

HABITUATION OF GRIZZLY BEARS TO PEOPLE: A HYPOTHESIS

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Abstract: Reports of grizzly bear (*Ursus arctos*) observations between 1977 and 1979 in Glacier National Park were examined to test whether the behavior of grizzly bears was different in areas with high versus low levels of human activity. In both types of areas, females with young were more likely than adults and subadults to avoid human-use areas and showed little habituation to people. A midseason increase in habituated behavior by adult and subadult bears occurred in both areas, but adults and subadults showed a greater degree of habituation throughout the season in the high-use area.

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Knowledge of the behavior of grizzly bears is essential in understanding their responses to human activities and the influences that people have on grizzly bears in national parks. Behavior is an important mechanism by which grizzly bears respond to environmental fluctuations, and regulation of bear numbers apparently involves an integration of behavioral and nutritional factors (Stokes 1970; Martinka 1974, 1976; Kemp 1976; Rogers 1977; Nagy and Russell, Can. Wildl. Svc., Edmonton, unpubl. data). Under most circumstances, grizzly bears' intraspecific intolerance and their mobility enable them to discover new sources of food in their relatively unstable environment. When food supplies become locally abundant, however, the intolerance diminishes. Thus, a number of bears may exploit the abundance, thereby promoting fuller use of the available resources (Hornocker 1962, Troyer and Hensel 1964, Craighead and Craighead 1972, Egbert and Stokes 1976, Martinka 1976, Herrero 1978, Singer 1978).

Hornocker (1962) and Egbert and Stokes (1976) recorded changes in the behavior of grizzly/brown bears through the course of seasonal aggregations at sites of particularly abundant food. Behavioral changes primarily involved habituation and establishment of dominance relationships among bears. When bears first arrived at a productive feeding site, interactions were generally limited to avoidance and flight, and the few close-range contacts that occurred were accompanied by much strife (Egbert and Stokes 1976). The response of an unhabituated animal

to a stressor may be either to eliminate its exposure to the stressor or to increase its tolerance of the stressor, i.e., to habituate to it (Selye 1973). Consequently, through the course of a feeding aggregation, a greater proportion of the bears that remained were those that could habituate to frequent contact with other bears or dominate in interactions with other bears. The social flexibility which facilitates habituation to this stress and formation of dominance hierarchies benefits individual bears by allowing them to use resources that would otherwise be unavailable to them. This social flexibility also reflects the importance of behavior to bears in adapting to environmental conditions and efficiently using available resources (Etkin 1964). Hornocker (1962) and Egbert and Stokes (1976) observed habituation by subadults and lone adults, but females with young remained intolerant of other bears.

Confrontations between grizzly bears and people in parks historically involved (1) unexpected close-range encounters between females with young and hikers on backcountry trails, and (2) aggressive foraging in campgrounds by grizzlies that learned to associate human presence with food (Herrero 1970a, Cole 1972, Cowan 1972, Mundy and Flook 1973, Hamer 1974). In recent years, 2 additional types of grizzly bear/human confrontations became evident in Glacier National Park: (3) charges by adult and subadult bears, and (4) approaches, in the absence of a food attractant, by adult and subadult bears apparently habituated to people. No hikers were injured by bears that approached them, but evidence suggests that charges by adult and subadult bears may be more likely than charges by females with young to result in human injury (McArthur 1979).

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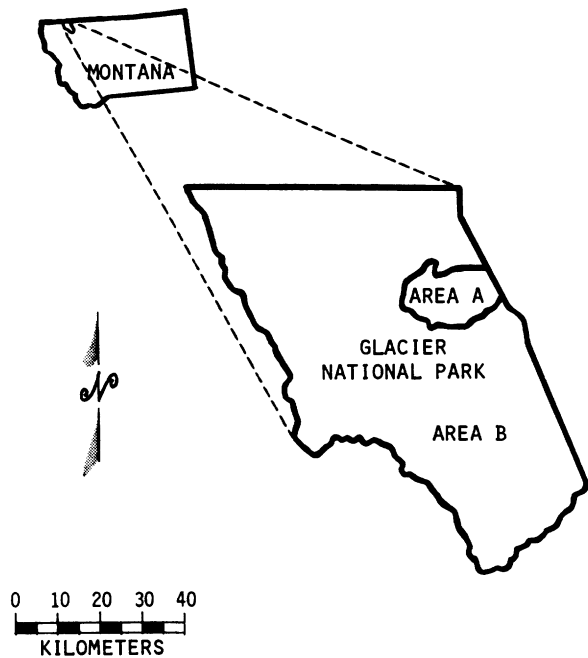


