as frightening or potentially harmful to a person and that we could distinguish from passive approach behaviors. We observed aggressive bear behaviors only 81 times; on 11 of these occasions, aggressive bear behaviors started interactions between bears and visitors, while the remaining 70 were in response to recorded human behaviors. This represented less than 2% of the 5,877 bear responses to human behavior.

Running toward visitors and jumping toward visitors, loosely termed "bluff" or "false charges" because the bear could have readily contacted the person but did not (Herrero 1983), together constituted more than half of the aggressive behaviors (Table 1). No physical contact between visitors and bears was observed. Huffing was the 3rd most common agonistic behavior (16%). This pattern differed from those reported in Great Smoky Mountains (Tate and Pelton 1983) and Jasper National parks (Herrero 1983), where huffing or snorting constituted 41.2%

Table 1. Number and percentage of aggressive bear behaviors, Yosemite National Park, 1978–79.

Aggressive behavior	<i>N</i>	%
Running toward	28	34.57
Jumping toward	19	23.46
Huffing	13	16.05
Circling person	10	12.35
Slapping ground/object	3	3.70
Misc. aggression	3	3.70
Grunting	2	2.47
Other aggressive vocalization	2	2.47
Popping jaw	1	1.23
Total	81	100.00

and 44.4% of the aggressive acts, respectively. Bears in the backcountry of Yosemite may have encountered fewer people per interaction than those in front-country or dump areas of other parks. Although lower numbers of people might result in bears being aggressive less often (as will be discussed later), the reduced threat accompanying fewer people may have resulted in less inhibition of Yosemite bears to use more intensive aggressive responses than simply vocalizations when aggression did surface.

We defined aggressive interactions as those in which at least 1 aggressive bear behavior occurred. Of the 992 interactions documented, only 58 were aggressive (<6%). Only 11 of the 17 marked bears we observed interacting with visitors were involved in at least 1 aggressive interaction. The other 6 bears were recorded in relatively few interactions ($N = 44$). Two bears, Nos. 868 and 740, accounted for 59% of the interactions involving bear aggression. Bear 868 was the only bear that was significantly more aggressive than all other bears combined ($P = 0.004$).

Visitor Response to Bear Aggression

People often responded to bear aggression with fear (38.3% of responses) and neutrality (also 38.3%). Visitors reacted to bear aggression with more fear than they responded to other categories of bear behavior, such as bear fear ($P < 0.001$), neutrality ($P < 0.001$), approach ($P < 0.001$), or all nonaggressive bear behaviors combined ($P < 0.001$). People also responded to bear aggression with more neutral actions than they responded to bear neutrality ($P < 0.001$) or all non-aggressive behaviors combined ($P = 0.003$). Visitors approached (3.7% of responses) less often when bears were aggressive than when bears were afraid ($P = 0.004$).

These responses were not surprising—when bears became aggressive, people usually appeared cautious or frightened. Human fear may have reinforced agonistic behavior because bears probably received less interference from people after displaying aggression.

Visitor Behaviors Preceding Bear Aggression

Human fear was the most likely behavior to precede bear aggression (Table 2). Visitor neutrality and approach were next most likely to precipitate agonistic responses, while human aggression was least likely to elicit bear aggression. Human fear ($P = 0.002$) and neutrality ($P = 0.004$) preceded bear aggression more often than bear fear. Human aggression ($P < 0.001$), however, preceded bear fear more than bear aggression. Thus, the data suggest that being unaggressive toward bears may increase the likelihood of precipitating bear aggression.

Photographing bears ($P < 0.001$) and running away from bears ($P < 0.009$) were more likely to precede bear aggression than other specific human behaviors. Tate and Pelton (1983) also found that taking photographs, especially when the photogra-

Table 2. Number and percentage of aggressive and non-aggressive responses by bears for each class of human behavior, Yosemite National Park, 1978–79.

Visitor behavior	Bear responses					Total
	Aggression		Nonaggression			
	<i>N</i>	%	<i>N</i>	%		
Fear	9	2.8	312	97.2	321	
Neutrality	47	1.2	3,715	98.8	3,762	
Approach	7	1.0	722	99.0	729	
Aggression	7	0.7	965	99.3	972	
Total	70	1.2	5,714	98.8	5,784	

pher crowded the bear or kneeled, precipitated agonistic encounters in GSMNP. Taking photographs or running probably caused people to take their eyes off the bear or assume a subordinate position, both of which made them more vulnerable.

Summary of Bear Aggression Correlations

There were several surprising results in correlating various factors with bear aggression. For instance, the rate of aggression was not correlated with age, size, or sex of the bear. Tate and Pelton (1983) also reported no significant differences in aggression between male and female panhandling bears in GSMNP. Whether property damage was sustained or camp food was eaten by bears also appeared irrelevant to ursid aggression in Yosemite. In fact, few of the 24 potential eliciting factors investigated were correlated with agonistic behavior. Bears appeared more aggressive in June ($P = 0.009$), with younger visitors (< 21 years old, $P = 0.004$), and at lesser distances when a bear approached people (< 6 m, $P = 0.001$). They were less aggressive in May ($P = 0.006$), at lower elevations ($< 1,585$ m, $P = 0.008$), at Rancheria Fall Campground ($P = 0.009$), and at greater distances (> 10 m from bear approaching people, $P = 0.003$, or > 10 m for visitor approaching bears, $P = 0.008$).

The discrepancy between degree of aggressiveness in May and June is difficult to explain, particularly because the breeding season occurred during both months. Younger visitors showed more fear than those over 20 years of age; this may have led to their becoming the target of more bear aggression. Also, younger visitors probably were smaller, although size of visitors was not recorded. The decreased likelihood of aggression at lower elevations is probably confounded with that of Rancheria Falls, a low-elevation campground with generally less aggressive bears.

Tate and Pelton (1983) identified crowding bears as the major contributor to panhandler aggression in the front-country of GSMNP. They also demonstrated that throwing food and photographing from a distance rarely led to aggression. Comparisons between their data and our results are difficult to make. We only recorded people attempting to feed bears on 3 occasions; backcountry visitors appeared much more frugal with their food than people in the front-country. The reaction of bears to photography is also difficult to fully compare because we did not record distance between the subjects at the time of photog-

raphy. Our data do, however, support the idea that being close to bears increases the likelihood of bear aggression. Although the act of approaching bears may not have directly led to aggression, close distance between the species did correlate with higher bear aggression.

Tate and Pelton (1983) observed a higher probability of bear aggression in GSMNP than we documented in Yosemite, as demonstrated by their recording of 624 acts of aggression and at least 1 aggressive act in over 40% of their "sessions." Tate (1981) explained that panhandling bears in the front-country of GSMNP were confronted with increasing noise levels and decreasing distance over the period of the interactions. The latter situation also occurred in Yosemite, as exemplified by bear aggression once bears and people were within 5 m of each other. However, there were considerably fewer people in the backcountry of Yosemite; therefore, there were fewer opportunities for crowd size and noise level to become critical, and less probability that people would approach bears to critical distances.

CONCLUSIONS

Most of the black bears in our study showed little aggressiveness toward people. That which did occur was usually in the form of a bluff charge (e.g., running toward, jumping toward) or agonistic vocalization (e.g., huffing). When aggression took place, it often had been preceded by visitors behaving in a frightened or neutral manner and exhibiting low levels of aggressiveness themselves. Perhaps people should not act too unaggressive with problem black bears but respond with mild forms of human aggression that do not bring the species too close together. Further study is needed to better document which specific behaviors are more and less likely to produce aggressive responses in black bears, possibly through a cautiously designed experimental approach that does not involve the public.

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