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STATUS OF THE BROWN BEAR IN NORWAY 1983-86

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Abstract: During 1983-1986 we conducted brown bear (*Ursus arctos*) surveys in Norway to determine bear distribution and abundance for comparison with similar work conducted in 1978-1982 by Kolstad et al. (1984, 1986). Minimum number of bears was evaluated for each area. The estimated Norwegian bear population was 102-153 bears, including at least 20 reproductive females. The distribution pattern in the northern counties of Norway was similar to that found earlier, with a stable or increasing population. The distribution pattern in southern counties sharply contrasted that of the 1978-1982 report, indicating either a decreasing population or 1978-1982 estimates that were too optimistic.

Bear management plans were proposed in 1988 partly based on a definition of "viable population" as a population with a <15% chance of being reduced within 20 years. The viability of the different bear populations in Norway is discussed based on the minimum estimated number of females. No population fulfills the above definition. Future management should consequently be very restrictive to secure the small and scattered bear populations in Norway for the future.

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The Carnivore Research Group of the Directorate for Nature Management, Game Research Division, collected reports on brown bear observations from 1978 to 1982 (Kolstad et al. 1984, 1986). The annual registration program was improved and continued to serve as a means of estimating presence of bears and bear numbers after 1982. Preliminary annual population estimates were calculated during 1983-1986 (Overskaug et al. 1986a, b, 1988; Kvam et al. in press).

In the 1960's the brown bear in Norway was regarded as endangered with only 25-50 bears (Myrberget 1969). By the mid-1970's the population size was estimated at approximately 100 bears (Elgmork and Myrberget 1977, Myrberget 1978, Heggberget and Myrberget 1979). The 1978-1982 population estimate was 157-230 bears (Kolstad et al. 1984, 1986). One "viable Norwegian population", 4 "viable border populations" and 8 populations of "questionable viability" were then identified, as well as 4 "occurrences" of unknown status. A "viable population" was then defined as 50 ± 20 bears based on Shaffer's (1978) population simulations and bear population parameters from Yellowstone National Park.

The optimistic view of a generally increasing population presented by Kolstad et al. (1984, 1986) was criticized by Elgmork (1987, 1988) who considered the higher population estimates to be caused partly by rediscovered small and cryptic populations. He compared hunting statistics for the entire country with his own survey in 1 small part of 1 of the 23 bear areas, to demonstrate a possible negative trend in the entire Norwegian bear population. He also criticized the works of Kolstad et al. (1984, 1986) for being based on data of questionable quality. He argued that many reports were not thoroughly investigated on the spot by qualified personnel.

This study is a continuation of the work by Kolstad et al. (1984, 1986). The methods have been revised and

strengthened based on comments from Elgmork (1987, 1988) and others to provide an enhanced system of status assessment of Norwegian brown bear populations.

Viability of Norwegian bear populations was also tested, using the new population estimates and a new definition of viability proposed by Norwegian game management authorities (Vaag 1987).

METHODS

Bear regions described in the first survey report (Kolstad et al. 1984, 1986) were revised, because they did not correspond to a Fennoscandian region system defined by Sørensen et al. (1989), and because their borders were not exactly defined for their subpopulation areas.

Estimates made by Kolstad et al. (1984, 1986) were re-evaluated in terms of the 23 areas within 5 regions defined by Overskaug et al. (1986a, 1986b) and Sørensen et al. (1989) (Table 1).

Most reports of bears were occasional given by local people. Few reports were results of efforts put into field work by the authorities. Most field work was dedicated to verifying local reports.

Sampling and evaluation methods for individual reports were comparable to those described in the earlier report by Kolstad et al. (1984, 1986). However, more restrictive use was made of "uncertain" reports. Thus, the present results will not be directly comparable to Kolstad et al.'s (1984, 1986) highest population figures. New information from the Swedish-Norwegian telemetry studies of bears (Björvall, Sandegren and Wabakken pers. commun.), indicates that male bears roam far more widely than earlier believed. This has led to more careful use of occasional reports from areas where permanent occurrence of bears has not been documented.

