

# BROWN BEAR DENSITY BASED ON OBSERVATIONS BY MOOSE HUNTERS

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*Abstract:* Moose (*Alces alces*) hunters were asked to report brown bear (*Ursus arctos*) observations made during the hunting season in central south Norway and in the eastern part of Hedmark county in the late 1960s and 1970s. Extremely high values for hunter-days/bear observation were obtained, indicating very low bear density. The density in Hedmark was about twice as large as that in central south Norway during the late 1970s. The quantitative results of a previous tracking study on snow in central south Norway could be converted to density in Hedmark by means of the results of the moose hunter study, since conditions during the hunt were very similar in the 2 areas. An approximate number of bears could thus be calculated for Hedmark, which was much lower than previous and later estimates.

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**Key words:** brown bear, density estimation, method of registration, Norway, *Ursus arctos*.

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Moose hunters in Scandinavia search the forests with dogs during the two-week hunting season in autumn. If brown bears are present in the area, chances of encountering them are great, and previously many bears were shot during the moose hunting season. Bear observations made by moose hunters can thus be used to assess number and density of bears. The first study of this type was performed by Swahn (1954) in central Sweden followed by later studies (Swahn 1976, 1977). A similar study was initiated in the central part of the Vassfaret area in central south Norway (Fig. 1) during 1966-68, each year covering 4 municipalities with a forested area of 2,927 km<sup>2</sup>. Information was collected to establish the important parameter of hunter-days/brown bear observation (hence forth called hd/obs). The study was repeated 10 years later (1976-78) in 12 municipalities, which also covered part of the surrounding area including 5,712 km<sup>2</sup> of forest (Elgmork 1991). During the last 3 years, questionnaires were also sent to moose hunters in 15 municipalities in the eastern county Hedmark (Fig. 1) covering a forested area of 13,724 km<sup>2</sup>. Ivar Mysterud was asked to analyze the results from Hedmark (Mysterud 1991).

## METHODS

Questionnaires were sent annually to all registered moose hunters in the selected municipalities asking about sightings of brown bears as well as tracks and sign of bears, requesting as many details as possible. The number of persons in the hunting parties and days hunted were also registered (Table 1).

The sizes of areas which different hunting parties reported using were so exaggerated that this parameter was discarded. The large majority of bear observations were tracks and sign, thus a possible difference in shyness between individual bears could be disregarded.

## RESULTS

During 1966-68 in the Vassfaret area, 11 brown bear observations were made, representing 526 hd/obs (Table 2). Ten years later (1976-78), only 4 bears were observed yielding 1,660 hd/obs. This suggests a reduction in brown bear density during the decade. From the peripheral area only 2 bears were reported (3,022 hd/obs), both in the northern part (Fig. 1). In the southern part of the marginal area no bears were detected in spite of an effort of 4,630 hunter-days.

According to Mysterud (1991), 62 brown bear observations were made during 1976-78 in Hedmark. Of these observations, 7 should not be included in hunter generated statistics since they were either made prior to the hunting season, outside the hunting area or by non-hunters, and are not compatible with hunter statistics as specified in Elgmork (1991). The number is consequently reduced to 44 bear observations in the central area of Hedmark with 683 hd/obs. In the peripheral area, with the exclusion of the 3 southernmost municipalities, 11 observations were made with 3,337 hd/obs. In the 3 southernmost municipalities no bear observations were made in spite of an enormous hunter effort of 18,816 hunter-days.

## DISCUSSION

The results from both study areas show relatively high hd/obs values, which in the central areas were >500 and in marginal areas ran >3,000. A formal comparison with previous results from central Sweden is difficult as the number of men/hunting party and the number of hunting days were not properly recorded. Nevertheless, Swahn (1954) received in only 1 year 156 bear sighting reports. In 1975, 130 hunters answered, reporting 130 bears, many of which were followed by young (Swahn 1976), and in 1976 reports were received from 190 hunting parties of

