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LARGE HOME RANGES AND POSSIBLE EARLY SEXUAL MATURITY IN SCANDINAVIAN BEARS

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Abstract: Radio-collared brown bears were studied in 2 areas, one located in northernmost Sweden, the other in the centre of the Scandinavian Peninsula on both sides of the border between Norway and Sweden. Most bears were tracked on snow in spring and radio-collared after being darted from a helicopter. When possible all bears were monitored once a week by fixed-wing aircraft. Some bears were monitored more continuously several days each week by car from forest roads. In 1984-88, 48 individual bears were radio-equipped in the project.

Males used larger home ranges than females. In the northern study area 4 adult males had minimum annual ranges of 726 - 2,634 km². Seven adult females in the same area used annual home ranges of 171 - 1,002 km². Eight adult males in the southern study area used annual home ranges of 1,200 - 4,297 km², while minimum annual home ranges of 4 adult females in the same area ranged between 254 - 531 km². Bimonthly aerial monitoring would have given home ranges of both adult males and adult females of approximately 60% of those obtained by weekly monitoring. A female in the north, monitored since she was a yearling, had her first litter of cubs at 5 years of age.

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The first radio-telemetry project on bears in northern Europe was initiated in Sweden in 1984 (Bjärvall and Sandegren 1987). Brown bears on the Scandinavian Peninsula are shared between Sweden and Norway (Elgmork 1987) and, as the project developed, cooperative work between the 2 countries seemed prudent. Since 1986 it has been a joint project run by the Swedish Environmental Protection Board, The Swedish Sportsmen's Association, The Directorate of Nature Management, Norway, and the Norwegian Institute for Nature Research. Additional economic support to the project was provided by the County Administrative Office of Hedmark, Norma, Volvo, Ockelbo and World Wildlife Fund for Nature in Sweden and Norway.

The purpose of this study was to obtain management related information on the ecology of Scandinavian bears. In North America many similar studies on bear ecology have been made. From Scandinavia there is some knowledge on food ecology based on snow-tracking (Haglund 1968), but virtually nothing is known about home-range size, movements, age of first breeding, litter size, reproductive interval and mortality in different age classes. Such data are important for management of Scandinavian bears, and also for educating the general public.

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STUDY AREAS AND METHODS

The work was conducted in 2 study areas, one in northernmost Sweden and the other in the centre of the Scandinavian Peninsula (Fig. 1). The areas have been described in an earlier report from the project (Bjärvall and Sandegren 1987).

The first bear - a yearling female - was radio-equipped in March 1984 in the northern study area. She was approached on skis, immobilized with a jabstick and

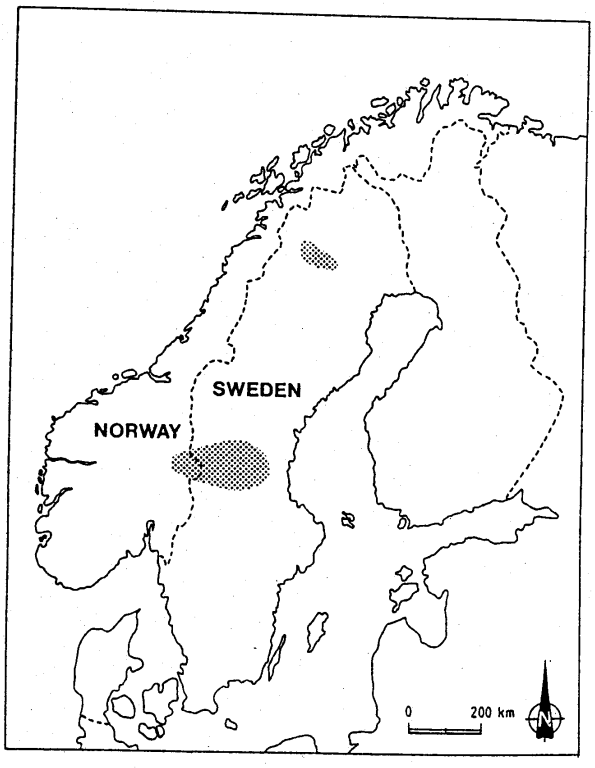

Fig. 1. Study areas for the Scandinavian bear project.

marked with an ear-mounted transmitter (Bjärvall and Sandegren 1987). With increased experience, we no longer use this method.

