

CANNIBALISM AND PREDATION ON BLACK BEARS BY GRIZZLY BEARS IN THE YELLOWSTONE ECOSYSTEM, 1975–1990

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We documented one instance of an adult male grizzly bear preying upon a black bear and four instances where circumstantial evidence suggested that grizzly bears (two cubs-of-the-year, one yearling female that was injured, and one adult male) had been preyed upon by conspecifics. We also examined feces of grizzly bears for bear remains. Remains of bears tended to be more common in spring feces and did not differ in frequency between early and late years of the study. Our observations generally support existing hypotheses concerning cannibalism among bears.

Key words: Ursidae, black bears, grizzly bears, cannibalism, predation, Wyoming

Observations of cannibalism by bears (Ursidae) are rare. To an uncertain extent this is due to low densities of bears, relatively infrequent encounters among bears in most populations, and low probability of documentation by human observers. Attempted or successful predations (most often by adult males) have been reported on denned bears (Alt, 1984; Ross et al., 1988; Tietje et al., 1986), females and their young (Dean et al., 1986; LeCount, 1987; Lunn and Stenhouse, 1985; Murie, 1981; Taylor et al., 1985; Troyer and Hensel, 1962), and bears that are small and solitary (Dean et al., 1986; Murie, 1981; Taylor et al., 1985). Only Ross et al. (1988) conclusively documented predation by a grizzly bear (*Ursus arctos horribilis*) on black bears (*U. americanus*), although this phenomenon may be relatively common where the two species are sympatric (Jonkel and Cowan, 1971; Miller, 1985). Because of the potential implications of predation among ursids to population dynamics (Bunnell and Tait, 1981; Kemp, 1976; Stringham, 1983) and to competition between black and grizzly bears, this rare phenomenon warrants documentation.

METHODS AND RESULTS

The Interagency Grizzly Bear Study Team studied ecology of grizzly bears in the Yellowstone ecosystem during 1975–1990. During this time, data were collected on 180 radiocollared bears, including 7,830 radiotelemetry locations. A representative sample of these locations ($n = 1,744$) was visited and sampled for habitat and feeding parameters. During this time, 6,976 bear feces also were collected and analyzed for frequency and relative volume of contents (see Mattson et al., 1991a, for methods). Here, we report instances of predation and scavenging by grizzly bears on conspecifics and black bears. We observed no instances of predation or scavenging by black bears on grizzly bears.

We observed five instances where circumstantial evidence strongly suggested cannibalism or a grizzly bear preying upon a black bear. The first instance occurred in late May 1980, and involved the death of a yearling female grizzly bear that had dislocated its ankle in a snare. She weighed 69 kg at the time of capture. Apparently within a few days of release, she was killed by another bear. She was found with a crushed skull and canine puncture wounds diagnostic of bear-inflicted injuries, but was otherwise intact. The species of bear responsible for the attack could not be determined, although black bears are

known to be present (though rare) in the area where she was killed (Henry and Mattson, 1988).

Another instance involved the death of a grizzly bear cub-of-the-year, and occurred during June 1985 at a stream where cutthroat trout (*Oncorhynchus clarki*) were spawning. Remains of a cub-of-the-year were identified in grizzly bear feces collected along the stream. Several grizzly bears were in the area, including two females accompanied by young and a bear whose track measurement (width of front pad = 13.7 cm) indicated it was an adult male (80% of 42 bears measured during our study with width of front track > 13.0 cm were adult males). These observations suggest that the cub-of-the-year was preyed upon by an adult male.

A third instance involved a grizzly bear found in late September 1988 that had died within the month along the Southeast Arm of Yellowstone Lake. The carcass had not been scavenged and was necropsied at the Wyoming State Veterinary Laboratory. The necropsy report indicated that the animal was a young adult male weighing ca. 118 kg at death. The bear died from a blow delivered by another bear to the back, over the posterior thoracic vertebrae, and also had a large bite wound on one thigh.

The fourth instance involved a grizzly bear cub-of-the-year, from the first litter of a 7-year-old female, and occurred in May 1989 in the vicinity of a tourist facility on Yellowstone Lake. The radiocollared mother and cub were observed near the development fishing for spawning cutthroat trout. The cub died soon after it was observed dragging its hind quarters. Necropsy of the animal at the Montana Department of Fish, Wildlife and Parks Wildlife Laboratory concluded the cub died from puncture wounds to the top of the hind quarters and a vertebral fracture caused by another bear.

