

BROWN BEAR IMMIGRATION INTO FINLAND FROM THE EAST

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Abstract: The dispersal of a brown bear (*Ursus arctos*) population in northern Europe was studied from 1968 to 1982 with the help of the Finnish Border Patrol Establishment and local hunters. Bears immigrated to Finland in the 1970s and early 1980s from the saturated Soviet Karelian population. Continued immigration from Soviet Karelia into Finnish Northern Karelia, Kainuu, and Koillismaa caused the bears to move through the inland areas of Finland, some crossing the entire country from east to west. Bears also appeared in the southeastern frontier area of Finland, and some immigration was recorded from the Kola Peninsula into eastern Finnish Lapland. From 1969 to 1981, 682 more bears immigrated to Finland, mainly from South Karelia, than emigrated. During this period at least 456 bears were killed in Finland; the number of bears in Finland thus increased by about 200 (to 300–350). The bears killed in eastern Finland were predominantly males, 64.1% in 1960–81, and the proportion of cubs killed was 17.8%. It is assumed that intraspecific aggressiveness (leading especially to subadult dispersal) results in emigration, the males being more mobile than the females.

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The dispersal and population self-regulation mechanisms of the brown/grizzly bear and black bear (*U. americanus*) have received considerable attention (Bunnell and Tait 1981, Garshelis and Pelton 1981, McCullough 1981, LeCount 1982, Miller and Ballard 1982, Young and Ruff 1982, MacDonald 1983, Pulliainen 1983). Expansion of a saturated Karelian brown bear population was studied in northern Europe (Pulliainen 1979, 1983). The purpose of this paper is to provide additional information on these studies.

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METHODS

Each frontier post station of the Finnish Border Patrol Establishment systematically recorded crossings by brown bears when patrolling the 2,574-km long frontier zone. Double or even multiple recording of the same track was eliminated by marking the tracks after counting, and by discussions among the staff members of each frontier post. Certain bears were recognized by track size and pelage color. Since 1968, these methods have allowed me to estimate the number of brown bears in the areas under surveillance 3 times a year. The bears spend about 6 months in a dormant state, but it is possible to calculate rates of immigration or emigration from these figures during the active period of the year. The most visible tracks appear in snow, on sandy, wet, muddy, or mossy ground, and near the fence along the frontier.

The open season for killing bears has been in the

reindeer (*Rangifer tarandus*) husbandry area in northern Finland in spring (1 May–15 Jun) and autumn (1 Sep–15 Oct); in the municipalities adjacent to the eastern frontier the open season occurs only during autumn. Elsewhere in the country, brown bears are protected. The only restrictions have been on killing in winter dens and in artificial feeding sites. Information on kills has been sought through every available channel (e.g., newspapers, local hunters, police). The same sources have provided data on bears in the inland area.

RESULTS

The bears found in Finland from 1960 to 1981 represent the western edge of the population inhabiting the northern European U.S.S.R. Changes in the core population are also reflected at its edges. In Soviet Karelia, a likely direction for emigration is west to Finland, because dense bear populations already exist in the north and south, and the White Sea lies to the east.

Bears did not inhabit the southeastern frontier in the 1960s, but they did appear there during the next decade (Fig. 1), indicating a further expansion of bears from the east. This immigration did not reach a regular flow until 1982. A regular immigration of bears from Soviet Karelia has been recorded in the southern part of Northern Karelia, the next frontier to the north, since the late 1970s, and in the northern part and farther north, in Kainuu and Koillismaa, since the early 1970s (Fig. 1). The rate of bear immigration from the Kola Peninsula into eastern Finnish Lapland did not reach the level recorded from Soviet Karelia into more southerly areas of Finland (Fig. 1), and there were no bears in northernmost Finland (Utsjoki and Enontekiö) from 1968 to 1981.

