THE VASSFARET BROWN BEAR POPULATION IN CENTRAL-SOUTH NORWAY NO LONGER DETECTABLE

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Abstract: Until recently, the Vassfaret area has been the last well-documented area inhabited by brown bears (*Ursus arctos*) in central-south Norway. In an intensive bear survey during 1990-91 a total distance of 3,126 km of line transects was examined. No bear tracks or other signs of bears were discovered, and the Vassfaret area probably does not support a brown bear population any more. An 18-year-old female shot in 1956 was the last brown bear known to have been killed in this region of Norway. The distribution of bear reports from 1956 to 1988 support the hypothesis that the presence of bear may be explained by the continued presence of one or a few females born before 1956.

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During the last century and up to about 1920, extensive hunting resulted in a dramatic reduction in abundance and distribution of brown bears in Norway (Myrberget 1969, Elgmork 1988, Wabakken, submitted). Around 1940, the Vassfaret area was regarded as the only place in southern Norway that still supported a remnant bear population (Olstad 1945). Until recently, bear presence in Vassfaret has been well documented (Elgmork 1976, 1978, 1988, in press). During a ground-tracking study on snow in 1970-72, presence of bear was verified in all 3 years (Elgmork et al. 1978). Outside the region near the national border in eastern Norway, where brown bear populations are connected with bear populations in neighboring countries, Vassfaret is the only area in southern Norway with well-documented series of bear tracks along forest roads or on snow-covered ground during the last 20 years. Single tracks of bears have, however, been documented from other areas in southern Norway (Elgmork 1987).

The occurrence of brown bears in Vassfaret have been well-known to the Norwegian public, and through the years has been the object of attention from the media. Long series of bear tracks were found both on snow and snow-free ground in the 1970s, while neither scientists nor local newspapers and local people have been able to document such signs during the 1980s. However, a possible track on snow was found in 1984.

The purpose of our study was to demonstrate possible existence of brown bears in Vassfaret, and evaluate the distribution of bear reports since 1956 in the light of new results on brown bear biology as revealed by radiotracking farther east in Scandinavia.

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STUDY AREA AND METHODS

A 25,000 km^2 study area (Elgmork 1976) was separated into a 2,735 km^2 core and a 22,265 km^2 surrounding area (Fig. 1). The Vassfaret core area is situated in central-south Norway, about 100 km northwest of Oslo. Central parts of this area are characterized by valleys with steep and often rugged forested slopes rising up to several naked mountain plateaus lying at 1,000-1,200 m. The timberline is situated at about 900-1,000 m (Fig. 2), and contains concentrations of cabins in more easily accessible parts (Elgmork 1983*a*). Southern parts of the core area consist of lower-lying forested hill country. The forest is dominated by spruce (*Picea abies*), with minor areas of pine (*Pinus sylvestris*) and birch (*Betula pubescens*) (Elgmork et al. 1978). The whole area is heavily intersected by forest roads and other minor roads (Elgmork 1978).

The core area is situated between the 2 main valleys, Begnadal and Hallingdal. Figure 1 illustrates the distribution of all 21 bears killed in this region of Norway since 1923 (Myrberget 1969, Elgmork 1983*b*). Of these bears, 19 were killed inside the core area, and two were killed outside. Our field study in 1990-91 was restricted to the core area, while bear reports during 1956-88 were derived from the total study area.