The final instance occurred in early May 1990 in the Hoodoo Creek drainage of the Shoshone National Forest. An adult male grizzly bear preyed upon what was probably an adult female black bear with young. Black and grizzly bears were congregated in the drainage during late April and early May 1990 to graze clover (*Trifolium hybridum* and *T. repens*) that was seeded in the wake of 1988 fires that had burned the drainage. On 20 May, we visited telemetry locations of an adult male grizzly bear. Based on his weight (217 kg) the previous July, and pre-July weights of adult males with similar track sizes, we estimate

that he weighed about 190 kg at the time of the incident. At one telemetry location we found a cache, numerous tracks from the radiocollared male, and the head, one front leg, and partial vertebral column of a black bear. Although we have no data on weights of black bears, a female grizzly bear with a track size similar to the black bear would have weighed ca. 99 kg. We inferred that the black bear was female by the presence of a series of small claw marks ascending a fire-blackened tree at the scene, presumably the marks of her cub.

We were able to reconstruct the probable scenario of predation. The black bear had been grazing lush grass on a small bench 135 m above the stream bottom. The grizzly bear came up over the lip of the bench, apparently surprising the black bear. A chase ensued directly down the 24–42° slope, towards the stream bottom. At ca. 100 m from the start, the black bear leaped onto a standing lodgepole pine (*Pinus contorta*) that was 53.1 cm in diameter at breast height, and was pulled off the trunk by the grizzly bear before it could climb out of reach. Another 14 m farther, this sequence was repeated (46.7-cm-diameter lodgepole pine), and 20 m farther, at the base of the slope, the black bear was killed and buried. Apparently the grizzly bear remained in the vicinity for the next 10 days, grazing clover and feeding on the black bear.

We also analyzed feces from grizzly bears for remains of both bear species. We considered feces containing bear meat ($n = 9$) or feces containing >50% indigestible bear remains to be evidence of cannibalism. Only 22 of 6,976 feces (0.31%) qualified; 12 contained remains of grizzly bear and 10 contained remains of black bears. Feces with bear remains were no more frequent during the period 1984–1990 than during the preceding period, 1977–1983 (log-likelihood ratio test: $d.f. = 1$; $G_c = 0.59$; $P > 0.10$). There was a tendency for more feces with bear remains than expected to occur during spring (March–May) compared to the rest of the year ($d.f. = 1$; $G_c = 3.44$; $P = 0.07$).

DISCUSSION

Our data corroborate the previously observed rareness of cannibalism in bears and support the hypothesis that adult males are responsible for most predation (e.g., Bunnell and Tait, 1981; Kemp, 1976; String-

ham, 1983; Troyer and Hensel, 1962). In both instances where we suspected or more confidently identified the predator, it was an adult male. Our observations also support the hypothesis that cubs-of-the-year are preyed upon at disproportional rates (e.g., LeCount, 1987; Taylor et al., 1985; Troyer and Hensel, 1962), as indicated by two of our observations and the tendency for bear remains to be more frequent in spring, when cubs-of-the-year are most vulnerable. The death of the young adult male grizzly bear neither supports nor refutes the hypothesis that older adult males aggressively exclude younger males (Bunnell and Tait, 1981; Kemp, 1976), because we could not identify the predator. The death of a young male does suggest, however, some vulnerability to cannibalism in this sex and age class. Our observations also do not support the hypothesis that cannibalism was more common in recent years, as might be expected if the population of grizzly bears in the Yellowstone ecosystem was either near carrying capacity or exhibiting social instability (Stringham, 1983, 1986).

Three of the five incidents occurred in areas with bears aggregated on natural foods. Streams where cutthroat trout spawn are well-known bear aggregation sites (Reinhart and Mattson, 1990), and were the location of both cub-of-the-year mortalities. Death of the adult female black bear also occurred at an aggregation of bears feeding on clover. This pattern does not contradict the hypothesis that cannibalism is more common at bear aggregations (Stringham, 1983), even though contemporary aggregations of Yellowstone grizzly bears at natural foods are much smaller than at most Alaskan spawning streams (Egbert and Stokes, 1976) or pre-1970 garbage dumps in Yellowstone Park (Craighead and Craighead, 1971).

The black bear that was preyed upon clearly oriented towards trees to escape. This incident provides support for the hypothesis that trees are important to the security and evolution of black bears (Herrero, 1978;

Stirling and Derocher, 1990). This incident also suggests that fear of predation may be one mechanism that underlies the apparent dissociation between black bears and adult grizzly bears in the Yellowstone area (Green and Mattson, 1988; Henry and Mattson, 1988; Mattson et al., 1991b; Reinhart and Mattson, 1990).

We encourage bear researchers not only to report instances of cannibalism among bears, but also to report sample size and effort. Only by having access to these data will a synthesis be possible; to evaluate cannibalism among bears in the more meaningful terms of rates. These rates could then be analyzed with respect to demographic and environmental parameters.

ACKNOWLEDGMENTS

This work was supported by the United States National Park Service, United States Fish and Wildlife Service, United States Forest Service, and Wyoming Fish and Game Department. We appreciate the work of numerous field technicians including G. Green and D. Reinhart. We also thank I. Stirling and an anonymous reviewer for their reviews of this paper.

