

A SUMMARY OF BEAR MANAGEMENT IN GLACIER NATIONAL PARK, MONTANA, 1960–1994

STEVE J. GNIADK, National Park Service, Glacier National Park, West Glacier, MT 59936, USA, email: steve_gniadek@nps.gov
KATHERINE C. KENDALL, Biological Resources Division, U.S. Geological Survey, Northern Rocky Mountain Research Group, Glacier National Park, West Glacier, MT 59936, USA, email: katherine_kendall@nbs.gov

Abstract: Bear management in Glacier National Park (GNP), Montana, has evolved from 1960 to 1994. Grizzly bears (*Ursus arctos*) and black bears (*U. americanus*) have become more highly valued in both a social and an ecological context. Management has shifted from focusing on removing problem animals to preventing problem bear behavior by modifying human behavior. Reducing the availability of human foods to wildlife and tolerating natural defensive reactions by bears coincided with a decline in the number of bears killed or relocated. Reported sightings of black and grizzly bears have risen from 192 in 1967 to 2,075 in 1994, suggesting that bear populations have increased. However, we suggest the number of bear sightings is an unreliable indicator of population trend. Human injuries resulting from black bear encounters declined to near zero with the control of human food and garbage. The grizzly bear-inflicted human injury rate, however, continued to increase. Progress in understanding the causes will not be made until reliable information on bear populations and human backcountry use is available.

Ursus 10:155–159

Key words: bear management, black bear, Glacier National Park, grizzly bear, human–bear conflict, mortality, *Ursus americanus*, *Ursus arctos*.

Bear–human interactions have played a role in Glacier National Park (GNP) since it was established in 1910. In 1918, an inholder complained to a park ranger that a bear had eaten most of the contents of his outdoor meat safe. Although he was “...aware that it is the policy of the Park Government that these dangerous animals have the absolute freedom of the Park and that they go unmolested and unharmed,” he suggested, “The policy should be to shoot these animals whenever they appear in the vicinity of hotels, private residences or camps” (letter to Park Ranger, 23 Aug 1918, GNP Archives). Similar attitudes toward bear management persist in some segments of society; however, bears have become more highly valued by society and GNP’s bear management program has evolved to reflect this awareness. Management has shifted from removing problem animals to preventing problem bear behavior by modifying human behavior. We evaluate the success of this approach.

Our evaluation began with data collected in 1960 for 2 reasons. First, a National Park Service (NPS) bear management program was implemented in that year (NPS 1960). Second, incidents before 1960 were not recorded reliably or in the same format as current records.

The 1960 NPS Bear Management Program was a national effort designed to reduce the number of bear-caused human injuries and property damage incidents and to re-establish bears to a natural state in the national parks (NPS 1960). It included the following guidelines: (1) increase visitor education about bear behavior, methods for reducing bear–human conflicts, and proper storage of food, garbage, and other bear attractants, (2) remove garbage regularly to make bears less dependent on garbage as a food source, (3) strictly enforce regulations that prohibit

feeding bears, (4) use garbage cans designed to prevent tipping by bears and develop bear-proof garbage cans, and (5) remove potentially hazardous food-conditioned bears. These management guidelines were directed primarily at black bears and were largely in response to public complaints of personal injury and property damage caused by roadside and campground bears in Yellowstone National Park (Craighead and Craighead 1967) and other parks with black bears.

In GNP, the decade of 1960–69 began with a directive from the Park superintendent stating that, “When a grizzly bear appears in any area of visitor use, it will be immediately destroyed by a park ranger” (Memo., 6 Dec 1960, GNP). A memorandum summarizing bear activities during 1961 mentioned an “all-out visitor education program” informing the public of “the seriousness...involved in feeding and molesting wildlife” (Superintendent Memo., 17 Nov 1961, GNP). However, efforts were relatively ineffectual in making human food and garbage unavailable to bears.

