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A brown bear population estimate for Finnmark County, North Norway

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We have estimated the average number of brown bears *Ursus arctos* L. in Finnmark, the northernmost county in Norway. We started by estimating the number of bears where reproduction has been documented in the Pasvik Valley (1,330 km²) and published densities of brown bears from 1) female concentration areas in Sweden and northern Russia (ca. 5 bears per 1 000 km²), and 2) an intensively studied area in northern Sweden (12.6 bears per km²). We then expanded this estimate to all of Finnmark using observations of bears far from the Pasvik Valley. We estimate that there are on average 7-17 bears in Sør-Varanger Municipality, and totally 8-21 in Finnmark County. The brown bears in Finnmark comprise 31-38% of the total estimated number of bears in Norway of 26-55, respectively. An area of only 1,330 km² in the Pasvik Valley is the major Norwegian brown bear area, contains about 30% of the bears in Norway, and is the area where reproduction is observed most regularly.

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INTRODUCTION

The number of brown bears *Ursus arctos* L. in Norway has been estimated previously using "mostly diverse, chance accounts from local communities, received indirectly through the daily press or given directly to research workers" (Kolstad et al. 1986: 81). Kolstad et al. (1986) estimated a minimum of 160-230 bears in Norway in 1978-82, or 130-194 in Norway excluding Finnmark, the northernmost county. A more recent estimate was based on the ratio of radio-marked and unmarked female bears observed accompanying radio-marked adult males during the breeding season in two study areas using a Pedersen estimator technique. The results were then extrapolated to four female concentration areas in Sweden and Norway based on the density of hunter-harvested bears (Swenson et al. 1994, 1995). The result was an estimate of 669 bears in Sweden and Norway (without Finnmark), but only 14 bears, on average, in Norway outside Finnmark in spring 1993 (Swenson et al. 1995). Even though there

appears to be more bears in Norway in late summer and fall than spring (Wabakken & Maartmann 1994), this suggests that the earlier figure was greatly overestimated. Elgmork (1988, 1994) and Sørensen et al. (in press) have reached the same conclusion. Elgmork et al. (1976) found that 32% of reports of bear sign from the public in Norway were wrong and another 16% were impossible to evaluate.

The study of Swenson et al. (1995) dealt only with the common Swedish-Norwegian bear population, and therefore excluded the northernmost Norwegian county of Finnmark, where the bears are part of a Russian-Finnish population. Because of the apparent overestimate of the total bear population in the rest of Norway, we felt it would be useful to reestimate the number of bears present in Finnmark, using new knowledge of densities in nearby areas, even though the earlier population estimates from Finnmark were not made in the same way as those in the rest of Norway. In Finnmark, field personnel worked full time in 1976-82 and part-

time afterwards. Much of the material was gathered by these field personnel and almost all observations from the public were checked to eliminate errors. This suggests that the previous estimates from Finnmark were more accurate than those reported from the rest of Norway. In addition, a new estimate for Finnmark would allow us to estimate the total Norwegian brown bear population in a consistent way.

STUDY AREA AND METHODS

The study area was the County of Finnmark, North Norway (Figure 1). Within Finnmark, the only area of consistent brown bear reproduction is the Pasvik Valley, which forms a wedge between Finland and the Russian Federation, in the Municipality of Sør-Varanger.

Although no bears have been marked in Finnmark, bears have been studied there since the mid-1970's, based mostly on intensive tracking on the snow in spring, on examination of kill-sites, and recording observations of bears (Wikan 1970, 1983, Wikan et al. 1994, Wikan in press a, b, c). These studies allowed annual estimations of the minimum number of bears present, especially in the Pasvik area.

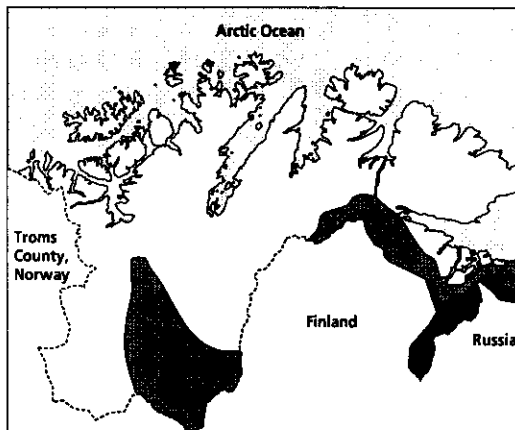


Figure 1
Map of Finnmark County, showing where brown bears occur irregularly (gray) and the upper Pasvik Valley, where reproduction occurs almost annually (black).