Spring Survey

Line transect surveys and ground-tracking on snow have previously been used in Scandinavia to record and study large carnivores (Haglund 1966, 1968, Wikan 1979, Kvam and Sørensen 1981, Bjärvall and Isakson 1982, Wabakken et al.1984), and also in Vassfaret (Elgmork et al. 1978). In central Scandinavia, the majority of radio-collared brown bears usually leave their dens between late March and mid-April

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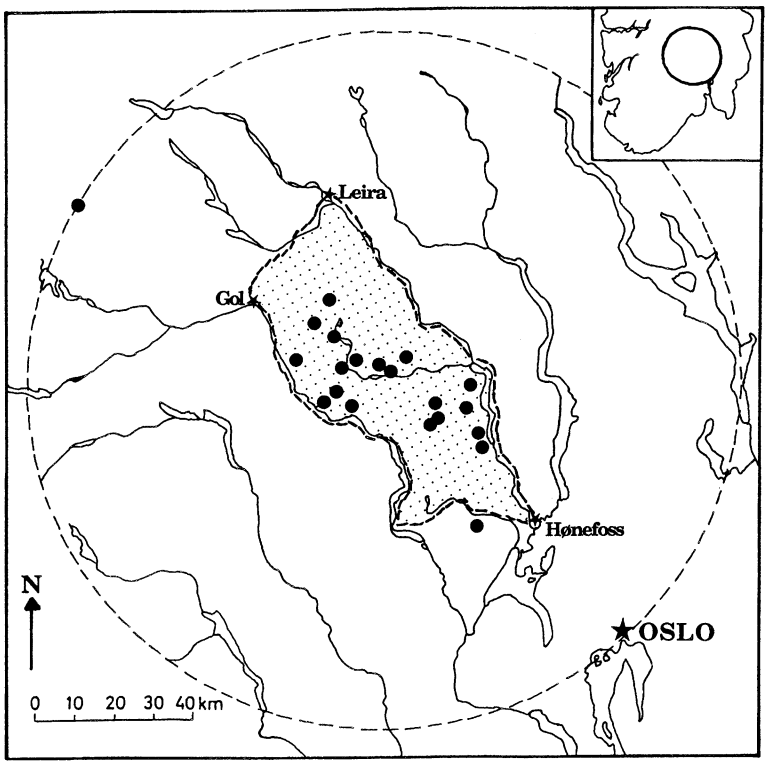

Fig. 1. Study areas 1956-88 (circle) and 1990-91 (hatched). Dots represent bears killed during 1923-91 according to Elgmork (1983*b*). The last bear was shot in 1956.

(Wabakken et al., unpubl. data). The ground is usually covered by deep snow at this time of year. The survey was conducted on 20 April 1991.

Our survey was based mainly on a line-transect search for bear tracks or other signs on snow-covered ground in spring, proceeding by ski, on foot, or by snowmobile. With good snow conditions, bear tracks on snow are easily visible from the air (Bjärvall 1978, Wabakken and Enerud, unpubl. data). Supplementary, a helicopter was therefore used to cover the least accessible and most precipitous slopes near the timberline (Fig. 2).

The core survey area was divided into 139 squares measuring 5 × 5 km, making it more easy to distribute the field personnel throughout the whole area. Lack of snow in some lower-lying and sun-exposed areas reduced the number of squares surveyed on snow to 100 (Fig. 2). Since some local people have claimed that a breeding bear population still exists in the Vassfaret area, they were specially invited to participate in the registration. The survey personnel consisted mainly of local big game hunters and farmers who were familiar with the area. Nearly 200 volunteers took part