During the 1960s, few bears were found in the

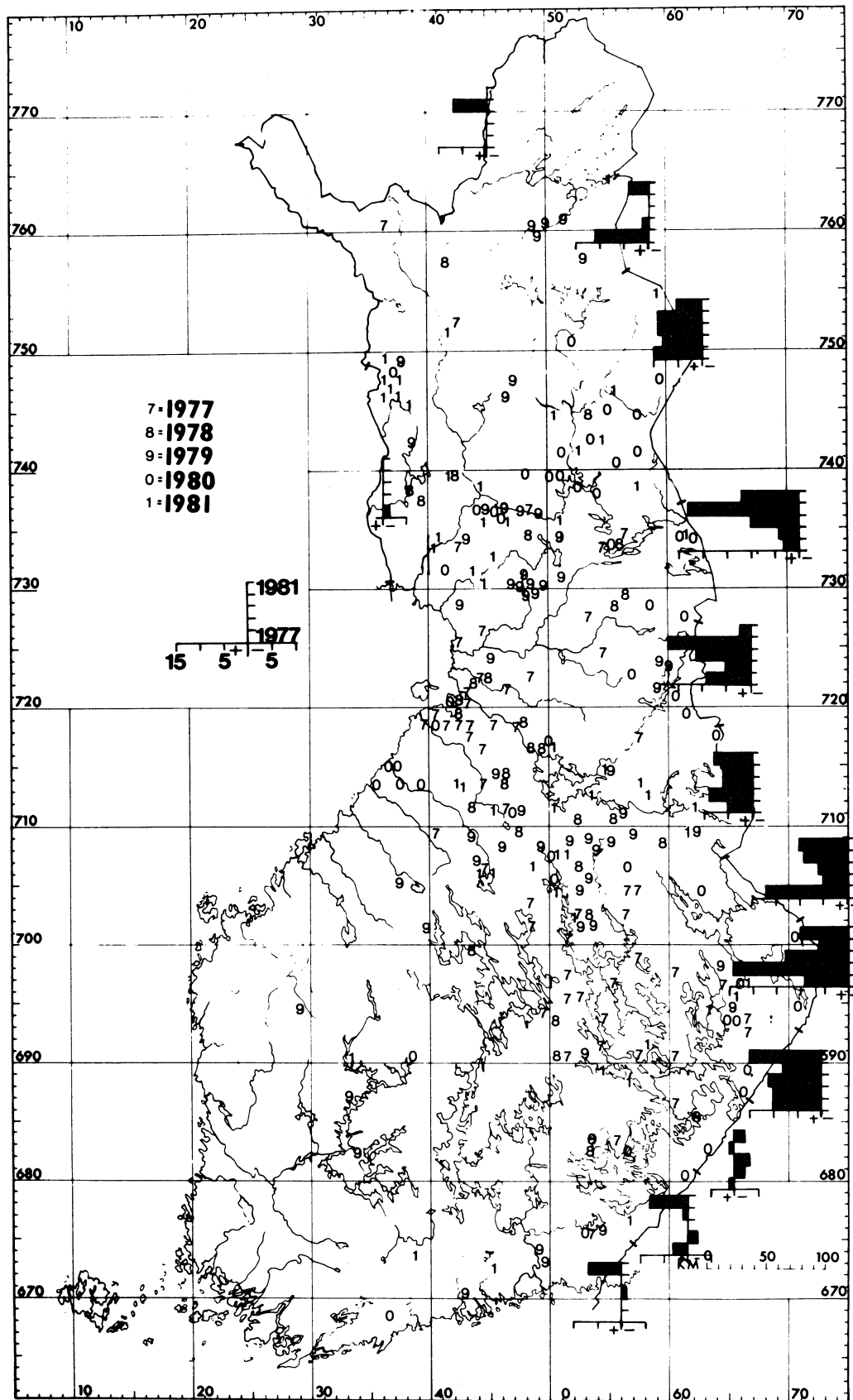


Fig. 1. Numbers of brown bears gained and lost by Finland due to wandering (according to the reports of the Finnish Border Patrol Establishment) and places where bears were observed in the inland area according to newspaper reports during the same period.

inland areas of Finland; but during the 1970s they began to appear in various parts of the country. Bears were observed in the western parts of Lapland, near the Tornio River valley, and wandered through central Finland as far as the Gulf of Bothnia. They were also seen in various parts of the Lake District in the southern half of Finland; some reached the town of Tammisaari fairly far west along the south coast (Fig. 1).