In the following year, 3 bears were collared in the southern area. As a result of the cooperation with Norway, the southern area was enlarged to the west and, in 1988, the first 2 animals were radio-collared in Norway. Vegetation and topography of the enlarged area was very similar to that of the original southern study area. However, in the border area between Sweden and Norway, some isolated mountain-areas with subalpine vegetation also occurred.

Snow was used to locate bears for capture. In April in the southern area, in May in the northern, when the first bears usually have left their dens, areas were searched on skis, from snowmobiles, or cars to locate tracks. Area residents were enormously helpful in these efforts, particularly in the southern area. Without their local knowledge, the total number of radioed bears would have been much lower.

When a track was found, the area where the bear was assumed to dwell was circled on the ground. The size of the area enclosed by this circle varied depending on the terrain and snow conditions. If the first circle was closed without any emerging bear tracks, a second identical circle was usually made to ensure that the work with the first circle did not frighten the bear out of the area. If emerging bear tracks were found, a new circle had to be made and so on. In practice, it took between 2 hours and up to 3 weeks to radio-collar 1 bear.

When a bear was confirmed to be inside the circled area, a waiting helicopter was called in to track and locate the animal. We then darted the bear from the air and handled it using the technique described by Pearson (1975). Captured bears were fitted with radio-collars manufactured by Televilt (Sweden). Solid collars were used on some of the largest males. Other bears were equipped with break away collars. All bears were tattooed on the upper lip and, to facilitate radio-collaring, a shallow groove was cut in the guard hairs around the neck.

For age determination a PM1 from the lower jaw was removed and sent to Matson's Laboratory, Montana, USA. Ages given in this paper are those determined by Matson's. Bears classified as adults were either females with young or individuals that were seen consorting with another bear during the breeding season.

Radio-collared bears were monitored from the air and from the ground. We tried to monitor all bears by fixed-wing aircraft once a week, although bad weather occasionally caused delay, particularly in the northern area. Monitoring of selected bears from the ground was done during short, intensive periods. Some of the bears in the southern area were intensively monitored through assistance from local residents specially trained for this work.

The home range of each bear was calculated by connecting the outer-most radio-locations to a minimum polygon (Mohr 1947). By using all locations or only those found by aerial monitoring of a bear, different polygons were obtained.

RESULTS AND DISCUSSION

Home Range

A total of 48 bears - maximum 35 bears simultaneously in 1 season (Fig. 2) - were radio-equipped during the study. Of these 31 were males, 16 were females (sex undetermined for 1 yearling). This uneven sex ratio is probably attributable to capture method. Adult males emerge from the dens earlier than other sex and age groups (Pearson 1975) and by working mainly on the spring snow one has to expect male-dominance among the captured animals.

The considerable loss of radio-collars that occurred each year between spring and fall was caused by males fighting and destroying each other's collars. In 1988, other losses included 1 male that was legally shot and another 2.5-year-old male killed by an unknown bear in

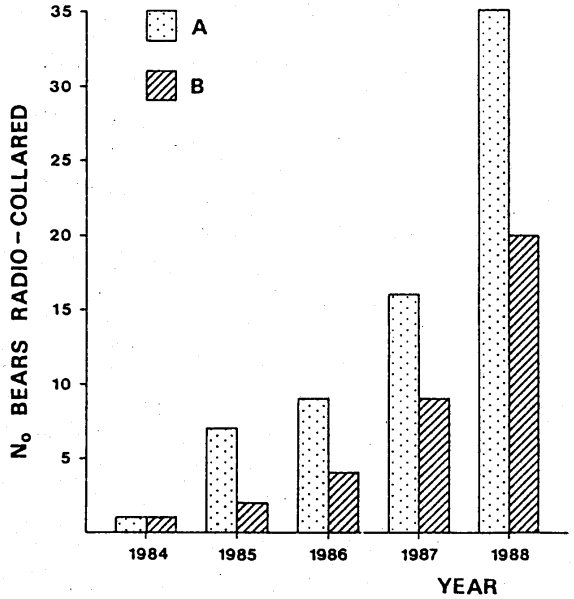

Fig. 2. Number of radio-collared brown bears. A = maximum number in spring, B = number entering den in autumn with active collar.

the northern area. In most cases of intraspecific aggression reported from North America, cubs have been involved, but there are also situations where 2- or 3-year-old-bears have been killed (Russell 1967, Stelmock 1981).