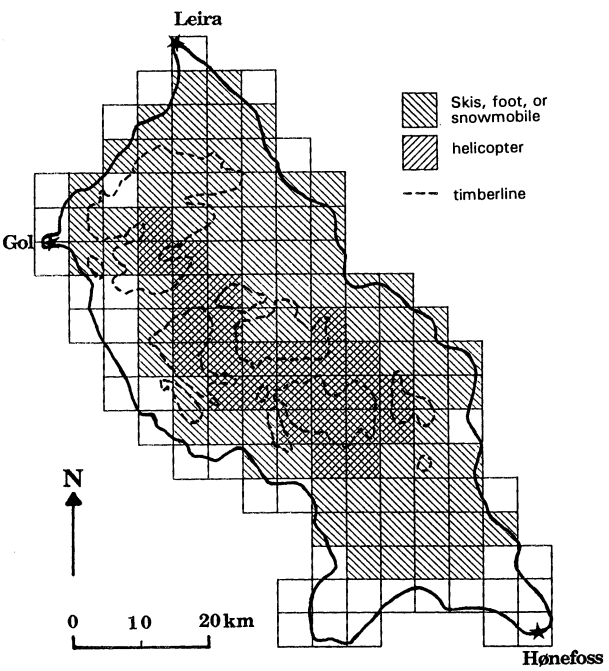

Fig. 2. Spring survey area 1991 (solid line) divided into 5 × 5 km squares. Hatched squares were searched for bear tracks and other signs on snow-covered ground.

in the registration.

Fall Survey

Brown bear defecation rate is higher during fall than at any other time of the year (Roth 1980). In autumn, various kinds of berries are important food resources for Scandinavian bears (Haglund 1966, Elgmork and Kaasa 1992). Berry-dominated scats are easily visible signs of bear occurrence (Wabakken and Enerud, unpubl. data), and scats have been sampled along forest roads and trails in bear habitats. In the present study, line transects along forest roads were searched for bear scats by driving slowly by car (Fig. 3). This survey was performed on 29-30 September in 1990, and on 28-29 September in 1991. Exactly the same roads were surveyed both years.

Bear Reports

Originally received from newspapers, a total of 150 bear reports in the period 1956-88 were accepted (Elgmork 1983*b*, in press). These reports were split into documented reports and accepted but not documented reports. Documented reports were those confirmed by field-check, excrement analyses, or evaluation of photos by K. Elgmork.

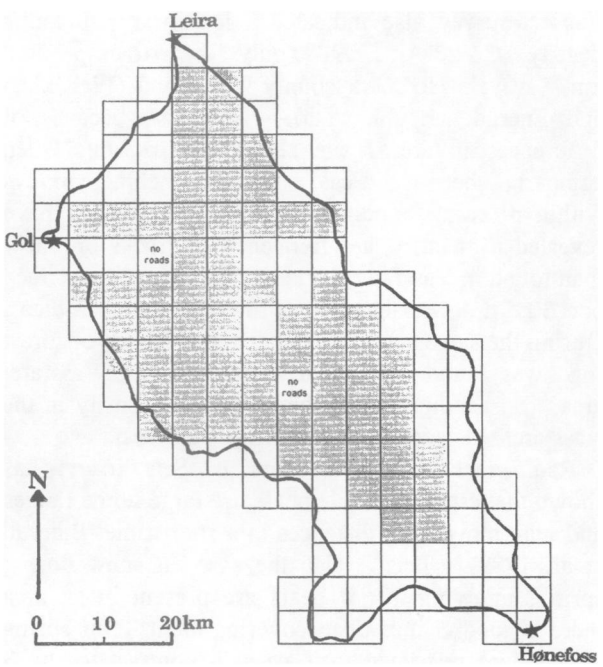

Fig. 3. Fall survey area 1990-91. Stippled squares were searched on forest roads for bear scats and tracks.

During the last 6 years P. Wabakken (1986-88) and B.T. Bækken (1989-91) have been employed full time looking for large carnivores in parts of the study area, including the Vassfaret core area. Field-checking of reports of sightings, tracks, predation on free ranging domestic sheep, or other signs of bears was given highest priority. These field-checked reports from the study area during 1986-91 are included in this study.

RESULTS

A total of 3,126 km of transect lines on snow-covered ground and snow-free forest roads were surveyed (Table 1).

During the spring survey in April 1991, a total 1,909 km of line transects was traversed by foot, on skis, or by snowmobile. An additional 205 km of transect lines were surveyed from helicopter. The mean distance surveyed on snow-covered ground was 19 km per square, but particularly in the central parts of the study area, the distance per square was higher (Fig. 4). Each of the 100 squares was traversed for a distance of 2-77 km, including the helicopter survey. No tracks or other signs of brown bears were discovered. Three tracks on snow were reported as bear tracks. These were immediately checked in the field, but were identified as tracks of lynx (*Lynx lynx*), reindeer (*Rangifer tarandus*), and either reindeer or moose (*Alces alces*).

