

MALE-INSTIGATED BREAK-UP OF A FAMILY OF BLACK BEARS

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Abstract: A free-ranging, human-habituated female black bear (*Ursus americanus*) accompanied by 3 yearling offspring was visually observed for about 100 hours (Apr–Oct) in the Camp Ripley Military Reservation, central Minnesota. During April–June, the mother played with and suckled the yearlings, although she was not lactating. The duration of suckling bouts by the yearlings was not significantly different from when they were cubs. During a suckling bout the mother was approached by a breeding-age male; she was initially aggressive toward the male, but then she turned her aggression toward the yearlings and left the area without them. These observations appear inconsistent with the theory of parent–offspring conflict, which predicts a gradual lessening of parental care rather than the abrupt, male-instigated break-up we observed. Caring for yearlings apparently exacted little cost to the mother until breeding activities began. We also observed 2 instances of yearlings rejoining for brief periods, independent of the mother and >2 months after family break-up.

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Bears are considered to be the least social group among the carnivores (Gittleman 1989). Except for congregations and interactions at rich feeding sites (Herrero 1983, Craighead et al. 1995), social behaviors tend to be limited to parent–offspring relations during the period of parental care and among adults during the breeding season. Breeding-related interactions are usually brief (Barber and Lindzey 1986). In contrast, interactions with offspring may comprise a substantial component of their social behavior, because female black bears typically produce a litter every 2 years and remain with their young for 17 months. Breeding interactions (Ammons 1974, Ludlow 1976) and social interactions between siblings (Burghardt and Burghardt 1972, Henry and Herrero 1974, Pruitt 1976) have been described from observations of captive animals. Observations of female–offspring interactions among wild bears before, during, and after family break-up have not been reported.

Often with the aid of radiotelemetry, researchers have identified the timing of family separation in black bears (usually between the last week of May and mid-June; Barnes and Bray 1967, Jonkel and Cowan 1971, Reynolds and Beecham 1980, Rogers 1987, Schwartz and Franzmann 1992). However, because opportunities to observe free-ranging bear families are rare, researchers have not been able to examine the impetus for family break-up. Trivers (1974) hypothesized that family break-up is preceded by a period of increasing parent–offspring conflict, as females provide diminishing care for their maturing offspring while offspring attempt to maintain or secure increased care. We had the opportunity to exam-

ine the predictions of Trivers' (1974) hypothesis while observing a free-ranging black bear family consisting of a mother and three 1-year-old (yearling) offspring.

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METHODS

Observations were made during the summers of 1991 and 1992 in the Camp Ripley Military Reservation in central Minnesota. Camp Ripley is a 215-km² reserve operated by the Minnesota Army National Guard as a field training area for troops in all branches of the military. The area was forested but contained scattered grasslands, wetlands, and a network of unimproved roads and trails. Dominant forest types included aspen–birch (*Populus tremuloides*, *P. grandidentata*, and *Betula papyrifera*), northern hardwood (oak [*Quercus* spp.], maple [*Acer rubrum*], ash [*Fraxinus* spp.]), and pine (*Pinus strobus*, *P. resinosa*, *P. banksiana*). In the summer of 1992, an estimated 6.8 bears/100 km² occupied the area (Ternent 1995).

The camp had persistent problems with bears due to the availability of human foods. Nuisance activity occurred primarily when large numbers of troops were training; at other times bears seldom associated with people (Ternent 1995). As a result of their frequent interactions

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with troops, some resident adult females became habituated to humans and could be approached without food rewards, enabling us to observe their normal daily activities.

In June 1991 we captured and radiocollared a 5-year-old female with cubs (1 male, 2 females) at a military bivouac site. The cubs were radiocollared the following winter in the den with their mother. All 4 bears also were given large (7 × 6 cm), individually color-coded eartags.

The family was located using radiotelemetry, and then approached within a distance (10–30 m) that facilitated continuous visual contact with minimal disruption of their behavior. In 1991 the female tolerated our presence, but the cubs often did not. The next year the yearlings were more accustomed to our presence, enabling us to easily observe them. We recorded observations using a hand-held tape recorder.

Observation sessions were conducted approximately twice a week for 1–3 hours, usually between 1100 and 1800 hours. We observed these bears for about 100 hours during April–October, 1992. For the week following family break-up, the mother and all yearlings were located daily to monitor reassociations. Military training activities often precluded our access to these bears during July to mid-August.