Home ranges of 5 adult females in the northern area monitored for 1 year (1987 or 1988) ranged between 171 and 901 km^2. Two other females monitored in 1987 and 1988 utilized 448 and 1,024 km^2, respectively. These sets of data are comparable with ranges reported for adult females from areas north of the Arctic Circle in North America (Reynolds 1978, Nagy et al. 1983).

Home ranges of 5 adult males in the northern area were considerably larger than those of the females. One of them, monitored only during part of 1988, had a range of 236 km^2. Two others that were monitored through 1988 had annual ranges of 1,977 and 2,634 km^2. The last 2 were monitored in 1987 and part of 1988 and had home ranges of 1,089 and 1,599 km^2, respectively. From the Canadian Arctic and from Western Brooks Range in Alaska, Nagy et al. (1983) and Reynolds (1978) reported annual home ranges for adult males of 8 - 1,352 km^2 and 746 - 1,927 km^2, respectively. The comparison indicates that Scandinavian male bears use large home ranges.

Home ranges of bears in the southern area were even larger. Based on data from 1988 and aerial monitoring only, home ranges were 135 - 523 km^2 for 4 adult females and 936 - 4,014 km^2 for 8 adult males. Incorporating ground-monitoring data, the average size increased from 290 to 370 km^2 for females and from 1,850 to 2,163 km^2 for males (Table 1). Maximum values were 531 km^2 for adult females and 4,297 km^2 for adult males (Fig. 3). These male home ranges are considerably larger than those reported for brown bears from any North American study (Canfield and Harting 1987). As a matter of fact, a 4-year-old male in the southern area had a home range in 1988 of more than 4,600 km^2. It is unclear whether this bear is a resident, or if the large range size is a result of dispersal. Subadult males are known to disperse and establish separate home ranges outside the maternal range (Nagy et al. 1983). Movements can be extensive resulting in relatively large home range sizes for this age/sex class (Canfield and Harting 1987). But in studies of brown bear home range sizes, very few authors specify if subadults are truly residents or may be dispersers.

Because aerial monitoring is expensive, it is important to determine the optimal frequency necessary to obtain relevant information on home range size. To test if there was a relationship between frequency of monitoring and size of home range, ranges based on every second aerial monitoring were calculated.

The data indicate that bimonthly monitoring would have given home ranges of approximately 60% of those obtained by weekly monitoring (Fig. 4). Variation was considerable between different individuals but mean values did not differ between sexes. The smallest difference was found among females with young. It is reasonable to conclude that bi-weekly monitoring would generally have revealed even larger home ranges than those found.

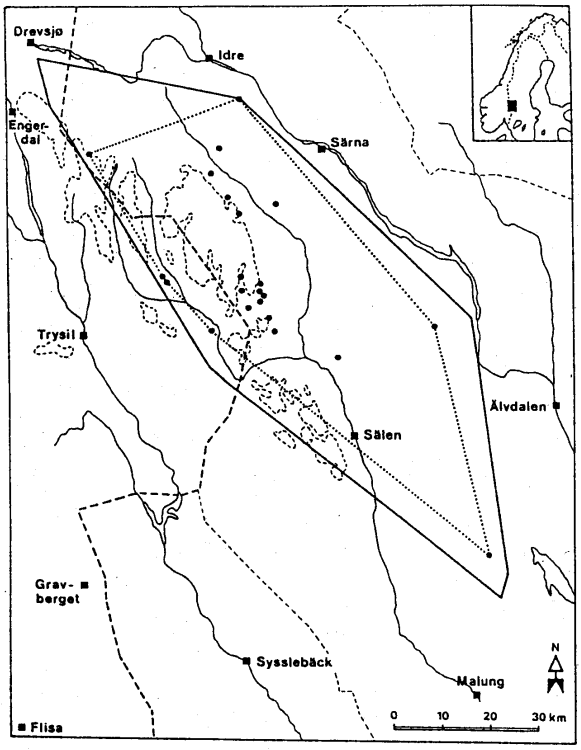

Fig. 3. Annual home range of resident adult male 88 05. Dotted line = aerial monitoring, each dot represents one weekly position, solid line = total monitoring.

Table 1. Annual home range sizes (km^2) measured as minimum polygons for 25 bears in 1987 and 1988.