During fall 1990 and 1991 a total of 1,012 km of forest roads were searched for bear scats. Each square was surveyed from 2 to 41 km (Fig. 4). No observations, scats, tracks, or other signs of brown bears were found during the fall survey.

Of the 150 newspaper reports from the study area, 76 reports within and 58 outside the core area during the period 1956-88, were not documented. Sixteen reports were documented by Elgmork, all situated in the core area (Fig. 5). In addition to the documented newspaper reports, Elgmork further verified 18 reports within the core area from the same period (Elgmork, in press). During 1986-91, 32 bear reports from the study area were field-checked by Wabakken or Bækken, and none of them could be verified as true. Eleven reports were found to be erroneous (other mammalian species, and also tracks made by humans), and 8 were unsolved within the core area. The corresponding numbers outside this area were 9 and 4, respectively.

An area including the documented reports was calculated by the convex polygon method (Mohr 1947) to 906 km^2 including all 34 documented bear reports from the years 1956-88 (Fig. 5).

Table 1. Number of 5 × 5 km squares and distances surveyed by foot, skis or snowmobile, helicopter, and along forest roads.

			Squares surveyed		Distance per square (km)	
Habitat	Snow cover	Survey method	Total no.	Total distance (km)	Mean ± SD	Range
Forest, alpine	Yes	Foot/skis/snowmobile	100	1,909	19.1 ± 12.37	2-67
Forest, alpine	Yes	Helicopter	26	205	7.9 ± 5.42	1-22
Forest roads	No	Car	68	1,012	14.9 ± 9.63	2-41

DISCUSSION

The effectiveness of searching for tracks on snow may depend on snow conditions on the day of survey, but also the preceding days. During the search on 20 April 1991, the snow conditions were unusually propitious. A mild period during several preceding days had led to wet soft snow, but just before the registration, the temperature dropped and the snow surface became very crusty, with a thin newly fallen snow layer on the top. Thereby, old as well as new tracks were maintained. For instance, fresh ptarmigan (*Lagopus lagopus*) tracks were easily observed from the helicopter. An old lynx track found was well preserved and distinct, and we estimated that bear tracks at least 10 days old would have been discovered. The crusty snow cover also allowed long transects by the observers on skis.

Brown bears of different sex and age classes may leave the den sites at different times during spring (Pearson 1975). Bears have never been radiotracked in the Vassfaret area, and it is unknown when bears leave their dens in this area. In another forested study area 120 km farther east, but at the same latitude, 12 and 8 radio-collared females and males, respectively, were denning during the winter 1990-91. Most of these bears left their dens in late March or early April. On the day of our registration, 18 of these 20 bears monitored had left their dens (Wabakken et al., unpubl. data). Moreover, in a more northern and mountainous study area in Sweden, 7 of 11 bears had left their dens by the day of our registration (Wabakken et al., unpubl. data). It is, therefore, likely that most bears in the Vassfaret area, if present, should have left their dens by the time of our registration, leaving visible tracks in the snow.

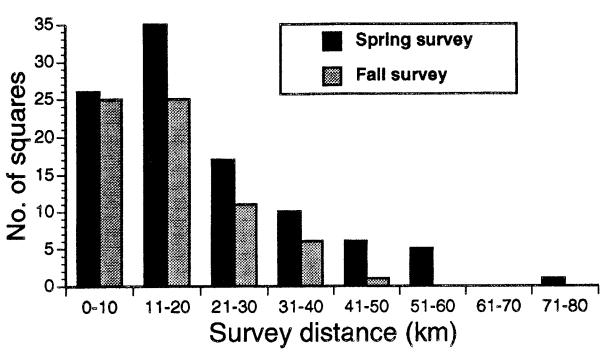

Fig. 4. Spring and fall survey effort within 5 × 5 km squares.