The reports were divided into 4 evaluation categories: accepted, uncertain, rejected, and incorrectly identified.

Table 1. Reports of brown bear observations from Norway 1983-1986 distributed by observation type, year and evaluation status.

Year	Observation type												All	Bear shot			
	Sighting ^a			Track, scat, hair			Carcass prey			Other signs					Total		
	A	U	R	A	U	R	A	U	R	A	U	R			A	U	R
1983	29	22	6	66	34	16	24	23	14	39	13	9	148	92	45	285	1
1984	21	36	19	77	31	16	31	16	16	21	2	17	150	85	68	303	1
1985	36	25	11	99	24	17	45	45	18	25	12	15	205	106	61	372	4
1986	52	37	10	100	33	19	32	24	37	11	12	12	195	106	78	379	1
Total	138	120	46	342	122	68	132	108	85	96	39	53	698	389	252	1339	7

^a A = Accepted reports, U = Uncertain reports, R = Rejected reports and incorrect reports.

1. Accepted. Checked by interview and/or field inspection. Some of the accepted reports, but not all, have been "documented", that is, positively verified by field or laboratory inspection by experienced personnel.

2. Uncertain. Checked reports of probable sightings or bear-sign. This group also includes reports that gave significant details, but had not been checked by interviews and/or field inspection.

3. Rejected. Reports giving details that most probably did not refer to bear activity.

4. Incorrect. Checked reports where the observation proved to be something else than a bear or bear sign.

The "minimum number" was based only on accepted reports. The "probable minimum number" was also based mainly on the accepted reports, but a very few, highly probable uncertain reports were included in this evaluation. Some uncertain reports probably would have been accepted if adequate documentation was available.

Annual evaluation of bear population size was undertaken for every area and region. The individual bears in each area were tallied as soon as they could be identified with confidence. Bears that very likely had been in 2 neighbouring areas/regions were only counted in 1 of the areas. The bear population level for the entire period was more subjectively evaluated, mostly based on the highest minimum annual estimate for each area. In some areas the presence of a male bear might have been added if females with cubs had been registered.

RESULTS

A total of 1,339 reports on bears observed during the years 1983-1986 was registered (Table 1). Of these, 698 were accepted, 398 were of uncertain validity, and 252 were rejected or incorrect. Of the 698 accepted reports 71% were documented, and 48% of all reports were investigated in the field or laboratory by experienced

personnel. The degree of reliability in the estimates may vary from 1 area to another due to variation in the percentage of documented reports among areas.

The bear distribution pattern was generally the same as reported for 1978-1982 (Kolstad et al. 1984, 1986), that is, the main concentrations of bears were in large, continuous areas of coniferous or mountain birch forests with low human density. The minimum and probable minimum population figure for the entire country was estimated at 102 and 153 bears (Table 2).

Evidence of reproduction was accepted and documented in 4 of the 5 regions. Accepted reports on family groups occurred in only 9 of the 23 areas. Uncertain reports on family groups were taken into consideration in 3 additional areas (Fig. 1).

North Fennoscandian Region (NFR)

The NFR has 3 partly separated bear populations. Some contact may be assumed with neighbouring bear populations in Finland, although dispersed distribution and low numbers are also found on the Finnish side of the border (Nyholm 1985).

The Pasvik-Tana bear area had the most bears and densest population, and estimates were stable or slightly increasing compared to the 1978-1982 estimates. At least 5 reproductive females were recognized in this area.

The 2 other bear areas, Karasjok and Reissa, contained only a few bears, and the estimate for the Reissa area was considerably lower than the 1978-1982 estimate, whereas the estimate for the Karasjok area was comparable, and included 1 female with cubs. These 2 populations are found in very remote areas with low human activity, which makes the evaluation for these areas uncertain.

North Scandinavian Region (NSR)

In the NSR only the Troms area contained a permanent and reproductively active bear population. At least 2,

Table 2. Annual bear population estimates for areas and regions in Norway 1983-1986. The bear estimates from 1978-1982 (Kolstad et al. 1984, 1986) have been converted to the new region and area definitions for comparison.