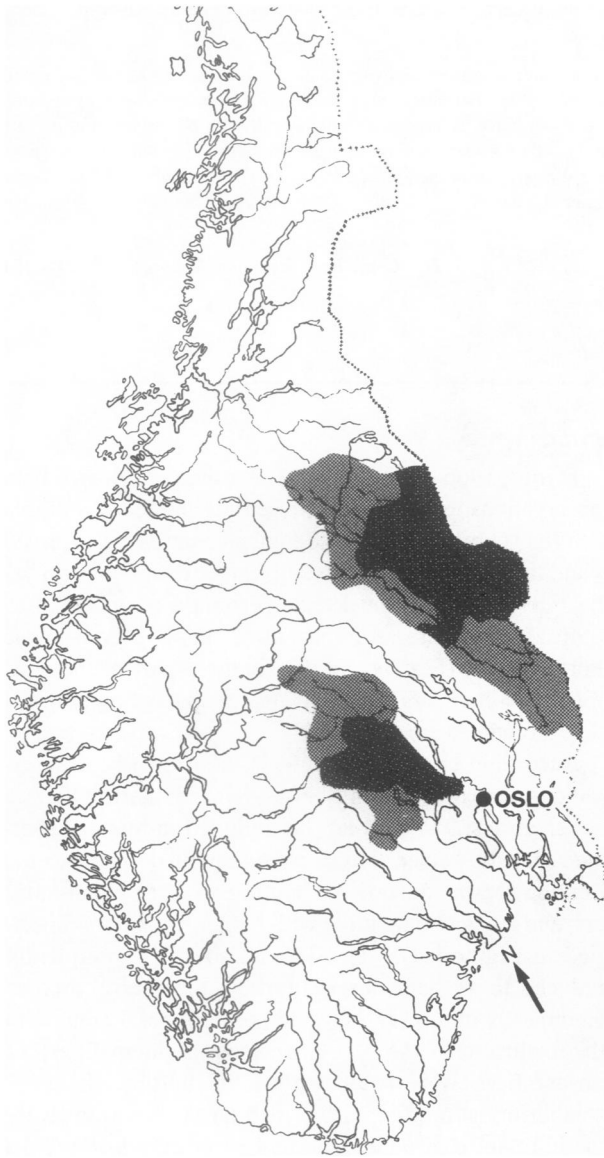


Fig. 1. The 2 study areas, Vassfaret to the south-west and Hedmark to the north-east. *High density dots*: Central areas. *Low density dots*: Peripheral areas.

which 169 reported brown bears (Swahn 1977). In contrast, 382 and 1,318 hunting parties in the 2 Norwegian areas during 3 years (1976–78) resulted in only 6 and 55 bear observations respectively (Tables 1 and 2). If it is tentatively assumed that number of men and time hunted was about the same in Sweden as in Norway, this implies that the density of brown bears was about 25 times greater in central Sweden than in the Norwegian areas in the late 1970s.

Table 1. Some average parameter values from a questionnaire sent to moose hunters in 2 areas in Norway.

	Central south Norway		Hedmark <sup>1</sup>
	1966–68	1976–78	1976–78
No. of hunting parties	139	382	1,318
Hunters/party	5.1	6.0	6.7
Days hunted	8.0	8.3	8.9
Hunting season	27 Sep–10 Oct		27 Sep–20 Oct

<sup>1</sup> From Mysterud (1991).

### Comparison Vassfaret–Hedmark

A more detailed comparison can be made between south central Norway and Hedmark for 1976–78 as the time of year for the hunt (last part of Sep–first part of Oct), the number of hunting days, and number of persons/hunting party were similar (Table 1). Furthermore, the hunting methods and habitat were also similar. While low densities of bears (as reflected by high values of hd/obs) were foreseeable for the Vassfaret area, it was surprising to find conformingly low values in Hedmark (Table 2). In the central area of Hedmark during 1976–78, the number of hd/obs were even higher, and density correspondingly lower, than what had been found in the central part of the Vassfaret area 10 years earlier. When the peripheral areas are compared, the 2 areas showed similar high values of >5,000 hd/obs. If the two entire study areas are compared, the bear density in Hedmark was about double that in central-south Norway, mainly due to the relatively high density in the central municipality Trysil (Mysterud 1991), where densities were about 4 times higher than in the Vassfaret area.

Table 2. Comparison of number of hunter-days/brown bear observation in central south Norway (Elgmork 1991) and in Hedmark (Mysterud 1991) from data reported by moose hunters. Figures in brackets indicate number of bears observed.