Fig. 1. Locations of Area A and Area B in Glacier National Park, Montana.

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STUDY AREA

Glacier National Park is situated adjacent to the Canadian border in northwestern Montana (Fig. 1). The park was divided into Area A, the 230-km² Many Glacier/Granite Park area in the eastern part of the park, which is very scenic and attracts large numbers of visitors, and Area B, the remainder of the 4,100-km² park. Elevations range from 1,460 m to 3,000 m in Area A and from 960 m to 3,190 m in Area B. Habitat types in Area A include *Abies lasiocarpa*/*Clintonia uniflora*, *Abies lasiocarpa*/*Galium triflorum*, and *Abies lasiocarpa*/*Xerophyllum tenax* (Pfister et al. 1977). Part of Area A was burned in 1936, and most south-facing slopes are maintained at a shrub stage by frequent snowslides.

Area A comprised only 5.6% of the total park area, yet it received more than 12% of park visi-

Table 1. Biweekly numbers of visitors entering Glacier National Park through all entrance stations and through the Many Glacier entrance, 1979. Hikers also enter Area A by trail from the west and north.

Dates	All entrances	Many Glacier entrance	Ratio (%)
6 May - 19 May	28,900	2,560	8.9
20 May - 2 Jun	57,100	3,980	7.0
3 Jun - 16 Jun	92,100	8,700	9.4
17 Jun - 30 Jun	101,600	15,370	15.1
1 Jul - 14 Jul	159,400	20,230	12.7
15 Jul - 28 Jul	160,800	19,930	12.4
29 Jul - 11 Aug	172,600	21,200	12.3
12 Aug - 25 Aug	148,600	15,970	10.7
26 Aug - 8 Sep	105,800 ^a	12,870 ^a	12.2
9 Sep - 22 Sep	79,500	8,060	10.1
23 Sep - 6 Oct	46,600	2,770	5.9
7 Oct - 20 Oct	38,200	1,170	3.0

^a Data for 1 week were missing and were interpolated.

tors during 10 of 14 summer weeks between 3 June and 8 September 1979 (Table 1). Although data were unavailable concerning levels of day-use in Glacier National Park, trails which had a developed area at the trailhead and were less than 8 km long seemed to receive heavy use by day-hikers. There were 6 such trails in Area A, totaling 30 km. Total trail length was 87 km in Area A and 1,035 km in Area B.

METHODS

I hypothesized that the behavior of grizzly bears is different in areas with high versus low levels of human activity.

Data on grizzly bear sightings between 1977 and 1979 were obtained from Glacier National Park's Bear Information Management System, in which all reported bear sightings are stored on computer (Smith 1983). Each sighting was evaluated to determine the bear's response to people and human-use areas (Fig. 2). Human-use areas include trails, campgrounds, picnic areas, roads, parking lots, and business and residential areas. A bear's response was defined as (1) *fear of human-use areas* if the bear was seen at a distance and rapidly moved out of sight without entering the area; (2) *avoidance of human-use areas* if the bear did not enter the area but remained in sight, generally at distances of 100-300 m; (3) *avoidance of people* if the bear encountered people and moved away; (4) *neutral* if the bear was aware of people nearby, generally within 50 m, and continued its activity; (5) *approach* if the bear walked or slowly loped toward a person; or (6) *charge* if the bear suddenly rushed toward a

