

## Cannibalism by Black Bears in the Nimpkish Valley, British Columbia

### Abstract

We studied black bears (*Ursus americanus*) between 1992 and 1995 in the Nimpkish Valley, Vancouver Island, British Columbia. During 1994, we observed 4 incidents of cannibalism by black bears. One incident of cannibalism occurred on a dened, radio-collared female that was consumed 390 m from her den and her two-cub litter that was consumed at the den site. The second incident involved a radio-collared male who consumed a female and her cub near their possible den site soon after den emergence. The third incident was one cub of a two-cub litter that was consumed 39 days after its radio-collared mother emerged from her den. The fourth incident was a subadult female attacked by an adult male during autumn before hibernation. Several authors have hypothesized that males kill unrelated cubs to increase their reproductive fitness. In our study, cannibalistic behavior of male bears is unlikely to have enhanced reproductive fitness because the bears involved were residents within their mating ranges, thus there is a high likelihood that the cubs were related to the aggressor. The high incidence of cannibalism in our study during 1994 is puzzling and inconsistent with explanations which attribute this behavior to enhancement of the fitness of male bears.

### Introduction

Assessment of mortality is helpful in the management of wildlife populations. Of all the causes of mortality, cannibalism, although infrequent, is particularly interesting and least understood from an evolutionary perspective. There have been few documented cases of cannibalistic attacks by male black bears (*Ursus americanus*) on female black bears despite many studies in which bears have been monitored intensively (see Garshelis 1994). Garshelis (1994) found 39 known cases of intraspecific killings (excluding cubs) reported in 17 North American black bear studies that were conducted between 1975-92. Ten of the victims were adult females with cubs (four in dens) and 11 were subadult females. Although uncommon, cannibalism may be an important source of mortality in populations of black bears.

Several factors may affect the frequency of cannibalism within a population. Cannibalism appears to be density dependent in some vertebrate populations (e.g. Elwood 1992). However, in his review of black bear population processes, Garshelis (1994) did not find an association between high population densities and high rates of cannibalism. The sex-age composition of the population may also affect the rate of cannibalism. Much of this cannibalism is inflicted on cubs. In Arkansas, a male dominated sex ratio may have led to an increased rate of cannibalism among black bears (Clark 1991). In one population which was comprised of 59% adult and subadult males,

cub survival rate was 0.31. In another population which was comprised of 39% males, cub survival rate was 0.90. Causes of cub mortality were unknown, but Clark (1991) suspected that the male-dominated adult sex ratio was a factor in low cub survival.

Although cannibalism by black bears is uncommon, we observed four incidents during 1994 on northern Vancouver Island. This frequency of cannibalism is much greater than that reported from other studies. Our objectives are to describe the incidents and discuss possible causative factors.

### Study Area and Methods

The incidents of cannibalism that we report occurred in 1994 while monitoring 19 radio-collared black bears (7 females, 12 males) as part of the 3-year Nimpkish Black Bear Study. The study area was located in the Nimpkish Valley, 40 km south of Port McNeill on Vancouver Island, British Columbia. The forests in the area have been commercially harvested by clearcutting since the 1920's. Most of the cutovers have regenerated to conifer-dominated, second growth stands with closed canopies. Because of recent logging, a few early seral stage cutovers occur in a mosaic of second growth and some old growth stands. Bears were captured in culvert traps or by Aldrich foot snares, immobilized using Telazol (Ayerst Laboratories, Montreal), and radio-collared. Radio-telemetry was conducted by ground and

air at least twice weekly from the spring of 1992 to 1995. Home ranges were determined from a minimum of 95 locations for the bears involved in the cannibalism incidents.

## Results

Trapping success, based on 49 captures of 34 individuals (25 males and 9 females), indicated that there were more males than females in the black bear population (2.8 males : 1 female;  $\chi^2 = 7.53$ , d.f. = 1,  $P < 0.006$ ). This ratio is biased because males were easier to trap than females; the recapture rate of males was 36% while that of females was only 10% (Table 1). Despite this trapping bias, visual sightings of uncollared bears corroborated our trapping results and confirmed that the population had a male-dominated sex ratio. Our preliminary estimate of population density in the area that the cannibalism occurred (0.25 bears/km<sup>2</sup>) reveals that the density of black bears is not abnormally high compared to elsewhere in North America (range 0.07-1.30 bears/km<sup>2</sup>, Garshelis 1994).