RESULTS

Mother–Offspring Interactions before Family Break-up

We observed 14 incidents of suckling by the yearlings during 63 hours of observations from 3 April to 2 June 1992. The mean duration of suckling bouts was 7.5 minutes, compared to 8.0 minutes ($n = 3$, $t = 0.24$, $P = 0.82$) during 1991, when the offspring were cubs. Typically, a yearling approached the mother while she was sitting and attempted to suckle by nuzzling her chest. As a yearling suckled, it made pulsating, humming sounds that seemed to prompt the other yearlings to nurse. We discerned no tendency for a particular individual to initiate suckling and no instances in which the mother rejected attempts of yearlings to suckle. We captured the mother on 24 May; her mammae were not enlarged and we could not express milk from her nipples.

Yearlings commonly played with each other, with their mother, or with inanimate objects, such as stumps, logs, or trees. Lengths of mother–yearling play bouts ($\bar{x} = 6$ min, $n = 44$) were about the same as bouts between yearlings ($\bar{x} = 7$ min, $n = 29$, $t = 0.66$, $P = 0.51$). Play in-

cluded biting, pawing, and wrestling, sometimes while climbing a tree.

Family Break-up

The first detected separation of the family occurred on 2 June. At 1130 hour CST (Central Standard Time) we sighted the 3 yearlings together, 1 km from their mother. However, later that day the 2 female yearlings had rejoined their mother. At 1700 hour we saw them feeding in a marshy area. At 1755 hour they stopped at a small upland area, the mother reclined, and both yearlings began suckling. We later found that the male yearling had been captured in a barrel trap, 1 km from the rejoined family group. We released him at 2000 hour.

At 1800 hour, a radiocollared 3-year-old male approached to within 30 m of the mother and 2 nursing yearlings. At 1802 hour, the mother stood, moved towards him, and made a “woofing” vocalization. At this sound, the 2 yearlings climbed separate aspen trees. When the male approached to 4 m of these trees, the female charged him and growled. The male ran away and the mother followed. Both male and female moved out of view for 5 minutes. When the mother returned to the trees that the yearlings had climbed, she lay down and remained in a prone position with her head up for approximately 25 minutes. After retreating up the trees, both yearlings periodically huffed and whined. This behavior continued after the mother returned.

At 1835 hour the mother left. At 1840 hour we saw her about 20–30 m away with the male. They were facing each other, approximately 1 m apart, grunting. At 1845 hour, the mother abruptly turned away from the male and charged up a tree at a yearling. She growled loudly and slapped branches as she chased the yearling further up the tree. Upon reaching the top, she immediately descended and repeated the same behavior with the other yearling. After descending from the second tree, she left the area. A final telemetry check at 1902 hour indicated that the male was no longer nearby and the mother was moving in a different direction. The yearlings came down at 1910 hour and departed in separate directions.

After Family Break-up

The mother and 1 female yearling were located together the first day after the initial family break-up (3 June); the other 2 yearlings were together, 6 km away. The next day, the mother was with a 7-year-old radiocollared male, 5 km from her location the previous day, and the yearlings were all separate. Afterward, we observed the yearlings reunite twice. The

male yearling was with 1 female sibling on 7 August and with the other on 11 August. He subsequently dispersed outside the military reservation, where he was killed by a hunter on 7 September.

The adult male associated with the initial break-up and the male observed with the mother the day after break-up were not found with her again, but she was seen with a 3-year-old male on 16 June and another 3-year-old (both radiocollared) on 17 June. Of the 4 males observed with the mother, 2 were also observed with other females. Two of the males were captured in early June, and both had multiple cuts on their heads and necks from recent fighting.

DISCUSSION

Females face costs in caring for offspring, some of which may affect their future reproductive success. As the benefits of caring for present offspring decline and costs to future reproduction increase, a time is reached when mothers leave their young. However, in terms of inclusive fitness, the young have less to lose and more to gain by continued parental care. Trivers (1974) argued that they should try to garner more care than the mother prefers to give, leading to increasing mother-offspring conflict. In the early stages of parenting, mothers tend to initiate contacts with offspring, but as time progresses the offspring increasingly must induce maternal investment, which the mother becomes increasingly more reluctant to provide.

Our observations of mother-offspring interactions in a single black bear family did not follow this pattern. We observed no indication of increasing conflict between mother and offspring. Instead, the mother continued to play with and suckle her young regularly and willingly up to the virtual instant before family break-up, but then became aggressive toward them.