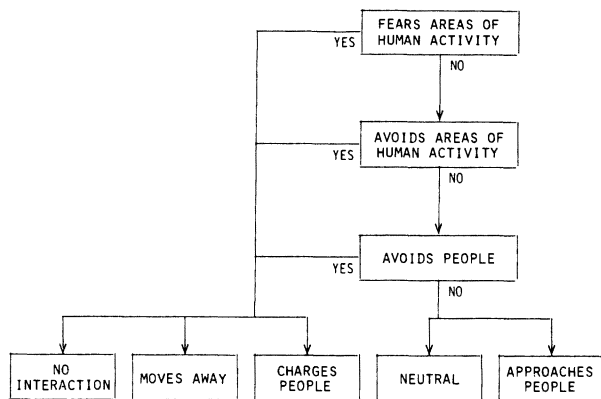


Fig. 2. Possible behaviors that may be exhibited by grizzly bears toward people or human-use areas. (Modified from McArthur 1979)

person. Responses that involved fear or avoidance of human-use areas or people, including charges, were grouped as *unhabituated* responses; responses that were neutral toward people or involved intentional approaches were grouped as *habituated* responses. For all bear sighting reports, I appraised the observer's ability to accurately and objectively report the event and did not use questionable records. Using these categories, behavior by different classes of bears was compared, using chi-square analysis, between Areas A and B, and seasonal changes in behavior of adult and subadult bears were evaluated using linear regression.

Visibility along the trails, in both directions, was measured at 60-m intervals along 17 2.5- to 5.5-km trail sections in the Many Glacier portion (215 km²) of Area A, and mean visibilities were calculated. Visibility along trails was a function of vegetation and microtopography, and did not necessarily reflect visibility perpendicular to the trail. Numbers and types of observations in which bears were on or in the immediate vicinity of trails were compared using linear and nonlinear regression. It was not possible to pinpoint the exact location, and thus the visibility, where each observation occurred.

RESULTS

Results reported here indicate only the behavior of bears while they were in sight of people, and conclusions about the behavior of these bears at other times should not be inferred.

Altogether, 291 grizzly bear sighting reports in Area A and 375 sighting reports in Area B were assessed. Of the sightings in Area A, 5% were of

females with cubs, 6% were of females with yearlings, 21% were of subadults, 66% were of adults, and 1% were of unknown-age bears. Of the sightings in Area B, 16% were of females with cubs, 8% were of females with yearlings, 18% were of subadults, 56% were of adults, and 2% were of unknown-age bears. These distributions are significantly different ($P < 0.005$).

Behavior of Different Classes of Bears

Behavior of each bear class was different between Areas A and B ($P < 0.005$, Fig. 3). Females with cubs and with yearlings observed in Area A exhibited more avoidance than fear of human-use areas. Females with young exhibited neutral responses to people in 1 of the 125 reported observations. When females with cubs encountered people, in both areas, the bears were nearly as likely to charge as to move away (13% vs. 18% of the observations of females with cubs, $P > 0.1$).

Subadults showed more habituated responses in Area A than Area B (39% vs. 15% of observations of subadults, $P < 0.005$). Subadults entered human-use areas more in Area B than Area A (76% vs. 64%, $P < 0.05$), but their responses to people encountered in human-use areas were most frequently avoidance in Area B (58%) and neutral in Area A (26%).

Adult bears also exhibited more habituated responses in Area A than Area B (37% vs. 12% of observations of adults, $P < 0.005$). Adults entered human-use areas equally in Areas A and B (62% vs. 55%, $P > 0.05$), but, as with subadults, adults' responses to people encountered in human-use areas were most frequently avoidance in Area B (34%) and neutral in Area A (28%).

Behavior Through the Season

In Area A, habituated behavior tended to increase until 21 July ($R = 0.758$, $P < 0.1$, Fig. 4). The increase occurred primarily in approaches. Observations of bears that entered human-use areas but avoided people also tended to increase until 14 July ($R = 0.696$, $P < 0.1$). After 21 July, habituated behavior decreased ($R = -0.663$, $P < 0.1$). Charges (2% of observations in Area A) occurred only after 14 July.