LITERATURE CITED

- ALT, G. L. 1984. Reuse of black bear dens in north-eastern Pennsylvania. *The Journal of Wildlife Management*, 48:236-239.
- BUNNELL, F. L., AND D. E. N. TAIT. 1981. Population dynamics of bears—implications. Pp. 75-98, in *Dynamics of large mammal populations* (C. W. Fowler and T. D. Smith, eds.). John Wiley and Sons, New York, 477 pp.
- CRAIGHEAD, J. J., AND F. C. CRAIGHEAD, JR. 1971. Grizzly bear-man relationships in Yellowstone National Park. *BioScience*, 21:845-857.
- DEAN, F. C., L. M. DARLING, AND A. G. LIERHAUS. 1986. Observations of intraspecific killing by brown bears, *Ursus arctos*. *The Canadian Field-Naturalist*, 100:208-211.
- EGBERT, A. L., AND A. W. STOKES. 1976. The social behavior of brown bears on an Alaskan salmon stream. *International Conference on Bear Research and Management*, 3:41-56.
- GREEN, G. I., AND D. J. MATTSON. 1988. Dynamics of ungulate carcass availability and use by bears on the northern winter range: 1987 progress report. Pp. 32-50, in *Yellowstone grizzly bear investigations: annual report of the Interagency Study Team, 1987* (R. R. Knight, B. M. Blanchard, and D. J. Mattson,

- eds.). United States National Park Service, Yellowstone National Park, 80 pp.
- HENRY, J., AND D. J. MATTSON. 1988. Spring grizzly bear use of ungulate carcasses in the Firehole River drainage: third year progress report. Pp. 51–59, in *Yellowstone grizzly bear investigations: annual report of the Interagency Study Team, 1987* (R. R. Knight, B. M. Blanchard, and D. J. Mattson, eds.). United States National Park Service, Yellowstone National Park, 80 pp.
- HERRERO, S. 1978. A comparison of some features of the evolution, ecology and behavior of black and grizzly/brown bears. *Carnivore*, 1:7–17.
- JONKEL, C. J., AND I. M. COWAN. 1971. The black bear in the spruce-fir forest. *Wildlife Monographs*, 27:1–57.
- KEMP, G. A. 1976. Dynamics and regulation of black bear *Ursus americanus* populations in northern Alberta. *International Conference on Bear Research and Management*, 3:191–197.
- LECOUNT, A. L. 1987. Causes of black bear cub mortality. *International Conference on Bear Research and Management*, 7:75–82.
- LUNN, N. L., AND G. B. STENHOUSE. 1985. An observation of possible cannibalism by polar bears (*Ursus maritimus*). *Canadian Journal of Zoology*, 63:1516–1517.
- MATTSON, D. J., B. M. BLANCHARD, AND R. R. KNIGHT. 1991a. Food habits of Yellowstone grizzly bears, 1977–1987. *Canadian Journal of Zoology*, 69:1619–1629.
- MATTSON, D. J., C. M. GILLIN, S. A. BENSON, AND R. R. KNIGHT. 1991b. Bear feeding activity at alpine insect aggregation sites in the Yellowstone ecosystem. *Canadian Journal of Zoology*, 69:2430–2435.
- MILLER, S. D. 1985. An observation of inter- and intra-specific aggression involving brown bear, black bear, and moose in southcentral Alaska. *Journal of Mammalogy*, 66:805–806.
- MURIE, A. 1981. The grizzlies of Mount McKinley. United States Department of the Interior, National Park Service Scientific Monograph Series, 14:1–251.
- REINHART, D. P., AND D. J. MATTSON. 1990. Bear use of cutthroat spawning streams in Yellowstone National Park. *International Conference on Bear Research and Management*, 8:343–350.
- ROSS, P. I., G. E. HORNBECK, AND B. L. HOREJSI. 1988. Late denning black bears killed by grizzly bear. *Journal of Mammalogy*, 69:818–820.
- STIRLING, I., AND A. E. DEROCHE. 1990. Factors affecting the evolution and behavioral ecology of the modern bears. *International Conference on Bear Research and Management*, 8:189–204.
- STRINGHAM, S. F. 1983. Roles of adult males in grizzly bear population biology. *International Conference on Bear Research and Management*, 5:140–151.
- . 1986. Effects of climate, dump closure, and other factors on Yellowstone grizzly bear litter size. *International Conference on Bear Research and Management*, 6:33–39.
- TAYLOR, M., T. LARSEN, AND R. E. SCHWEINSBURG. 1985. Observations of intraspecific aggression and cannibalism in polar bears (*Ursus maritimus*). *Arctic*, 38:303–309.
- TIETJE, W. D., B. O. PELCHAT, AND R. L. RUFF. 1986. Cannibalism of denned black bears. *Journal of Mammalogy*, 67:762–766.
- TROYER, W. A., AND R. J. HENSEL. 1962. Cannibalism in brown bear. *Animal Behaviour*, 10:231.

Submitted 26 April 1991. Accepted 30 May 1991.