Trivers' theory (1974) predicts a conflict only because of increasing cost to the mother's future reproduction. If these costs are minimal, the mother should freely provide care. Thus, an explanation for our observations is that until the breeding season there was little cost to the mother's parental care. When approached by a male, however, circumstances changed; remaining with her offspring could have jeopardized breeding, and moreover her offspring could have been injured or killed by a male. If these were the only costs, the mother might have reunited with her yearlings after breeding and provided additional care, including protection from males. Furthermore, she might have even denned with these off-

spring, providing greater warmth and protection for them, herself, and her new litter of cubs. These situations occur in black bears, but they are rare (Jonkel and Cowan 1971, Rogers 1987, Schwartz and Franzmann 1992, Noyce and Garshelis 1994), suggesting that there is a cost to the mother's future reproduction in providing such continued care. Extending this reasoning, a cost should also exist prior to breeding. However, our observations did not suggest any lessening of parental care prior to the approach of the male.

Whereas the suckling and play exhibited by the mother indicated a high level of parental care, these activities by themselves probably had little cost to her. Also, although the suckling may have been comforting to the yearlings, it did not benefit them nutritionally, as we found no evidence that the female was lactating. Cubs are known to produce the same pulsating, humming sounds when suckling their paws or other objects as when nursing their mother's nipples (Burghardt and Burghardt 1972; D. Garshelis, pers. observ.). Moreover, these yearlings appeared to be self-sufficient foragers; they weighed 36 to 40 kg, well above the average weight (21 kg, D. Garshelis, unpubl. data) for other Minnesota bears of this age group and thus had no need for more nourishment from suckling. Instead, the continued suckling probably enhanced the bond between parent and offspring. Similarly, Robbins and Moen (1975) proposed that late lactation in white-tailed deer (*Odocoileus virginianus*) serves principally to maintain a mother-young bond.

The primary cost to the mother in caring for yearlings was likely competition for food. The family always foraged together, often at the same source (e.g., a single ant hill). Prolonging parental care could exact a cost on production of future offspring if foraging by yearlings affected the mother's physical condition, either by requiring her to expend more energy locating food or diminishing the availability of food. This cost was likely small prior to the breeding season because the mother had several months to recover from any nutritional deficiencies, but the cost would increase afterwards. Furthermore, whereas the young probably derived significant benefits from maternal assistance in finding spring foods (since they had not done this before), they already had experience foraging with their mother on summer and fall foods the year before.

The presence of a male dramatically altered the mother's behavior toward her young. When the male first approached, the yearlings were suckling and the mother defended them by chasing the male away.

Shortly afterward, she became aggressive toward her yearlings. This aggression did not appear to be in protection of the yearlings, as they were already safe in trees and the male did not attempt to approach them. We did not witness similar behavior previously by the mother, even when she or her cubs occasionally appeared threatened by our proximity; her young sometimes climbed trees, but she did not follow.

The change in behavior by the female was abrupt, but not instantaneous. She was temporarily separated from her yearlings prior to the incident with the male that we observed (possibly due to a previous encounter with a male), and she rejoined a yearling the day following the incident that we observed, suggesting conflicting pressures on her behavior. Her final split with her offspring appeared to be prompted by an encounter with another male.

This female associated with ≥ 4 different males during 2 weeks with no pairings lasting >1 day. Barber and Lindzey (1986) observed short-term (<2 hr) associations between male and female black bears during the breeding season in Washington. They interpreted these occurrences as males assessing the estrous status of females. Also, male-female associations may induce ovulation (Craighead et al. 1995), which would benefit the female. Longer associations, generally involving >1 male with each female, characterized actual breeding both in black bears (Barber and Lindzey 1986) and grizzly bears (*U. arctos*; Craighead et al. 1995). The males that we observed with the female during the 2-day family break-up stayed with her for <1 hour and did not copulate. During this same period 2 other adult females, who did not have offspring, also were seen with adult males, suggesting that the presence of yearlings did not affect attraction of males and, hence, timing of breeding.

We caution that these observations represent a single case of a family break-up, which we felt were important to report simply because researchers rarely witness such events. We do not know whether the incidents that we observed are typical, or if other scenarios are also common (e.g., mother becoming progressively less involved in parental care, male chasing yearlings away, yearlings leaving on their own). Furthermore, we warn that these observations do not provide any insight into the more important question of what prompts male (and occasionally female) dispersal from the mother's home range (Garshelis 1994).

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