Regions areas	1978-1982	1983	1984	1985	1986	1983-1986
North Fennoscandian Region	30 - 39	17 - 20	5 - 7	12 - 15	21 - 25	26 - 34
Pasvik-Tana	18 - 23	14 - 15	1 - 2	6 - 8	20 - 21	20 - 25
Karasjok	4 - 7	2 - 3	1 - 1	4 - 4	1 - 2	4 - 5
Reissa	8 - 9	1 - 2	3 - 4	2 - 3	0 - 2	2 - 4
North-Scandinavian Region	24 - 29	11 - 15	14 - 17	8 - 12	10 - 15	15 - 22
Troms	23 - 27	11 - 15	13 - 16	8 - 12	10 - 15	14 - 22
Salten	1 - 2	0 - 0	1 - 1	0 - 2	0 - 0	1 - 2
Mid-Scandinavian Region	25 - 41	10 - 18	15 - 27	25 - 37	29 - 42	32 - 42
Børgefjell	9 - 13	2 - 3	1 - 4	6 - 9	2 - 3	6 - 8
Helgeland-Ytre Namdal	2 - 3	3 - 5	0 - 1	2 - 5	2 - 3	4 - 5
Lierne-Verdal	14 - 22	5 - 10	14 - 21	17 - 24	24 - 35	21 - 28
Fosen	0 - 3	0 - 0	0 - 1	0 - 0	1 - 1	1 - 1
South-Scandinavian Region	66 - 100	14 - 38	10 - 29	12 - 38	10 - 29	25 - 47
Gauldal		0 - 1	1 - 4	2 - 4	1 - 2	2 - 3
Nord-Østerdal						1 - 3
Trysil	30 - 42	7 - 10	4 - 8	4 - 9	5 - 11	11 - 14
Kongsvinger		0 - 3	0 - 0	1 - 2	1 - 1	1 - 1
Østfold		0 - 0	0 - 0	0 - 0	0 - 2	0 - 2
Nordmøre-Orkdal	7 - 15	1 - 4	1 - 4	0 - 3	1 - 3	3 - 4
Romsdal	1 - 2	0 - 0	0 - 1	0 - 5	0 - 0	0 - 4
Gudbrandsdal	6 - 11	0 - 3	0 - 1	1 - 1	0 - 3	1 - 4
Valdres-Hallingdal	12 - 17	1 - 3	2 - 3	2 - 6	1 - 2	2 - 4
Telemark	10 - 13	5 - 13	2 - 7	2 - 7	1 - 4	1 - 7
Agder	0 - 0	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
West-Norwegian Region	12 - 21	3 - 6	0 - 7	3 - 5	2 - 4	4 - 8
Fjordane	3 - 7	0 - 0	0 - 1	1 - 1	0 - 0	0 - 1
Voss-Vaksdal	7 - 10	2 - 4	0 - 4	0 - 0	2 - 2	2 - 3
Ryfylke	2 - 4	1 - 2	0 - 2	2 - 4	0 - 2	2 - 4
Total	157 - 230	55 - 97	44 - 87	59 - 110	72 - 115	102 - 153

probably 3 females with cubs were recognized. One adult male bear was shot in July 1984 due to depredation of sheep, and a young female was illegally shot in May 1985. Bear habitat in this area consists of remote birch forest near the Swedish border and steep-sided river valleys leading to the coastal fjords. The population appeared to be decreasing from the 1978-1982 estimates. However, the lower numbers may also be the result of too optimistic evaluations on reproduction by Kolstad et al. (1984, 1986). The bear reports from the Salten area are only regarded as occasional, and comparable to the 1978-1982 situation.

Mid-Scandinavian Region (MSR)

Three of the 4 bear areas of the MSR had few bears. In the Børgefjell area, bear numbers were low compared to the 1978-1982 figures. This might indicate a real decrease in the population. However, the former estimate

also included bears that likely stayed in Swedish border areas much of the time. These observations were excluded from the present evaluation. At least 1 female with cubs was reported and a young male was shot in April 1983 due to predation on sheep the year before.