To estimate the number of bears in Finnmark, we started with an estimate of the number of bears in the female concentration area in Pasvik, based on its size and density estimates from reproduction areas in northern Sweden and northern European Russia and from an intensively studied area in northern Sweden. Bears are observed irregularly in the remainder of Sør-Varanger Municipality outside the female concentration area, but we have considered these to be Pasvik bears that are outside the area for short times. We expanded our estimate to include bears found outside Sør-Varanger using the proportions of bears reported to be inside and outside Sør-Varanger from other studies that were based on observations of bears. This assumed that sources of error in making these estimates were similar in the two areas.

RESULTS

The female concentration area in Finnmark, defined as the area where dens and reproduction are documented almost annually, is about 1 330 km² in the upper Pasvik Valley (Figure 1). Otherwise, bears occur irregularly in areas adjacent to the female concentration area in Sør-Varanger Municipality (an additional 2 060 km²) and on the Finnmark Plateau (Figure 1).

There are three estimates of brown bear densities in northern areas relatively close to Finnmark (Table 1). The two estimates from Murmansk Oblast' in Russia, adjacent to the Pasvik Valley female concentration area, are based on subjective and untested estimates using a variety of techniques (Schevchenko 1990, Chestin et al. 1992). The estimate from the closest female concentration area in far northern Sweden is also somewhat subjective, being based on the Pedersen population estimate technique described earlier, but in a study area in another, although the nearest, female concentration area. The results were extrapolated to the northernmost female concentration area using density of hunter-harvested bears and assuming similar hunting pressure (see Swenson et al. 1994 for further details). Actually, all these densities were very similar, around 5 bears per 1 000 km². This resulted in estimates for Pasvik of about 6.7 (4.1-7.3) bears on average (Table 1). The closest area with an actual density estimate is the northernmost study area of the Scandinavi-

an Brown Bear Research Project, near Kvikkjokk, Norrbotten County, Sweden. Density estimates from 4 years in a 3 000-4 000 km² area ranged from 8.1 to 17.3 bears per 1000 km² and averaged 12.6 (95% C. I. = 6.0-18.6) (Swenson et al. in prep.). This translates to a mean of 16.8 bears (10.8-23.0) on average in Pasvik (Table 1).

Observations of bears and their sign in three different studies from 1978-92 showed good agreement; that a mean of 81% of the estimated number of individuals in Finnmark were found in Sør-Varanger Municipality (Table 2). One study deviated from this pattern. Myrberget (1969) estimated 2-6 bears in Sør-Varanger in

1969; only 23% of the total for Finnmark. His study is excluded from this calculation, because Wikan (1970) estimated 10-12 individual bears in Sør-Varanger in 1966-68, based on field studies.

From this, we calculated an estimate of the number of bears in Finnmark. Using the low density estimate of 5 bears per 1000 km² in the Pasvik female concentration area gives 6.7 bears in Sør-Varanger. If we divide this by 0.81 to account for the 19% found outside Sør-Varanger, we obtain a total of 8.3 bears, on average, in Finnmark. Using the high density estimate, 12.6 bears per 1000 km², yields a total of 16.8 for Sør-Varanger and 20.7 bears for Finnmark on average.

Table 1. Calculations of the number of brown bears in the female concentration area in Pasvik Valley, based on density estimates from other areas.

Area	Bears per 1000 km ²	Area for calculation (km ²)	Ave. number of bears in Pasvik
Density estimates in northern areas			
Murmansk Oblast', Russia ^a	5	1330	6.7
Murmansk Oblast', Russia ^b	5-9 in forest	810 ^c	4.1-7.3
Northernmost female conc. area Norrbotten, Sweden ^d	5	1330	6.7
Northernmost Swedish study area (mean of 1990-94 over an area of 3 000-4 000 km ²) ^d	12.6	1330	16.8

^a Chestin et al. (1992)

^b Schevchenko (1990)

^c 61% of Pasvik is productive forest (Solheim 1976), or 810 of 1330 km²

^d Swenson et al. (in prep.)

Table 2. Estimates of the number of individual bears in Sør-Varanger Municipality and the rest of Finnmark.