In Area B, habituated behavior tended to increase until 21 July ($R = 0.721$, $P < 0.1$). The increase occurred in both neutral responses and approaches. Unhabituated behavior tended to in-

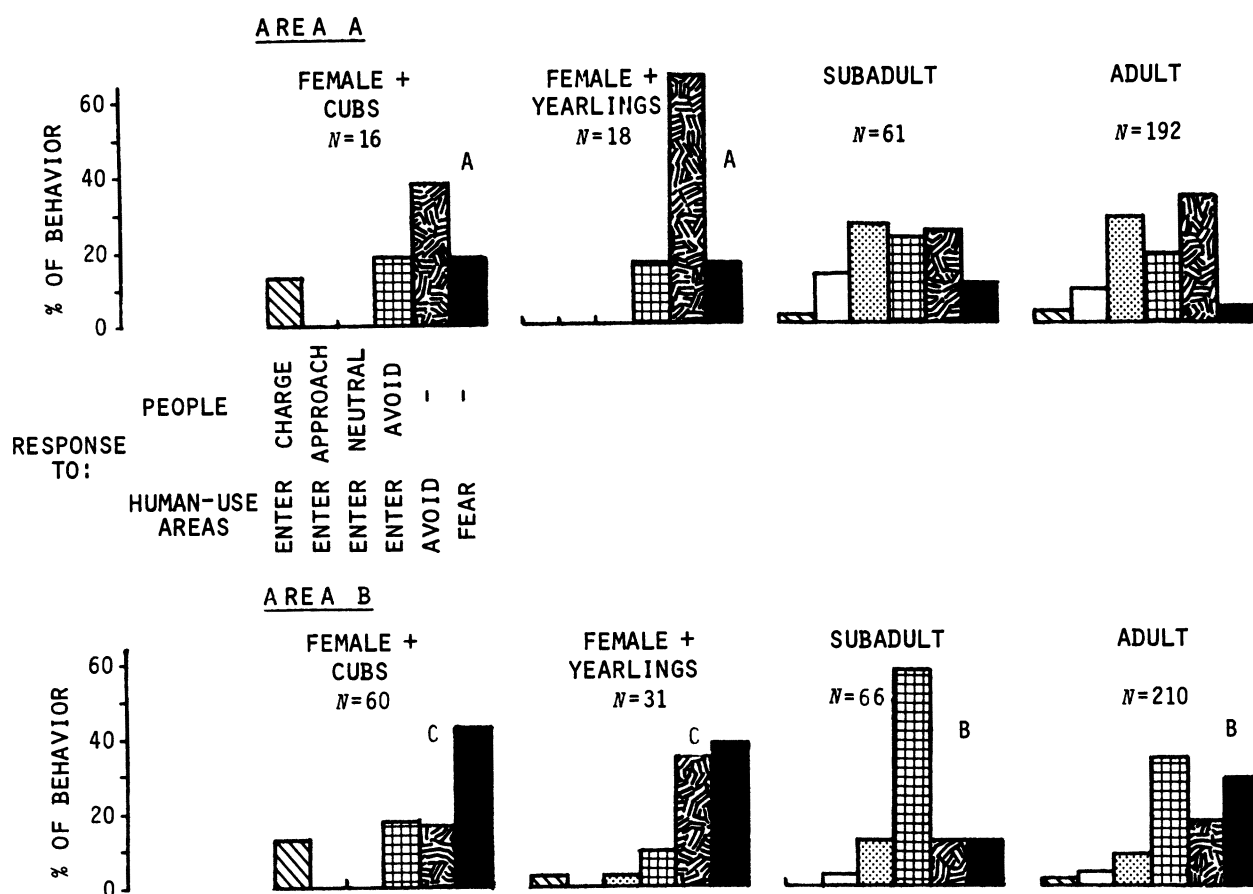


Fig. 3. Behavior (% of total sightings) exhibited by classes of grizzly bears toward people in Areas A and B, Glacier National Park, 1977-79. For each class, differences between the two areas are significant at $P < 0.005$ except "A" indicates differences significant at $P < 0.1$, "B" indicates differences significant at $P < 0.025$, and "C" indicates differences significant at $P < 0.01$.

crease again after 29 July ($R = 0.658$, $P < 0.1$). Charges (1% of observations in Area B) occurred only before 30 June.