In general, at latitudes where bear immigration from the east has been strongest, their occurrence in inland areas has also been strongest (Fig. 1). On the other hand, many bears have moved rapidly from 1 area to another, thus giving an impression of many individuals rather than of 1. At least in autumn, however, they have settled down to prepare for overwintering.

Immigration of bears from neighboring countries, especially Soviet Karelia, increased in the 1970s (Fig. 2). The number of bears killed each year was lowest in the early 1970s (Pulliainen 1980), but has increased since then. The difference between the immigration figures and the number of bears killed (Fig. 2) suggests that the total number of bears in Finland has increased since around 1970.

Table 1 shows the proportions of male bears (≥ 2 years old) among those captured in the frontier areas (Fig. 3) from 1960 to 1981. All figures are between 58% and 70%. Apart from the Lapland data for 1970–81, all sex ratios differ significantly ($P < 0.05$) from 50:50. The proportion of males is 64.1% ($N = 523$), which differs significantly from a 50:50 distribution ($X^2 = 41.31$, $P < 0.001$).

Major temporal and local variations occurred in the proportion of cubs killed (Table 2). The percentages were highest in eastern Lapland, which may be because cubs are unable to escape hunters in snow during spring and can be easily shot from trees. Hunting in snow is not so common farther south, and it is not practiced at all in Kuhmo or Northern Karelia. The proportion of cubs in the total of bears killed from 1960 to 1981 was 17.8%.

DISCUSSION

The considerable immigration of bears into Finland from Soviet Karelia since 1970 may be caused by population pressure (saturated Soviet populations) or to changes in prevailing natural conditions. According to studies by Danilov (pers. commun.), the number of bears in Soviet Karelia in 1980 was approximately 3,000.

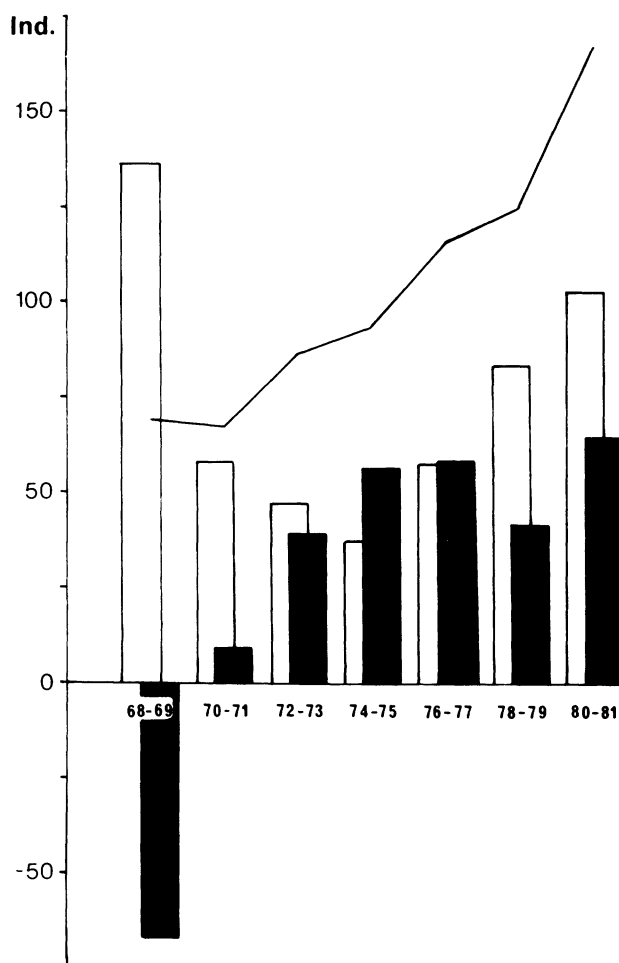


Fig. 2. Relationship between the number of bears received by Finland from neighboring countries and the numbers killed in the years 1968–81. The line indicates the number of bears gained by Finland in 2-year periods, white columns the number of bears killed, and black columns the values obtained by deducting the latter from the former during the same periods.