In the 2 coastal bear areas, Helgeland-Ytre Namdal and Fosen, bear sightings were documented and 1 report on reproduction accepted, but the estimated number of bears was low. Occasional transient bears from inland bear areas might be the explanation.

The most numerous bear population in Norway during 1983-1986 was found in the Lierne-Verdal area. At least 5 females with cubs were reported and accepted. This population showed an increasing trend. The northeastern part of the area is adjacent to a large Swedish bear population (Björvall 1978, in press), and immigration of bears into Norway is very likely. Four male bears were shot in this area during the period, all due to impacts on sheep husbandry, 3 in 1985 and 1 in 1986.

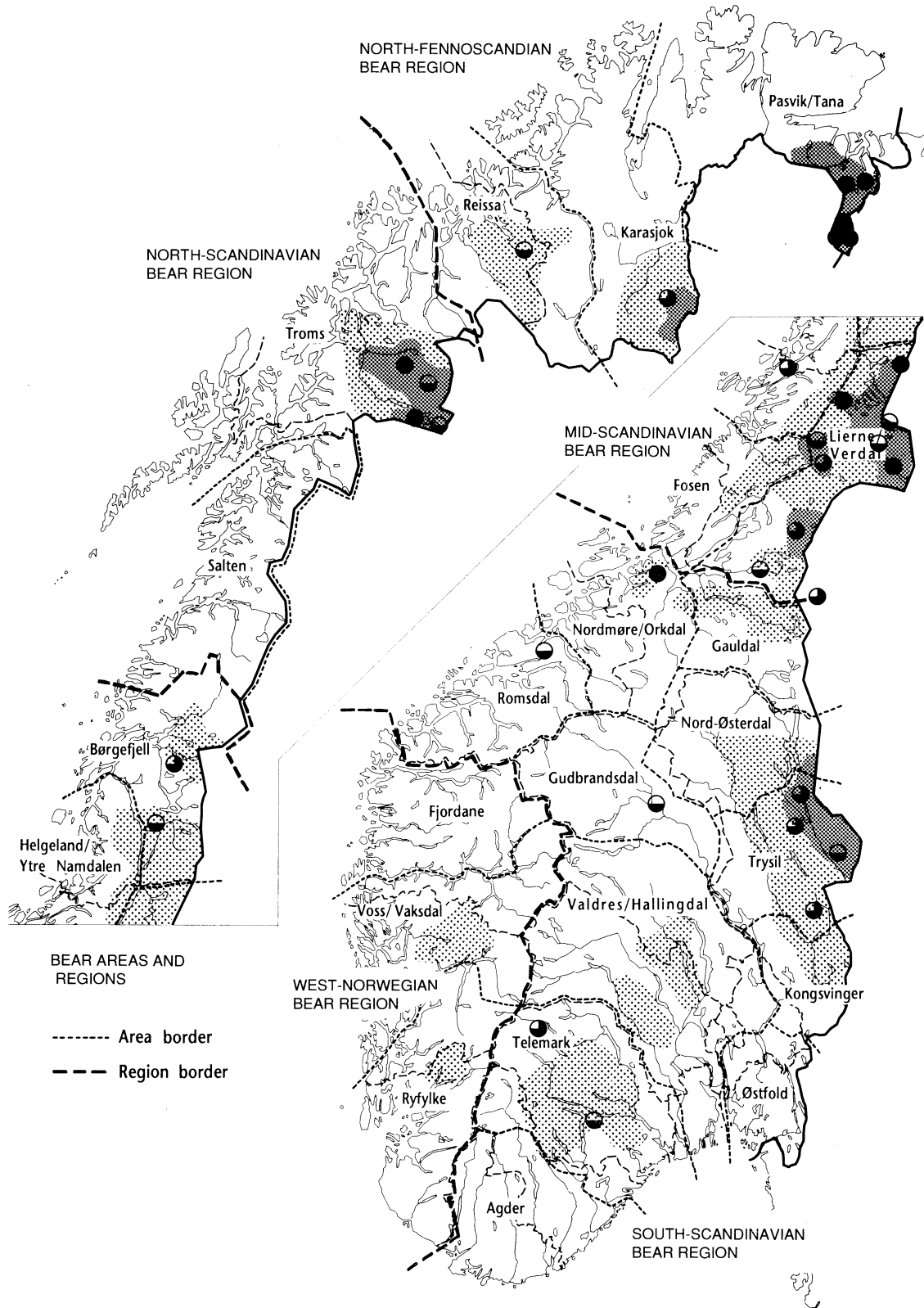


Fig. 1. Bear distribution in Norway 1983-1986. Dense hatching: Bear distribution substantiated. Light hatching: Bear distribution less certain. Distribution of recognized family-groups in Norway 1983-1986. Filled circles: Accepted, documented reports. 3/4 filled circles: Accepted reports but not documented. 1/2 filled circles: "Uncertain", but highly probable reports used in the evaluation of probable minimum number of bears.

South-Scandinavian Region (SSR)

Our estimates of bear numbers in the SSR were dramatically different from those reported for the 1978-1982 period. However, the distribution pattern of reports from the area was essentially unchanged. But reports from some of the core areas from the 1978-1982 period were scattered and uncertain in 9 of the 11 areas of the region. The population in the Trysil and Engerdal areas is adjacent to a relatively large Swedish population. The very low number of accepted, and especially documented, reports from the other areas indicate few bears. Some populations may be more or less an artificial result of occasional transients from eastern areas. Their future is highly uncertain, also due to steadily increasing isolation from other bear areas through widespread urbanization of possible movement routes. There are few reports of reproduction, and only 2 are documented.

West Norwegian Region (WNR)

Documented reports in the WNR were obtained only from the Ryfylke area. The number of reported bear observations remained at a level comparable to that of the 1978-1982 period. But verification revealed that most of the reports could not be substantiated so the number of bears appeared to be lower than reported by Kolstad *et al.* (1984, 1986) for 1978-1982. Reproduction was not recorded in this region during this period, and the number of bears seems to be small and decreasing. The reports available from the 2 northern areas of the region indicate that resident bears may not exist in these areas.