Efforts to minimize human foods available to bears were initiated before 1945 (Martinka 1970) but were poorly documented. Conversion to bear-proof garbage cans in campgrounds, initiated in 1963 (Martinka 1970), was not completed until the mid-1970s, with some dumpsters lacking bear-proof features persisting until recent years. Open disposal of food waste continued at the chalets and other areas in the Park until 1967, and the last open dumps near the park boundary (at St. Mary and West Glacier) closed in 1982.

The first GNP bear management plan (GNP 1968) was in response to the first 2 grizzly bear-inflicted human fatalities in the Park, occurring in separate incidents on 13

August 1967. This initial plan was 1 page long; the current plan is more comprehensive and includes guidelines for management activities and bear handling procedures (GNP 1996). Training of bear management personnel has been expanded, and certification following NPS guidelines (NPS 1991) is required by employees who handle bears.

We gratefully acknowledge the documentation of bear sightings and management actions by NPS employees over the past 35 years. M. Coleman compiled and collated the data. Computer programming and assistance was provided by T. Gilk and C. Ames. Statistical assistance was provided by R. Bennetts. This project was funded by the National Park Service, Glacier National Park, and the Northern Rocky Mountain Research Group, Biological Resources Division, U.S. Geological Survey.

METHODS

Data were derived from incident records, bear sighting reports, management reports, letters, memos, and other documentation in park records. Incident records were standardized throughout the NPS by 1975. Bear sighting reports were informally maintained until the GNP Bear Information Management System was established in 1967. This system has undergone modifications since its inception, including computerization in 1978–79, but most information collected since 1967 is comparable.

Information obtained from these sources included: bears killed for management reasons, bears relocated, incidents of bears obtaining human food or causing property damage, trail and campground closures or warnings due to bear presence, bear-caused human injuries or fatalities, and bear sightings. Bears moved to zoos or research facilities or inadvertently killed during relocation efforts were included in our analysis of bear mortality, because they were effectively removed from the populations. Similarly, bears relocated outside the Park were included in our analysis of bear relocations.

Records of bear-caused human injuries are probably complete; however, less emphasis was placed on other records until the late 1960s. Some black bears were destroyed without documentation as late as 1966 (J. DeSanto, retired NPS ranger, Babb, Montana, pers. commun., 1995). Records on grizzly bears are more comprehensive than those on black bears.

Bears are relatively wide-ranging and few live entirely within the boundaries of the park (410,201 ha). Because human activities outside the Park affect park bear behavior and populations, it is appropriate to examine bear management from a regional perspective. However,

records of bear management actions outside the Park are incomplete and not used in this analysis. We tested for an association between bear management actions and time (year) using Spearman Rank Correlation (SAS Inst., Inc. 1988).

RESULTS

Bear Mortality

The number of black bears from the GNP population killed for management purposes declined during 1960–1994 (Spearman $r = -0.59$, $P < 0.001$), averaging 10.5/year during the 1960s and 2.8/year for 1990–94. Periodically, large numbers of bear mortalities occur in a summer. For example, 12 bears were killed during 1992 in management actions, including 1 handling-related death. This number was the highest since 1968 and comprised 85% of 1990–94 mortalities.

In contrast, the number of grizzly bears killed in management actions exhibited no significant trend over time (Spearman $r = -0.17$, $P = 0.33$), averaging 2.2/year during the 1960s and 0.6/year during 1990–94. In response to the first bear-caused human fatalities in GNP, 10 grizzly bears were killed between the night of 13 August 1967 and the end of 1969. During the same period 38 black bears were killed. This represents 21% of all grizzly bear management deaths and 19% of all black bear management deaths since 1960. The highest number of grizzlies killed during any 1 year occurred in 1960 when 7 were shot. Most recently, a family of 3 grizzlies was killed following a human fatality in 1992.