The breeding potential of bears is lower than that of many other mammals, but natural mortality among adult bears is also low; consequently, a high percentage of the population is capable of breeding (LeCount 1982). Novikov et al. (1969) report that 13.8% of bears harvested in Soviet Karelia were < 1 -year-old; the proportion of cubs among those killed in eastern Finland from 1960 to 1981 was 17.8%.

An average of 150 bears per year were reported killed by humans in Soviet Karelia in the 1970s (Danilov, pers. commun.). Using a figure of 14% cubs, there would be 420 cubs in the 1st summer; a figure of 18% would provide 540 cubs. These calculations suggest a yearly extra recruitment, which must be

Table 1. Percentage of male Bears \geq 2-years-old killed in the eastern communes of Finland from 1960–81.

Study area ^a	1960–69		1970–81	
	<i>N</i>	%	<i>N</i>	%
Lapland (area 1)	200	62.5 ^a	80	58.8
Oulu region (area 2)	107	65.4 ^a	49	69.4
N. Karelia (area 3)	48	68.8 ^a	39	66.7

^a See Fig. 3.

^b Significantly different from 50:50 sex ratio, chi-square test, $df = 1$, $P < 0.05$.

accounted for by death or dispersal, assuming that the population is saturated.

At least 3 factors are known to be important in regulating bear numbers and distribution: nutrition, subadult dispersal, and cannibalism (McCullough 1981, Young and Ruff 1982). MacDonald (1983) has recently suggested that female dispersion, rather than food, may regulate the spacing of males in those species in which several exclusive female territories are encompassed within that of 1 male. In the core of the Soviet Karelian bear population, it is typical for the home ranges of up to 5 mature females to lie inside that of a large adult male (Danilov, pers. commun.). I do not consider the home ranges of this bear population to be territories (Pulliainen et al. 1983), even though the concept has been used in referring to the space and resource use system of black bear populations (Jonkel and Cowan 1971).

The colonization process can be separated into 2 phases: dispersal and home range establishment. This can also be thought of as a progression from food as a resource to the female and the female as a resource to a male. Several authors (LeCount 1982, Miller and Ballard 1982, Young and Ruff 1982) have recently emphasized the importance of subadult dispersal as a factor in regulating bear numbers. Subadult and adult male bears are also known to travel more extensively than their female counterparts (Rogers 1977; Alt et al. 1980; LeCount 1980, 1982; Reynolds and Beecham 1980).

Young and Ruff (1982) found that there was a

greater tendency for subadult black bears to move away from the study area than for adult bears and concluded that adult males may influence subadult dispersal without actually excluding the subadults from their home ranges. Young and Ruff (1982) assume that subadult males recognize the dominance and potential threat of larger adults from earlier experience and may subsequently avoid habitats preferred by adult males (Garshelis and Pelton 1981) or disperse to areas where direct encounters with larger males are less frequent. Bunnell and Tait (1981) also conclude that aggression by adult males of the Ursidae is directed toward subadult males, resulting in their eviction or voluntary evacuation from an area.

During the expansion phase of the Karelian bear population, its western edge (those bears near the eastern frontier of Finland) has been dominated by males (Table 1), giving support to the finding that males are more mobile than females and that a high proportion of the bears killed have been subadults. Five of the 6 bears seen at an artificial feeding site in this area were males, 2 of them large adults (Pulliainen et al. 1984).

Our field observations suggest that a dominance hierarchy soon forms among subadult and adult bears visiting any concentrated food source, such as a carcass or artificial feeding site (Pulliainen et al. 1979, 1984). Antagonistic movements by higher-ranked members toward their subordinates is enough to result in avoidance by the latter (Pulliainen et al. 1984).

These observations were made on the edge of the

Table 2. Percentage of cubs among bears killed in Finland from 1960–81.

Study area ^a	1960–69		1970–81	
	No. of cubs	% of harvest	No. of cubs	% of harvest
Lapland (area 1)	62	18.7	29	22.8
Oulu region (area 2)	13	9.7	1	1.8
N. Karelia (area 3)	1	1.7	5	10.6

^a See Fig. 3.