Bear Observations Along Trails in Many Glacier

Mean visibilities along trails in Many Glacier ranged from 23 m to 48 m.

As single factors, total number of bears seen along trails and number of habituated bears seen were not significantly correlated with mean visibility along the trails ($R = 0.327$ and 0.553 , respectively; $P > 0.1$). When considered together, the two factors were highly correlated with visibility ($R^2 = 0.974$, $P < 0.01$, Fig. 5).

No relationships between response types and standard deviations of visibility along trails were identified.

DISCUSSION

Data presented here suggest that a different pattern of behavior operated in the study area than was documented elsewhere; 35% of the grizzly bears seen along trails in Area A ignored or walked toward people. This is contrary to the belief that, when allowed, bears avoided people (Jonkel 1970 cited by Schallenger 1980, Craighead and Craighead 1972, Martinka 1976).

Historically, bear incidents have been associated with sites of low visibility. In most injuries by grizzlies in North American national parks, the person was not aware of the bear until less than 91 m from the bear (Herrero 1970b). Although mean visibilities along trails in Area A were far less than 91 m, it is worth noting that neutral responses and intentional approaches constituted

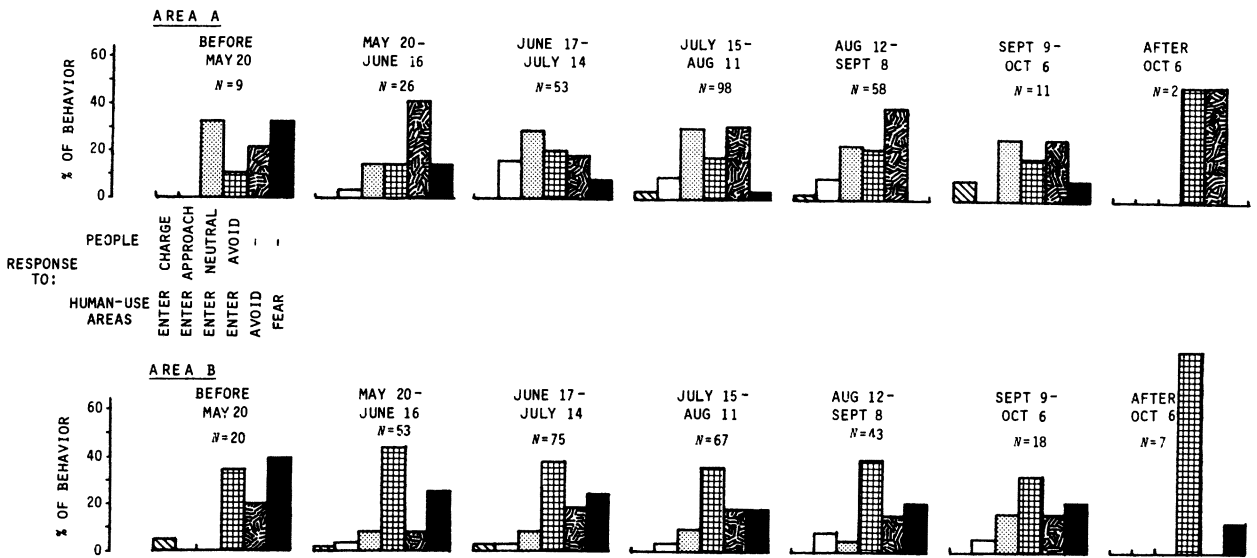


Fig. 4. Behavior (% of total sightings) exhibited by adult and subadult grizzly bears toward people during 4-week periods through the summer in Areas A and B, Glacier National Park, 1977-79.

greater proportions of bear observations along trails with greater mean visibility (Fig. 5).