	Central south Norway		Hedmark <sup>1</sup>
	1966–68	1976–78	1976–78
Central area	526(11)	1,660(4)	683(44)
Peripheral area			
Northern part <sup>2</sup>	–	3,022(2)	3,337(11)
Whole	–	5,337(2)	5,048(11)
Entire study area	–	2,886(6)	1,556(55)

<sup>1</sup> Adjusted from Mysterud (1991).

<sup>2</sup> Three southernmost municipalities had no bear observations and were excluded.

A few years prior to the moose hunter study during 1976–78, a tracking study on snow was performed in the central Vassfaret area during 3 consecutive years 1970–72 (Elgmork et al. 1978). Tracks of brown bears were found every year. Results from a subsequent study (Elgmork 1994) indicated that the range of the bear may have been more restricted than previously believed (Fig. 2). The area covered by the tracking study thus represented a larger part of the bear range than previously assumed. In addition, the negative results of 2 helicopter flights (1970 and 1971) have more significance in light of recent experience from the joint Swedish–Norwegian radio-tracking project (P. Wabakken, Hedmark, Norway, pers. commun., 1992). It is therefore believed that only 1 bear was present in the central area of Vassfaret during the tracking periods. This represents approximately 1 bear/1,200 km<sup>2</sup> of forest. This figure can be considered representative of the time of the moose hunter study that started only a few years later. The density in Vassfaret can thus be converted to density in Hedmark in the following manner:

Density of bears in an area, as numbers per 1,000 km<sup>2</sup> forested area, is proportional to the number of moose hunter observations/hunter-day. The following formulas can be set up using these abbreviations:

*obs<sub>v</sub>* and *obs<sub>H</sub>*: Number of bear observations in Vassfaret and Hedmark respectively,  
*hd<sub>v</sub>* and *hd<sub>H</sub>*: Number of hunter-days in Vassfaret and Hedmark respectively,  
*area<sub>H</sub>*: areas of forests and bogs in Hedmark (Mysterud 1991),  
*N<sub>H</sub>*: Number of bears in Hedmark to be calculated.

$$(1) \quad 1 \cdot \frac{1,000}{1,200} = \frac{obs_v}{hd_v}$$

$$(2) \quad \frac{N_H \cdot 1,000}{area_H} = \frac{obs_H}{hd_H}$$

Dividing equation (1) by (2) we get:

$$(3) \quad N_H = \frac{hd_v}{hd_H} \cdot \frac{obs_H}{obs_v} \cdot \frac{area_H}{1,200}$$

Equation (3) defines the connection between the two areas. The figures for 1976–78 from Elgmork (1991) and Mysterud (1991) are entered into this equation as follows:

$$N_H = \frac{6,639}{85,590} \cdot \frac{55}{4} \cdot \frac{13,724}{1,200} = 12$$

Due to the uncertainties involved in the presuppositions, the result should not be regarded as a fixed figure, but rather as an order of magnitude around 10, corresponding to a density of 0.7 individuals/1,000 km<sup>2</sup> of forest during the last part of the 1970s. This calculation should only be considered an attempt to get to a more exact number than the many guesses previously published.

### Previous Estimates

Based on the relation between numbers of reported cubs and yearlings on the one hand and adults on the other, Elgmork (1954, 1976) assessed the number of bears in the Vassfaret area. For the period 1949–54, I estimated that >15 bears were present; around 1975, 5–8 individuals (Fig. 3). A 40-year study (1949–88) indicates, however, that many reports of females with young are more unreliable than previously believed (Elgmork 1994). Of >800 observations of adult bears, 35 were verified as true, while none of the 91 reports of young could be verified. This casts doubt on reports of young, and previous estimates based on these reports should be rejected. The tracking studies in the early 1970s indicated that there were extremely few bears, perhaps only one individual. These low densities were corroborated