Bear Relocations

The number of black bear relocations decreased (Spearman $r = -0.85$, $P < 0.001$), averaging 31.3/year during the 1960s and 5.0/year between 1990–94. The 16 black bears relocated during 1992 was the highest annual total since 1976 when 18 were trapped and relocated. After only 1 documented transplant of a grizzly bear during the 1960s, grizzly bear relocations peaked during the 1970s at 1.4/year and averaged 0.8/year during the 1980s. No grizzlies have been relocated since 1987.

Human Foods

Recorded incidents of black bears obtaining human food were at relatively high levels during the 1960s (11.3/year) and 1970s (10.5/year), but declined during the 1980s and 1990s (Spearman $r = -0.55$, $P < 0.001$), despite 19 incidents in 1992. Reports of grizzly bears obtaining human food were much fewer than black bears, with a high of 6

incidents during 1976. There have been no reports of grizzlies obtaining human food since 1986.

Property Damage

Reports of property damage attributed to black bears declined (Spearman $r = -0.86$, $P < 0.001$), averaging 23.2/year during the 1960s and 1.2/year during the 1980s and 1990s. Incidents of grizzly bears causing property damage were relatively few throughout the period, with a high of 8 during 1973.

Bears Charging People

The number of reports of a black bear charging people was relatively low during the entire period, averaging 1.1/year during the 1960s and 1.2/year during 1990–94, and exhibited no significant trend (Spearman $r = 0.11$, $P = 0.540$). Reports of a grizzly bear charging people but not making physical contact increased (Spearman $r = 0.70$, $P < 0.001$), with 0.6/year during the 1960s and 5.8/year during the early 1990s.

Human Injury and Death

The first recorded bear-caused human injury in GNP involved a grizzly bear in 1939. There were no additional recorded injuries until 1952, involving a bear of unknown species. There were 25 more bear-caused injuries during the 1950s, 22 by black bears, 2 by grizzlies, and 1 by a bear of unknown species.

In 27 incidents during the 1960s, 32 people were injured by bears. Black bears injured 20 people and grizzlies injured 12. In 18 incidents during the 1970s, 21 people were injured by bears, with only 7 black bear-related injuries. Grizzlies injured a total of 11 people in 8 separate incidents. Three people were injured by bears of unknown species. In the 1980s, 28 people were injured in 21 incidents; 26 injuries were caused by grizzlies and 2 by unknown bears. No black bear-related injuries were recorded. During 1990–94, 16 people were injured in 13 incidents; 10 people were injured by grizzlies and 6 by bears of unknown species. No black bear-related injuries were recorded.

There have been 9 bear-related human fatalities in GNP, all involving grizzly bears. The Park's first bear-caused fatalities occurred in 2 separate incidents on the same night during 1967. A third fatality occurred in 1976. In 1980, 3 people were killed in 2 incidents, and in 1987, 2 people were killed in 2 incidents. The last fatality occurred in 1992. All 6 fatal incidents before 1987 involved food-conditioned bears. The bears involved in the 3 incidents in 1987 and 1992 were not known to have obtained human foods. Two of these incidents were interpreted as

surprise encounters; the other was precipitated when the person approached a grizzly with cubs.

Human Management

Efforts to alert visitors to bear activity by posting warning signs and closing trails and campgrounds began in the 1960s. The earliest records of trail closures are from 1966, and the first records of posting warning signs are from 1968. The annual number of closures increased through the 1980s and declined during the early 1990s. Recorded postings of warning signs on trails or at campgrounds also increased through the 1980s but remained unchanged during the early 1990s.

Bear Sightings

Annual bear sighting reports increased from 192 in 1967 to 2,075 in 1994 ($\bar{x} = 625.0$, $SD = 345.8$). A maximum of 1,755 black bear sightings was reported in 1992, and a high of 1,321 grizzly bears was reported in 1989. The number of grizzly bear sightings was correlated with visitation (Spearman $r = 0.83$, $P < 0.001$) and does not necessarily indicate a population trend.