No tracks or other signs of bears were found during this study. However, line transects on generally poorer snow conditions in Vassfaret 1970-72 resulted in at least 1 bear track being discovered every spring (Elgmork et al. 1978). The chance of discovery was 1 bear track per 500 km. Consequently, in our study we should have expected to find at least 4 tracks if the number of bears were unchanged. Therefore, the results of this study support the idea that a reduction in the population has occurred, as stated by Elgmork (1988). In another area in eastern South Norway a line transect survey also indicated a low bear population density. On 28 April 1988, only 1 bear track per 850 km survey in Hedmark county was found (Wabakken and Enerud, unpubl. data). However, because of differences in areas, one should be cautious when comparing between areas. Ground-tracking surveys within breeding populations in central Sweden have revealed a much higher frequency of tracks on snow than found in Vassfaret in the 1970s, about 1 bear track per 30 km (Wabakken and Enerud, unpubl. data). During the same study, 1 bear scat per 30 km of forest road was found, compared to none in the Vassfaret area. This indicates that the population density in the Vassfaret was extremely low already 20 years ago.

Radio-tracking brown bears in Scandinavia has shown that especially male bears use large home ranges and may move long distances in a short time (Bjärvall et al. 1989). This is also the case on snow during spring, implying that if bears are present in an area there is good chance of discovering them. Our spring survey was restricted to 1 year in contrast to the 3 years during 1970-72 in the Vassfaret area. However, in our study we covered a larger area, including the 1970-72 area, but about 500 km shorter distance of line

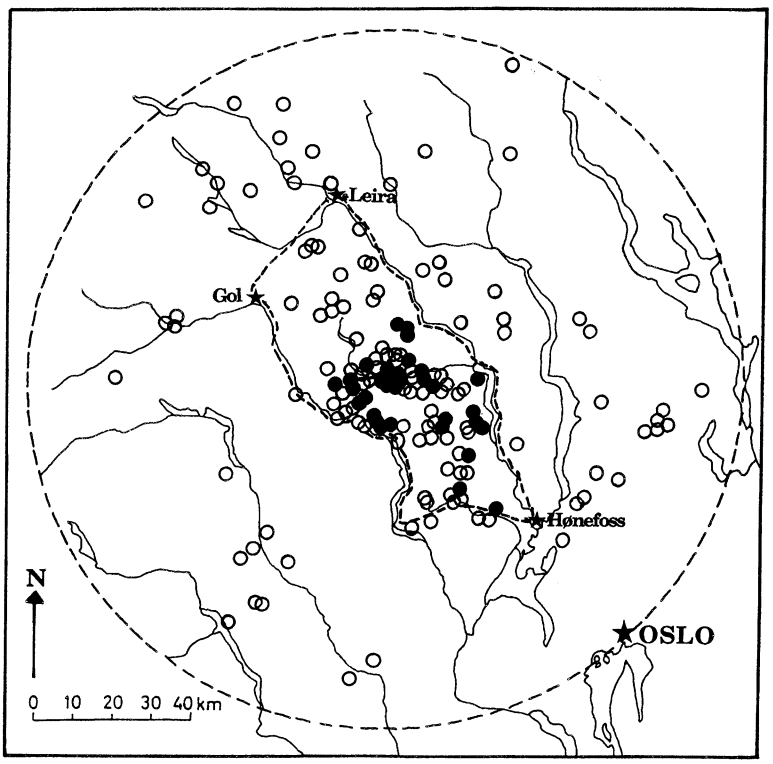

Fig. 5. Bear reports 1956-88 documented (filled dots) and accepted, but not documented (unfilled).

transects on snow were surveyed. During the period 1986-91, no reports could be verified, and no domestic sheep have been documented killed by bears since 1976 (Elgmork, in press), although sheep density in the study area has increased since then.