Period	Number of bears			Percent in Sør-Varanger	Source
	Sør-Varanger	Rest of Finnmark	Total		
1969	2-6	7-20	9-26	23	Myrberget 1969
1978-82	18-23	4-7	22-30	79	Kolstad et al. 1986
1983-86	20-25	4-5	24-30	83	Sørensen et al. 1990
1988-92	12.4/yr (2-20)	2.8/yr (2-4)	15.2/yr (4-22)	82	Bergström et al. 1993
1996	7-17	1-4	8-21		This study

DISCUSSION

Our calculations yielded population estimates of 8-21 brown bears in Finnmark on average, that is, at any given time. This estimate is not directly comparable with the estimates from previous studies in Table 2, which are based on minimum number of individuals. However, the mean of the estimated absolute minimum number of individuals in 1988-92, 15.2 per year (range 4-22), is within our range. Based on our results, the previously published estimates from Finnmark do not appear to have been greatly overestimated as was apparently the case for the rest of Norway (see introduction).

The range of 8-21 bears is relatively wide, but bears are notoriously difficult to census (Eberhardt & Knight 1996). When calculating the average number of bears present, it is important to remember that the size of the female concentration area in Pasvik, 1330 km², and total areas where bears are observed in Sør-Varanger Municipality, 2 400 km², are not large when compared with mean home range sizes of adult female bears, 512 km², and adult male bears, 1 444 km², in Norrbotten, northern Sweden (Wabakken et al. 1992). Thus, probably very few of the bears in Pasvik spend the entire year within Norway.

Observations suggest that the Pasvik Valley has a higher density of bears than the surrounding areas, especially in the spring and early summer. The valley is a relatively rich wedge in a less productive taiga, and has much better nutrition conditions for bears than the surrounding areas, with higher densities of moose and reindeer, and therefore more carcasses in spring, and more berries on old clearcuts. In addition, bears are protected in Finnmark and the border areas of Russia, but are hunted in neighboring Finland. In 1994, an absolute minimum of 11 different individuals, including two females with young-of-the-year and a female with yearlings, and a probably minimum of 14 individuals were recorded in Pasvik. In 1995, the absolute minimum was 12 individuals, including two females with yearlings and one with young-of-the-year, and the probable minimum was 16 (S. Wikan 1995 & unpubl.). These counts, the observations described above, and the counts reported in Table 2 suggest that the average number of bears in Pasvik is most likely intermediate between the two estimates reported in this paper.

The most current estimate of number of brown bears in Norway, outside Finnmark, is 18-34 in spring 1996 (Swenson et al. in prep.). By adding our estimates from Finnmark, we obtain a low total estimate for Norway of 26, with 31% in Finnmark, and a high total estimate of 55, with 38% in Finnmark. It is apparent that Finnmark, and especially the area of 1 330 km² in Pasvik, which contains about 30% of the bears in Norway, is the major Norwegian area for brown bears. This is even more evident when considering documented reproduction. Females with cubs have been observed every year in Pasvik from 1978 to 1995, except 1983 (Bergström et al. 1993, Henriksen 1994, Wikan 1995). In Norway outside of Finnmark, however, reproduction has not been documented with photographs of young or tracks of young during the past 24 years (Ree 1992), although quite reliable observations have been made in the border areas in Troms, Nord-Trøndelag, and Hedmark counties in recent years.

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SAMMENDRAG

Et estimat over antall brunbjørn i Finnmark

Vi har estimert antall bjørn i reproduksjonsområdet for bjørn i Pasvik. Bestandsestimater ble basert på bjørnetettheter i reproduksjonsområder i det nordligste Sverige og i russiske områder som grenser til Finnmark (begge hadde ca. 5 bjørn pr 1 000 km²) og en taksering, med bruk av radiomerkte bjørner, i Norrbottens län, Sverige (12,6 bjørn pr 1 000 km²). På grunnlag av fordelingen av estimert antall bjørner innen og utenfor Pasvikområdet fra andre studier anslo vi også antall bjørn i hele Finnmark. Anslagene ble 7-17 bjørner i Pasvik og 8-21 i hele Finnmark. Antallsvurderinger basert på godkjente observasjoner ga lignende tall. Innenfor 1.330 km² i Pasvik finnes ca. 30% av alle bjørner i Norge.

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