DISCUSSION

Bear management efforts may have been even more successful than portrayed by the data, as a result of increasing emphasis on documenting incidents and maintaining records. For example, the number of bears killed or relocated was probably higher than recorded during the 1960s and perhaps the 1970s; some bears were probably shot or relocated without documentation and some records lost. Likewise, records of bears obtaining human foods, damaging property, and charging people are probably more complete for recent years than for earlier periods. An abrupt increase in reports of a grizzly bear charging people in the mid-1970s probably reflects an increase in the reporting rate.

Most of the reduction in bear mortalities, relocations, and incidents of bears obtaining human food or damaging property may be attributed to improved food control efforts. The decline in black bear-related injuries, with only 1 documented black bear-caused injury since 1978, supports other studies showing that human injuries by black bears increase when bears have access to human food and garbage (Herrero 1985). Episodic increases in black bear mortalities and relocations, such as during 1992, may result from general failure of natural foods; however, most evidence for this relationship is anecdotal.

Based on bear behavior, severity of injuries, and habitat characteristics, we believe most, if not all of the 8 hu-

man injuries attributed to unknown bears since 1975 were probably inflicted by grizzly bears. If that is the case, grizzly bear-caused injuries have continued to increase at an even greater rate during 1960–94. Although some serious encounters have undoubtedly been prevented by reducing grizzly bear access to human food and garbage, most recent incidents in which people were injured by grizzly bears involved surprise encounters and not food-conditioned bears.

Martinka (1981) stated that GNP has “the capability to monitor bears over time” with standardized sighting reports. That perception has persisted; GNP’s Management Plan for the North Fork Study Area states, “Bear populations will continue to be monitored through the Park’s computerized Bear Information Management System (BIMS)” (GNP 1992). We caution against inferring population trend from sighting data; making inferences from count data suffers from autocorrelation and confounding from other sources of variation (Barker and Sauer 1992). For example, we have shown that the number of grizzly bear sightings is highly correlated with the number of park visitors. Other potential sources of variation in sightings include weather conditions, forest succession, changes in the recording effort by park employees, and production, phenology and distribution of bear foods. Consequently, we suggest that inferences about population trends from these data are questionable without controlling for confounding sources of variation.

Bear management programs in other North American national parks have experienced similar results as GNP. In Denali National Park, following implementation of a bear–human conflict management plan in 1982, bear-related incidents declined from 40 during 1982 to 9 during 1988 (Schirokauer and Maier 1998). After an average of 0.75 bears were killed or relocated/year between 1917 and 1982 (Dalle-Molle and Van Horn 1989), only 2 bears were removed for management purposes since 1982. Management in Jasper National Park, Canada, effectively eliminated bear access to human food and garbage during the 1980s. The number of bears destroyed in Jasper declined from 13.9 black bears and 2.8 grizzlies/year during the 1960s to 0.7 black bears and 0.3 grizzlies/year during 1990–95 (R. Ralf, History of bear-human conflict management in Jasper National Park, 1907–1995, Parks Canada, Jasper Natl. Park, Alberta, 1995). Yellowstone National Park intensified efforts in 1970 to strictly enforce bear feeding prohibitions and to greatly reduce the availability of human foods to bears. The number of bears removed from the Park declined from 35 black bears and 3 grizzlies/year to 0.4 black bears and 1 grizzly/year, and bear-caused human injuries declined from 51/year to 1/

year for 1960–67 and 1983–93, respectively (Gunther 1994).

Black bear incidents in Shenandoah National Park declined from a high of 257 during 1976 to 13 during 1986 following the closure of garbage dumps, conversion to bear-proof garbage cans, a decline in back-country camping, and an increase in bears harvested outside the Park (Garner and Vaughan 1989). In Yosemite National Park, incidents of property damage caused by black bears decreased during a 12-year period in most frontcountry areas following the implementation of a bear management program that included education, removal of human food, law enforcement, and control of problem bears (Keay and Webb 1989); however, no such decline was noted in backcountry areas.

CONCLUSION

Coincident with increased management and education efforts, and information availability, GNP’s bear management program was largely successful during the past 35 years. Management-related mortalities and relocations of black and grizzly bears, incidents of bears obtaining human foods and causing property damage, and black bear-caused human injuries were reduced. Challenges remain, especially the grizzly bear-inflicted injury rate.