DISCUSSION

Kolstad *et al.* (1984, 1986) and Sørensen *et al.* (1984*a,b*) discussed the general problems with using occasional reports, and the reliability of the estimates derived from them. It will always be possible to question the reliability of such estimates as well as the possible population trend. Managers as well as researchers have to realize that more reliable methods are very expensive. Small areas might be covered by better methods, but, for economic reasons, not the entire country. The comparability of data and evaluations between periods may also be questioned, since the researchers often have to evaluate the reports subjectively, and new knowledge, for instance on bear movement patterns, may lead to adjustments of population size estimates.

We found bear distribution patterns and population estimates of the 3 northern bear regions (NFR, NSR and MSR) to be comparable to those found by Kolstad *et al.* (1984, 1986). Even with a known mortality of 7 bears,

there was an overall increase in 2 areas. A total loss of at least 40 bears in the 2 southern regions (SSR, WNR) cannot be explained. No bears were reported killed in the southern part of the country in this period. Few reports on bears killing livestock were recorded.

Since 1983 local people have become more aware that bears might be found in their districts. The bear study is well known, and the local people are more active and better educated than before. The number of reports from most areas remained at the same level, but the existence of bears has been hard to document in most areas.

Recent telemetry studies on brown bears in Scandinavia have shown examples of especially male bears having extremely large home ranges (Björvall, Sandegren and Wabakken *pers. commun.*). Our estimates were reduced in some areas due to this new information. The degree of movement across area boundaries seemed to be greater than presumed when the bear area system was constructed. This may also have contributed to a possible optimistic evaluation of bear numbers in some areas. But, regardless of new information and methods, bear existence in many areas is difficult to substantiate.

