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Formation of a dominance hierarchy among wild Brown bears *(Ursus arctos)*[1]

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Brown bears (*Ursus arctos* L.) are usually asocial, the home ranges of the males and females more or less overlapping, but a dominance hierarchy may form at concentrated food sources such as berry patches, salmon streams and garbage dumps (see review in Bunnell and Tait 1981). The present authors have had an opportunity to record three cases on the formation of this kind of hierarchy among wild brown bears in wild forest areas near the eastern frontier of Finland.

In the first case (site A), a large bear (probably male, size of track 26 × 16 cm) chased a younger bear away so violently from a moose carcass that the latter only stopped to lie down after walking for 3.1 km. The larger bear was still at the carcass a week later and the younger one had kept away.

In the second case, two same-sized bears (aged over 2 years) walked together towards a feeding site (site B), commencing struggling (wrestling) at the distance of 150 m from it. The lighter one won and went to eat. During its feeding it did not allow the darker one to come to the feeding site.

In the third case, a large male (I) was seen at a feeding site (C) every year during 1980–1983. Another large male (II) came to feed at this site on June 25 1981, and serious fight took place some time between 9.30 h on 26 June and 17.45 h on 29 June. After the fight the less obviously wounded bear I would flee from the feeding site when he observed bear II approaching. The same bears were seen after the dormancy period on 15 May 1982. The bears fed consecutively at the same site at 16.35–17.10 h. A new bear (III) appeared at the site at 17.37 h on 17 May, and again a new one (IV; female) on 19 May 1982. Bear II saw the arrival of bear III at a distance of 50 m and walked towards the newcomer, whereupon the latter soon ran away. It also drove away bear IV. Bears I, II and III all visited the feeding site later in the spring and summer. Bear III was killed on 13 June. It proved to be a male weighing approx. 100 kg.

Bears I and II and two new bears (V and VI) were seen at this feeding site in summer 1983, bear II only in early May. Bears I and V were seen there during the night of 3/4 July, for instance. Bear I was moving at and around the feeding site simultaneously with the male bear VI on 8–9 July. Bear VI arrived to feed at 0.05 h and left at 0.27 h as bear I approached.

The present observations were made in May–early July, i.e. just after dormancy and during the breeding season. Here agonistic actions were recorded throughout the observation period. Pearson and Halloran (1972) found fresh wounds on most large males captured during the breeding season, indicating considerable fighting within the mature male sector of the population, while Ruff and Kemp (1983) report that scarring was most apparent during the breeding season (May–June) among both sexes. Here the most serious wounds were seen on the faces of the two largest adult males (I and II) at site C at the end of June, the winner (II) being more seriously wounded (externally) than the looser (I).

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Stonorov and Stokes (1972) found that at a salmon-spawning stream in Alaska the very large males were mostly the highest in rank, then came the females with cubs, the single mature females and the smaller mature males and lowest of all the sibling groups of non-breeders. Here at site A a large bear (probably male) chased a small bear away from a carcass, causing it to retreat over 3 km and not to come back for at least a week. Site C had been found and occupied by the male I in 1980. Bear II, also a large adult male, appeared the following year. The fight between the two bears between 26 and 29 June was not seen, but there is no reason to assume that the protagonists were not these animals. The newcomer was the winner, bear I falling to second in rank. The other bears, including a female which visited the site in summer 1982, were below these two in the hierarchy. When bear II ceased to visit the site C in 1983, bear I took its position as the first in rank. A hierarchy may also occur among non-breeders, as at the site B.

Hornocker (1962), studying the brown bears of the Yellowstone National Park (USA), stated that they established a dominance hierarchy that presumably reduced the incidence of actual fighting. The same conclusion can be drawn from the present observations. It should also be noted that the dominance hierarchy between the two large high-ranking males and the subordinates was probably established without any fight, since no visible wounds were detectable on them.

Here at site C the two large adult males, one sub-adult or mature male weighing 100 kg and a female of the same size were moving in the immediate vicinity of the feeding site at the same time. The site was defended by the highest-ranked male (II), but the other bears had an opportunity to feed when it was absent. It was only a question of the sufficiency of the food available and of a feeding order among the (hungry) bears. In a scarcity situation the highest-ranked male (bear II), and in its absence in 1983 the next in rank order (bear I) would have been more likely to survive than the subordinates.

Herrero (1978) emphasized that sexual competition between males for oestrous females seems to be most common reproductive strategy for the bear, leading to the selection of large, aggressive males. The present observations and those made at other concentrated food sources have similarly shown that such males are the successful in the competition for food, which further strengthens their position in the competition for females.

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