Progress in understanding the causes of an injury rate from grizzlies that is in part unmitigated by management efforts depends on detailed information on both bear and human use of the backcountry. Annual visitation to GNP continues to grow and now exceeds 2 million visitors. Approximately 200,000 hikers share the Park’s backcountry trail system with a large number of black and grizzly bears. It will be a continuing challenge to meet the needs of both people and bears. Continued well-conceived and integrated research efforts to improve the knowledge of grizzly bear ecology, population trends, and the role of habituation in bear–human interactions is crucial if these challenges are to be met.

LITERATURE CITED

- BARKER, R.J., AND J.R.SAUER. 1992. Modelling population trends from time series data. Pages 182–193 in D.R. McCullough and R.H. Barrett, eds. *Wildlife 2001: Populations*. Elsevier Appl. Sci., New York, N.Y.
- CRAIGHEAD, J.J., AND F.C. CRAIGHEAD. 1967. Management of bears in Yellowstone National Park. *Mont. Coop. Wildl. Res. Unit, Univ. Montana, Missoula*. 113pp.
- DALLE-MOLLE, J.L., AND J.C. VAN HORN. 1989. Bear–people conflict management in Denali National Park, Alaska. Pages 121–128 in M. Bromley, ed. *Bear–people conflicts:*

- Proceedings of a symposium on management strategies. Northwest Territ. Dep. of Renewable Resour., Yellowknife.
- GARNER, N.P., AND M.R. VAUGHAN. 1989. Black bear-human interactions in Shenandoah National Park, Virginia. Pages 155-161 *in* M. Bromley, ed. Bear-people conflicts: Proceedings of a symposium on management strategies. Northwest Territ. Dep. of Renewable Resour., Yellowknife.
- GLACIER NATIONAL PARK. 1968. Bear management plan. Natl. Park Serv., West Glacier, Mont. 1p.
- . 1992. Management Plan, North Fork Study Area. Natl. Park Serv., West Glacier, Mont. 69pp.
- . 1996. Bear management plan and guidelines. Natl. Park Serv., West Glacier, Mont. 49pp.
- GUNTHER, K.A. 1994. Bear management in Yellowstone National Park, 1960-1993. *Int. Conf. Bear Res. and Manage.* 9(1):549-560.
- HERRERO, S. 1985. Bear attacks: their causes and avoidance. Nick Lyons Books/Winchester Press, Piscataway, N.J. 287pp.
- KEAY, J.A., AND M.G. WEBB. 1989. Effectiveness of human-bear management at protecting visitors and property in Yosemite National Park. Pages 145-154 *in* M. Bromley, ed. Bear-people conflicts: Proceedings of a symposium on management strategies. Northwest Territ. Dep. of Renewable Resour., Yellowknife.
- MARTINKA, C.J. 1970. Grizzly ecology studies. Natl. Park Serv. Prog. Rep. GLAC-N-16. 43pp.
- . 1981. Grizzly bear management in Glacier National Park, Montana. Page 22 *in* Hearing before the Subcommittee on Public Lands and National Parks of the Committee on Interior and Insular Affairs, House of Representatives. Public Land Management Policy, Serial No. 97-8, Part II. West Glacier, Mont.
- NATIONAL PARK SERVICE. 1960. National Park Service bear management program and guidelines. U.S. Dep. Inter., Natl. Park Serv., Washington, D.C. 5pp.
- . 1991. Natural resource management guideline. Natl. Park Serv. NPS-77. Washington, D.C. 690pp.
- SAS INSTITUTE, INC. 1988. SAS/STAT user's guide. Release 6/03. SAS Inst., Inc., Cary, N.C.
- SCHIROKAUER, D., AND H. MAIER. 1998. Bear-human conflict management in Denali National Park and Preserve, 1982-94. *Ursus* 10:395-403.