A reasonable explanation for the dramatic shift in the status of bears in the southern regions (SSR and WNR) from 1978-82 to 1983-86 may be found in the study methods. The 1978-82 survey by Kolstad *et al.* (1984, 1986) was based on the generalization that Norwegian bears were shy and hard to detect. According to Elgmork's (1987, 1988) conclusions, small bear populations might have survived more or less undetected in remote areas for more than 40 years during which time occasional reports of bears had been explained as due to transients or as nonsense. Bear observations were often kept secret by observers who fearful of ridicule, thought: "They will only laugh and make jokes and never believe a thing".

The above scenario, which was often observed by researchers, led to bias in 2 ways:

1. Only a few reports from a district could lead to the conclusion that a permanent population was found in the area.
2. When researchers informed local people that bears might show up anywhere and that observations should be reported, this may have resulted in false reports.

Such false reports were probably results of the registration effort in some districts. This effect would probably be most evident in areas with dense human populations and few bears. The situation in the 2 southern bear regions compared to the northern bear regions seems to fit this scenario. (Everyone who would like to test this explanation is welcome to put out serious information that a shy but very dangerous tiger has escaped from the

local zoo, and then request public observations of this tiger, and afterwards try to evaluate the authenticity of the reports!).

Our estimates on bear numbers are not directly comparable to Kolstad et al.'s (1984, 1986) results due to the slight differences in the evaluation procedure of bear numbers. Our lower estimates should not be regarded as clear evidence of a rapidly declining population. However, the "minimum numbers" are based on reports of the same evaluation status in the 2 reports. The lower estimates are partly due to new knowledge concerning bear home range sizes in Scandinavia. The estimates of "probable minimum" is on the other hand only to some degree based on the same types of reports. The uncertain reports are used to a much lower degree, and this could lead to lower estimates. For comparison of results the method should have been kept the same in both periods. But time and costs made it more important to provide a best possible estimate, than to compare methods we had realized would give a too optimistic view on bear numbers.

Viability of Norwegian Bear Populations

In their proposal for future management of bear populations the Norwegian Directorate for Nature Management (Vaag 1987) defined a viable population as one which has <15% probability of being reduced within 20 years. This definition is based on a population model and corresponding computer model developed by Stenseth and Steen (1987) and Steen and Stenseth (1987). However, the model requires excellent population data, which are not available for any Norwegian, or Fennoscandian bear population.

Nevertheless, bear population estimates for the different regions were analyzed by means of this computer model to simulate vulnerability and viability of our populations. Based on a constructed set of very likely population data, a slightly increasing population was simulated (Sørensen et al., in press). The mortality was kept low, and the mean litter size was based on that recently observed in family groups. The output illustrated that approximately 17 females are required in order to maintain a viable population. If the computer-simulated 17 females were realistic, no Norwegian bear population should be designated as viable. However, 2 border populations would fulfill the conditions for being regarded as viable. The border populations of 2 other regions would be designated as endangered, and 2 populations would be designated as vulnerable with uncertain viability, even though they occur along the border.

The computer model was based on the assumption that

the analyzed populations were completely isolated. If this is not the situation, a less pessimistic view for the future might be appropriate. But the relatively low number of bears in each area, the widespread distribution pattern, and the possibility that the bear will be extirpated in our southwestern areas still make the bear a highly vulnerable species that has to be managed very carefully to secure its future in Norway's nature.

CONCLUSION

The registration work has demonstrated a wide but discontinuous distribution of brown bears in Norway. Only 4 areas contain permanent populations of more than 10-15 bears. No population is regarded as a "viable Norwegian population", but 2 are classified as "viable border populations". There are 3 Norwegian populations of "uncertain viability", which occur near national boundaries. These populations are highly vulnerable. The brown bear should be considered an endangered species in the West-Norwegian bear region and in parts of the South-Scandinavian bear region.

Nine years of bear registration has brought the insight that reports from inexperienced people should be used with care. If possible, such observations should be evaluated on the spot by experienced personnel before they are included in the analysis of bear distribution and population size.

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