Off-trail travel and on-trail travel through open vegetation may enhance the frequency with which bears in an area are exposed to human

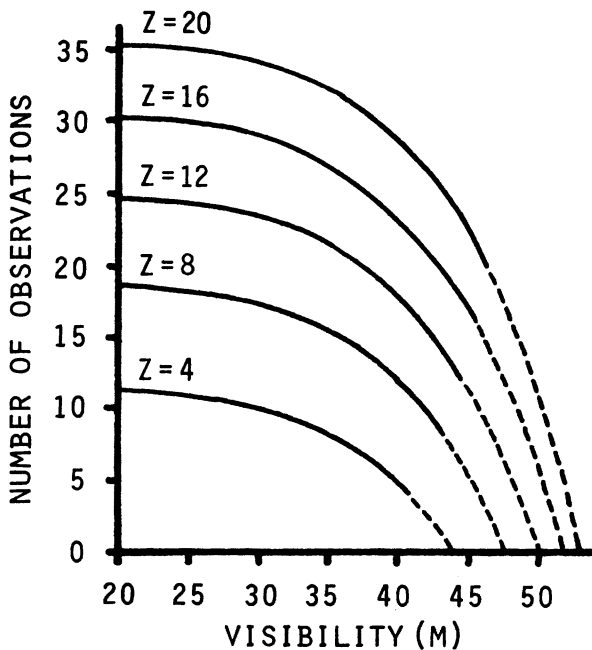


Fig. 5. Trivariate regression of mean visibility along the trail, total number of observations of bears along the trail, and number of observations of habituated bears [$Z = (-0.0153 + 3.811 \times 10^{-10} X^6 + 0.240Y)^{1.4}$, $R^2 = 0.974$] along trails in the Many Glacier portion of Area A, Glacier National Park, 1977-79. Dashed line indicates impossible combinations of Y and Z , in which $Y < Z$.

presence, thereby contributing to habituation by bears. Chester (1980) stated that off-trail hikers come into contact with greater numbers of wildlife; an off-trail hiker therefore tends to have a greater influence on wildlife in an area than does an on-trail hiker. People hiking through open vegetation also influence a wider area than do people hiking through dense cover.

As food becomes more abundant during the summer, grizzlies' aggressiveness toward each other may diminish (Egbert and Stokes 1976), and their aggressiveness toward people may also diminish. Midseason habituation was exhibited by bears in Area A, and neutral responses became the most common bear/human interactions (Fig. 4). In Area B, a midseason increase in habituated behavior also occurred, but avoidance of people remained the predominant bear/human interaction. Adults and subadults in Area A showed a greater degree of habituation throughout the season than did adults and subadults in Area B. The greater level of habituation exhibited by adult and subadult bears in Area A may reflect long-term habituation to frequent human contact.

In Area B, charges toward people tended to occur as habituated behavior increased. Egbert and Stokes (1976) documented conflicts among bears arriving at a feeding aggregation. As the bears habituated and approached one another more closely, the frequency of low-intensity threats in-

creased. Early-season habituation toward people may preclude early-season charges in Area A. Instead, bears in Area A may exhibit low-intensity threats which are not recognized by the people toward whom they are directed. Other explanations, such as habitat use by grizzly bears in relation to areas seasonally used by people, are possible, or the pattern may be an artifact of the small sample size.

Bears habituate to the presence of other bears when it results in a return, such as access to food, that outweighs the cost of the stress that precedes habituation (Selye 1973, Egbert and Stokes 1976). Bears may also habituate to people to gain access to natural food in human-use areas. However, habituation to people may have 2 detrimental results: (1) people may be frightened if a bear approaches them, even though such approaches have not yet resulted in human injury; or (2) people may inadvertently approach within a bear's "individual distance" (Herrero 1970b), and the bear may charge. A bear's motivation to charge, in such a situation, may be an assertion of dominance rather than a threatening bluff. Therefore, the bear may be more likely to carry the charge through to injury.

Additional research is needed to learn more about the ways in which grizzly bears respond to the ever-increasing levels of human activity in their habitat, both within and outside of parks. Patterns of habitat use by grizzlies should be compared with distribution of human activity in areas with high levels of human use. In addition, the relationship between rates of grizzly bear/human confrontations and habituation should be examined.

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