	Aerial monitoring (*N* days)		Total monitoring (*N* days)	
Northern area:				
Adult females (7)			171-1,002	(12-78)
Adult males (4)			726-2,634	(12-59)
Southern area:				
Adult females (4)	135-523	(24-25)	254-531	(33-135)
Adult males (8)	936-4,014	(20-25)	1,200-4,297	(28-95)
Subadult males (2)	510-4,512	(25)	510-4,676	(31-46)

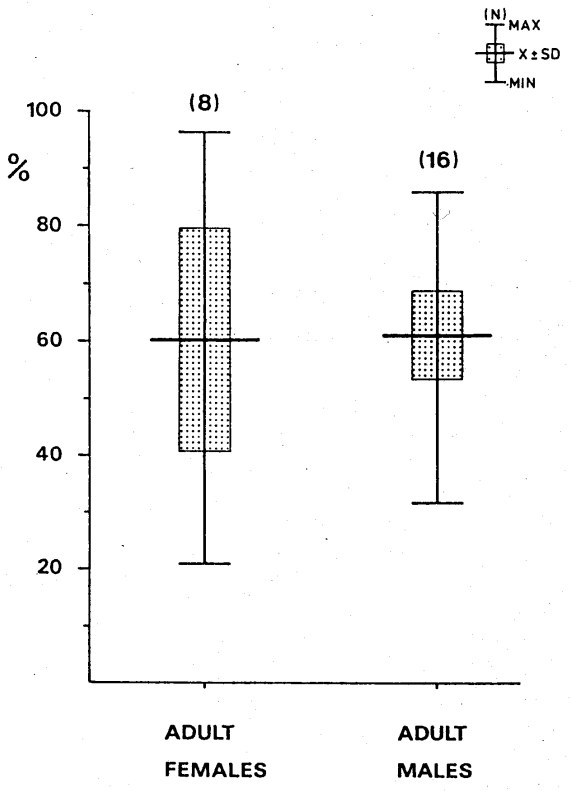

Fig. 4. Comparison of home range size between weekly monitoring (100%) and bimonthly monitoring for adult females and males. Data from the southern area 1988.

Sexual Maturity

The first female in the northern area has been monitored for 5 complete seasons (1984-88). During the initial 2 years, she stayed within an area of around 185 km² measured as a minimum polygon (Bjärvall and Sandegren 1987). In July 1987, she suddenly moved south and east of her traditional range and within 2 weeks expanded her home range to 1,024 km². On 20 July, she was observed in the extreme eastern part of this area together with another much larger bear that probably was a male. They were standing side by side on a moose carcass.

Later she returned to her original area and stayed there for the rest of 1987. On 8 May 1988, she emerged from the den with 2 cubs and all through that season the family stayed inside the original 185 km². Her home range during 4 of the 5 monitored seasons has been only about one-sixth of her total 5-year range. Her range expansion in 1987 seems related to her first oestrus period.

This female, radio-equipped as a yearling in 1984, bred for the first time at the age of 4.5. The same age of first breeding has been indicated also for another female in the northern area. The latter and her 3 young were radio-collared in May 1988 and age determination of the teeth showed that she was 7±1 year and her young were 2-years-old.

These females had their first litters much younger than expected. In North America, north of the Arctic Circle the mean age of first parturition seems to vary from 6.6 to 9.6 years (Canfield and Harting 1987). The age and frequency with which sexual activity first occurs and continues generally reflects different levels of nutrition and, for North American grizzlies, there is a negative correlation between age of sexual maturity and food supply (Bunnell and Tait 1981) as well as between age of sexual maturity and latitude (Stringham 1984). It is further believed that the larger the home range utilized by bears the less productive the habitat. In less productive areas, bears have to travel further to meet their life requirements. Data from our northern study area indicate large home ranges and yet a young age of successful reproduction. This is contradictory to North American statements.

Data are limited but the first radioed female in the northern area used a large home range in only 1 of 5 years. She bred this particular year and her extensive travel outside her usual home range could be explained as search for a male. Twice in this study area, 2 females were seen around 1 male during the breeding season. This behaviour may indicate low adult male density. The 4 remaining years the female stayed essentially within a deep birch-dominated valley as described by Bjärvall and Sandegren (1987). This relatively restricted home range could be a result of high habitat diversity and good food production in the valley.

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