Our conclusion is that Vassfaret no longer contains a breeding brown bear population, defined as animals of different sex and age classes. However, the possibility of the continued existence of single individuals cannot be excluded. Immigration from bear areas farther east may also occur in the future.

A nationwide bear survey during 1978-82 defined 7 separate breeding brown bear populations in southern Norway (Kolstad et al. 1986, Mysterud and Muus Falck 1989). In that study, the population in the Vassfaret area was estimated to include 8-11 individuals, with 2 instances of reproduction stated as being confirmed. However, no documentation of reproduction in Vassfaret or any other bear area in the rest of Norway the last 2 decades has been published (Wabakken, submitted). Elgmork (1988) has pointed out the misleading use of the words "confirmed" and "verified" as used by Kolstad et al. (1986) and Mysterud and Muus Falck (1989) concerning undocumented reports. In fact, the last documented female bear from southern Norway before the 1990s is from Vassfaret, where an 18-year-old female was shot in 1956 (Elgmork 1986).

Unlike other areas in Norway with possible remnant brown bear populations, the Vassfaret area is unique, since there is agreement among Norwegian bear researchers that the brown bear has survived here until recently. Some authors have suggested that isolated remnant bear populations may have survived undetected by researchers for decades (Elgmork and Mysterud 1977, Mysterud 1981, Elgmork 1987).

The existence of bear populations in central and western Norway is uncertain, and recent occurrences of brown bears in Norway as a whole can best be explained as extensions from breeding populations in the neighboring countries of Sweden, Finland, and Russia (Wabakken, submitted).

The documented reports from the period 1956-88 cover an area of 906 km^2. Radiotracking in Scandinavia has proved that adults of both sex may use annual home ranges of this size. However, males usually utilize larger areas than this (Bjärvall et al. 1989). Lifetime range sizes for Scandinavian brown bears have not been published, but in a North American

long-term study total home-range size of grizzly bears monitored during 3-8 years was 540-1,390 km^2 for females and 2,110-5,370 km^2 for males (Blanchard and Knight 1991). Scandinavian brown bears may live for about 30 years in the wild (Pettersson and Sandegren 1987), and bear presence in the Vassfaret area up to the 1980s may have been bears born in the 1940-50s. This may support an alternative explanation of the remnant bear population in Vassfaret, suggesting that for the last 3 decades the presence of brown bears in this area may have involved only 1, or a few, resident females, rather than a remnant reproducing population (Wabakken, submitted). It cannot be excluded, however, that some bear reports outside the Vassfaret core area may be true. These may have been bears from the Vassfaret area, or immigrating bears from outside the study area. In May 1992 a brown bear was detected by both sightings and documented tracks in snow in our surrounding study area for the first time during our study period. This brown bear was a radio-collared male immigrating into the eastern part of the surrounding area from the Swedish-Norwegian brown bear population farther east.

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Note: Since the IBA Conference in Montana 1992 relevant results from the Scandinavian Brown Bear Project have been published. Total home ranges for adult females followed for 4-5 years varied from 250-1,500 km^2 (Wabakken, P., Bjärvall, A., Franzén, R., Maartmann, E., Sandegren, F. og Söderberg, A. 1992. The Swedish-Norwegian brown bear project 1984-1991. - NINA Oppdragsmelding 146:1-45. [In Norwegian, English summary.]) The project has also presented data on historical and present status of brown bears in Scandinavia (Swenson, J.E., Sandegren, F., Wabakken, P., Bjärvall, A., Sõderberg, A., and Franzén, R. 1994. The historic and present status and management of the brown bear (Ursus arctos L.) in Scandinavia. - NINA Forskningsrapport 53:1-23. (In Norwegian, English summary.) The last three years 1992-94 brown bears have not been verified in the Vassfaret core area.