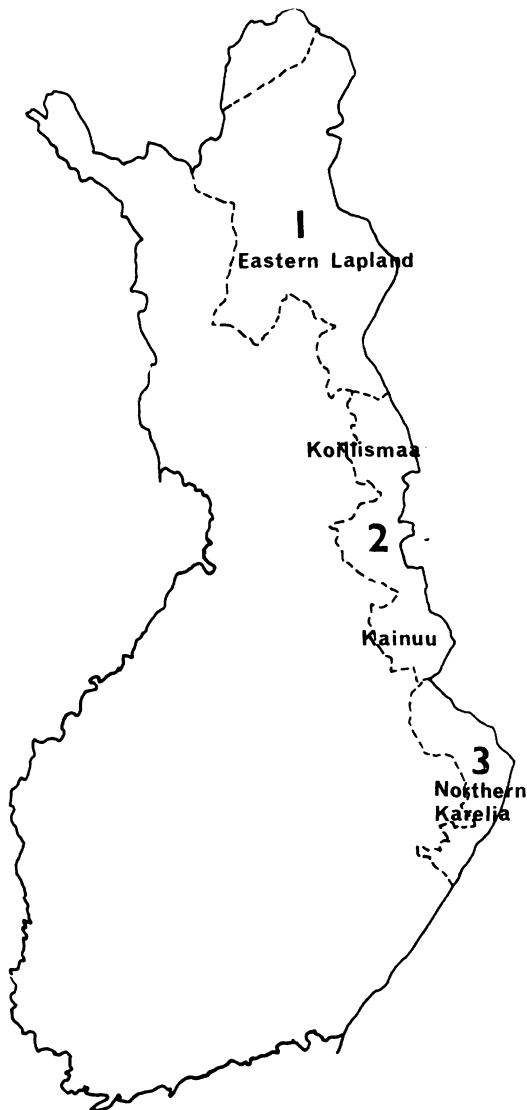


Fig. 3. Study areas referred to in Table 1.

population, where the decisive factor was the presence of a concentrated food source. Correspondingly, I believe a similar dominance hierarchy may be present among mature females in the core population. A considerable emigration of females may take place when too few berries are available with no compensatory food items. Wanderings by starving male and female bears have been observed in Manchuria (Rakov 1966) and Irkutsk (Gudritis 1963).

Bears may leave an area where habitat has been destroyed, which might also explain immigration in this study. If the bears left areas affected by clear-felling or other forest destruction, the sexes might

have been expected to be equally represented, but this was not the case (Table 1).

Throughout this century, bears have inhabited Finnish Northern Karelia, Kainuu, and Koillismaa, areas adjacent to the eastern frontier of Finland, but the population density has been rather low and only occasionally have any individuals wandered farther inland. In this respect, the situation in recent years has been different, because considerable numbers of bears have continued westward, even crossing the entire country, for example, to the vicinity of Oulu on the west coast (Fig. 1). The ultimate cause of this behavior must lie in population pressure of the core population, brought about primarily by the scarcity and patchy distribution of food under the unpredictable climatic conditions of eastern Finland in the spring and early summer (Pulliainen et al. 1984) and maintained by a continuous immigration of bears from the east (Fig. 1). The rate of movements to the west has been greatest at the latitude where immigration from the east has been most pronounced (Fig. 1).

Finland received 682 bears more from its neighboring countries (mainly Soviet Karelia) than it lost to these countries from 1969 to 1981, a period during which at least 456 bears were killed in Finland (Pulliainen 1980, unpubl. data). Taking the natural population increase and mortality rates into consideration, it can be expected that the number of bears in Finland will have increased by about 200 during this period. The estimates confirm this impression, because the population in the areas under surveillance by border patrols appears to have increased by about 110 individuals from 1968 to 1982, in addition to which many bears have wandered farther inland in Lapland and central and southern Finland (Fig. 1).

The recent annual number of bears killed has been so high in Finland, compared with the total number of bears in the country (about 300–350 bears in autumn 1982), that without continuous immigration from the east, the Finnish bear population would soon drastically decline.

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