The first case of apparent cannibalism of a female and cubs was encountered on 26 April 1994. An 11-year-old radio-collared female (F03) with cubs (one of four collared reproductive adult females) apparently left her den site between 20-22 April. On 26 April, we approached the den site to determine the type of den structure that she used. When we reached the den, an uncollared bear was nearby and ran away. A bear bed was 5 m from the den, and bear hair and cub claws (21 in total) were found in bear scats located at the bed and around the den. The den bedding was intact and there were no signs of struggle at the den site. The den was in a spaced second growth stand beneath a root bole and had three entrances. At the time of the first investigation, we believed that F03 was alive and 390 m from the den. Three days later she was found dead at the same location, with a radio-collared male (M08) and an

unmarked bear feeding on her body. An investigation of F03's body later revealed a large hematoma in the hide, suggesting that she was injured before death, perhaps while defending her cubs.

The second case of cannibalism on a female and cubs became evident after a 6-year-old radio-collared male (M06) had not moved from a closed canopy second growth stand for eight days, beginning 19 April 1994. The body of a partially consumed adult female was discovered when we approached and scared M06 away. The site was very disturbed, including marked trees, marked trails, and masses of ferns used to cover the body. There were a few beds and numerous scats, some of which contained bear hair and cub claws (eight claws were found). The female's face was not damaged and there were no signs of fighting.

Later during summer, we searched the area surrounding the site where the female's carcass was found. A den was found under a root bole in a small patch of old growth, 180 m from the body site. The den was used the previous winter but we cannot definitively state that this den was used by the female and her cub. A well-lined bed was found 17 m from the den, suggesting that the female was not in the den when the attack occurred (if the den was hers). A large heavily-climbed tree was between the den site and the body site, next to which we found signs of a food cache and marking of small trees. A tooth and thin skull fragments from a young cub were retrieved from this cache. Our evidence suggests that the attack started at, or near, this climbed tree.

A third case of cannibalism was observed 12 June 1994. Thirty-nine days after emerging from her den, a radio-collared female (F01) was located in a cutover that she used regularly. She was bawling and vocalizing to one of her two cubs-of-the-year which had climbed a small conifer tree at the cutover's edge. The second cub was not seen. A large 11-year-old radio-collared

TABLE 1. Recapture rates of individually marked black bears in the Nimpkish Valley, Vancouver Island, 1992-1994.

	Number of individuals captured	Number recaptured	Total number of bears captured	Percent recaptured
Female	9	1	10	10
Male	25	14	39	36
Total	34	15	49	31

male (M15) was at the site, but was not visible to us. We returned to the site 6.5 h later and observed the cub still in the tree. Subsequent investigation confirmed that M15 had consumed one of the cubs and bedded at the base of the tree which the surviving cub had climbed. Scats next to the beds contained cub claws. Large claw marks in the bark of the tree suggested that M15 had attempted to climb up after the surviving cub. This cub was seen alive the next day but not afterwards, although the mother was observed repeatedly over the summer. She did not produce cubs in 1995.

Eight days later in the same cutover, M15 treed another radio-collared 5-year-old female (F06) and her two cubs-of-the-year. Both cubs were seen the next day. Although F06 was monitored regularly, she was not seen again for 58 days and was accompanied by only one cub at this next sighting. Besides these attacks on females and their cubs, M15 was observed the previous spring in a brawl with another radio-collared adult male close to the cutover in which he treed the females and their cubs.

The fourth case of cannibalism occurred on 6 November 1994. During regular monitoring of radio-collared bears, a 6-year-old male (M11) and a 4-year-old female (F07) were located close together. Loud vocalizations were heard upon walking closer to the pair. Bawling, huffing, and strange vocalizations appear to have been made by the female. The two bears were only 15 m from the observers in an 18-year-old second growth conifer stand but were very difficult to observe amongst the thick vegetation. An aggressive interaction between the two bears was not suspected because they and two other females used the same cutover almost year round. Furthermore, the two bears were seen together during the 1994 breeding season.

We thought that the bears may be consuming a deer carcass and decided to interrupt the interaction and investigate the site. We attempted to chase away both bears. M11 eventually left very slowly but remained close to the site. F07 refused to leave the site but stopped her vocalizations when we made a lot of noise. We were able to walk to within 5 m of F07. Her hind legs appeared to be partly immobilized when she attempted to drag herself away. The injuries appeared to be serious and we believe she would have been killed had we not intervened. We suspect that M11 had been involved in cannibalism

before, because he had eaten a young male bear during the spring. Evidence of cannibalism was more circumstantial in that situation because the young male's body was close to human activity and may have been killed by humans.