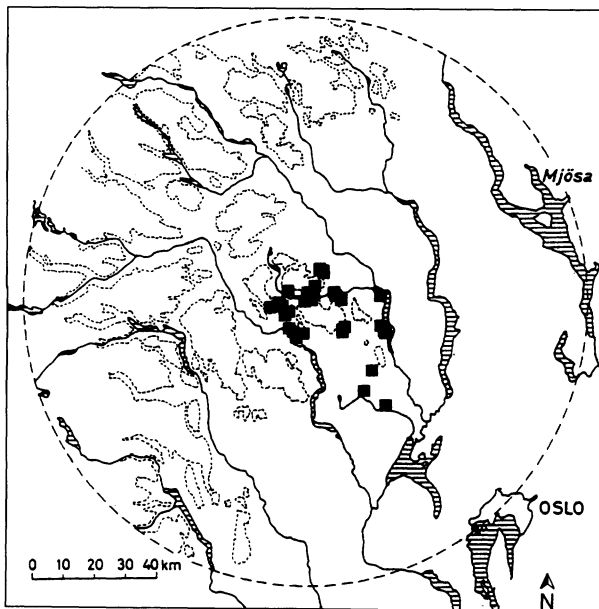
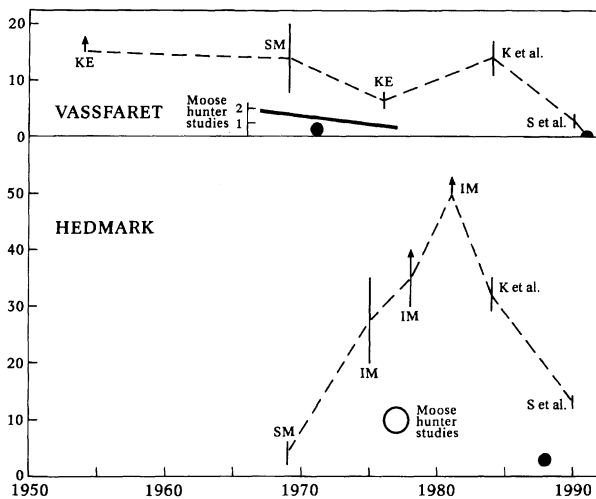


Fig. 2. Verified observations of adult brown bears in the study area in central south Norway during the period 1949–88. The distribution does not contradict the hypothesis that only one individual was present during the tracking studies in 1970–72.



**Fig. 3.** Estimation of population (vertical bars), number of bears observed in tracking studies (filled circles), and calculated numbers in Hedmark county according to moose hunter study (open circle). The ordinate in moose hunter studies in Vassfaret (coarse falling line) shows bear observations/hunter-day multiplied by 1,000. Initials are researchers: KE: K. Elgmork, IM: I. Mysterud, SM: S. Myrberget, K.et al.: M. Kolstad et al., S.et al.: O.J. Sørensen et al. Year of publication of estimate on the abscissa.

by a tracking study in 1991 which showed no bears to be present over a large area of the Vassfaret brown bear range (Bækken et al. 1994).

Even so, the Vassfaret area was believed to have a relatively large number of bears around 1980. A survey for all Norway, based primarily on reports, stated that 11–17 bears were present in 2 populations within the boundaries of the Vassfaret study area during 1978–82 (Kolstad et al. 1984, 1986; Mysterud and Falck 1989). A few years later, however, the number given by Sørensen et al. (1990) was radically reduced to 2–4 individuals.

In Hedmark, estimates of brown bear numbers have also varied considerably. Myrberget (1969) estimated a population of 2–6 individuals. Six years later the number was raised to 20–35 bears in Hedmark and bordering Swedish areas (Mysterud 1975). Based on extensive field work, Mysterud indicated a few years later that the population contained 30–40 individuals (Myrberget 1978). The estimate was soon boosted to a minimum of 50 individuals (Fig. 3), (Mysterud 1981a,b). A survey for all Norway conducted around 1980 concluded that the area contained 29–35 individuals including 11 cases of reproduction and alleged observations of 16 young. For the period around 1985, Sørensen et al. (1990) suggested that there were 12–14 individuals in Hedmark.

The relatively high numbers referred to above are not supported by other evidence based on special investigations. A publicly financed hunting expedition was established in spring 1981 using 4 men on snow scooters and trained dogs, with a shooting permit for 5 bears in Trysil municipality. They did not find any bears and came across only 1 or 2 bear tracks (Granberg and Ree 1989). In spring 1988, a tracking study was performed in Hedmark with the participation of about 450 people. The effort resulted in only 3 bears being detected, which is equivalent to 1 observation per 850 km tracking line. This contrasts with results from central Sweden with 1 brown bear observation/30 km tracking line (Bækken et al. 1994). These results, together with the moose hunter studies in the late 1970s (Fig. 3) indicate that previous estimates of bear numbers in Hedmark have been exaggerated.

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