We decided to intervene for three reasons: 1) F07 was an important study animal because she was one of two subadult females that had been followed for 1.5 years; 2) because of the previous three cases of suspected cannibalism in the spring, we wanted to determine the cause of her injuries; and 3) hunters were in the area and we wanted to determine if her initial wounds were due to gunshot. If M11 was allowed to consume the female we would not know the cause of her injuries.

F07 was immobilized and examined. Her injuries were extensive. Her right thigh had a large deep wound, 15 cm long x 10 cm wide, which extended down to the femur. A second large wound was located below and to the left of her anus. It was about 10 cm long but not as open as the thigh wound. The wounds were not caused by gunshot. It appeared that F07 had lost a lot of blood because her gums and tongue were whitish and cold. F07 was moved away from M11 to another location within her home range. Although F07 recovered from the drugs and was observed standing on her front legs, she never left this new site and died two days later from infection of her wounds. M11 remained close to the attack site for another day and then moved away. We do not believe he was nutritionally stressed because he was very fat and had consumed a deer 19 days before. A later investigation of the site revealed a large amount of bear hair with skin attached spread around a few flattened areas and on numerous shrubs. No meat or other attractants were found at the site. F07 had not yet dened, although other females had started to enter their dens. We later examined her decomposed body and found that none of her bones were broken.

In addition to these four cases of cannibalism during 1994, we observed two incidents in 1992 of male bears treeing females and their cubs at the edges of cutovers during early spring. The bears were not radio-collared and so the outcomes are unknown. It is possible that M15 was involved in the 1992 incidents because although he was unmarked at the time, these areas were part of his home range in 1994. To our knowledge no

cubs were born in the study area during 1993. Besides the scats at the cannibalism sites described above, three bear scats containing cub claws were found incidentally in the study area between 1992-94.

## Discussion

During 1994, there appeared to be a high rate of cannibalism among black bears in the Nimpkish Valley study area. Within one year, we documented four attacks: three involving cubs (two of which included the death of the mothers) and one attack on a subadult female. Other researchers (Rogers 1983, Alt and Gruttadauria 1984, Tietje et al. 1986) have reported these types of killings, but none report as many incidents within such a short time.

The role of cannibalism in population processes is not well understood. Incidents of cannibalism in northeastern Alberta described by Tietje et al. (1986) involved unrelated individuals and a female from outside the mating range of the predatory male. Tietje et al. (1986) hypothesized that killing cubs by male black bears was adaptive under particular conditions: males out of their mating range encountering bears that are not their kin. Males are thought to kill unrelated cubs to increase their reproductive fitness.

The rationale for cannibalism presented by Tietje et al. (1986) may not pertain to our study. In our study area, at least two of the incidents in which cubs were killed involved resident males in their mating ranges and resident females. The cannibalistic behavior of male bears which we observed is unlikely to have enhanced their reproductive fitness because the bears involved were within their mating ranges, thus there is high likelihood that the cubs were related to the aggressor. Furthermore, the killing of adult and subadult females by males seems particularly maladaptive because it would diminish the male's reproductive opportunities in the future.

Several factors may contribute to the high rates of cannibalism that we observed. Skewed sex ratios may affect the rate of cannibalism within bear populations (Garshelis 1994, Wielgus and Bunnell 1994). The bear population in our study area likely had more males than females. In populations that are dominated by males, females would

encounter many males over the breeding season. The following year when males encounter cubs there would be a lower likelihood that the cubs are theirs. Hunting of adult male bears by humans in such areas could further exacerbate cannibalistic attacks by causing influxes of subadult male bears (Wielgus and Bunnell 1994).

In addition to a sex ratio dominated by males, habitat alteration may increase aggressive interactions among bears. Much of our study area is managed for conifer production and thus dominated by closed canopy second growth forests. The few early seral stage cutovers which provide foraging habitat during spring result in seasonal concentrations of bears. These local high densities of bears may increase interactions between adult male bears and females with their cubs. Availability of den sites may also be affected by habitat alteration. Bears in the Nimpkish Valley den in large hollow trees, root boles and logs that may not persist after logging (unpub. data). Removing the structures used for denning may increase the vulnerability of females with cubs by limiting the supply of secure den sites. Females with cubs are in dens after males have emerged thus are vulnerable to attack (Tietje and Ruff 1980). If females are forced to use less secure dens (e.g. more than one small entrance) they increase their already vulnerable situation.

Some of the killings of adult females that we observed in the Nimpkish Valley study may have been a consequence of the attempts by the mothers to protect their cubs. The rationales argued to explain cannibalism in previous publications could apply to some of our observations but other incidents appear inconsistent with tactics to increase reproductive fitness of male bears.

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