

**FUTILITY OF SHOOTING BROWN BEARS *Ursus arctos* TO
STOP SHEEP LOSS IN NORWAY IS CONFIRMED.**



Photo: Staffan Widstrand

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Contents:

Contents:.....	3
Abstract	4
Samandrag	4
Introduction:	5
Materials and Methods	6
Results	7
Discussion:	10
Killing of marauding bears.....	10
The size of the Swedish population of brown bears and the loss of sheep in adjacent Norway.	11
Conclusion.....	11
Acknowledgements	12
References:	13

Abstract

The extinction of brown bears *Ursus arctos* and wolves *Canis lupus* and large reductions in the number and distribution of lynx *Lynx lynx* and wolverines *Gulo gulo* in Norway, allowed the introduction of free-range grazing without guarding for sheep for most of the 20th century. However, in the last decades bears have immigrated to Norway from growing populations in neighbouring countries, mainly Sweden. This has led to an increasing problem of bears killing sheep. The conflict is dealt with primarily by shooting marauding bears and compensating farmers economically for lost sheep. I tested the effect of shooting marauding bears, and examined potential relationships between the loss of sheep in two Norwegian counties bordering Sweden and the size of the adjacent populations of bears in Sweden. My results confirm earlier, controversial results that the shooting of marauding bears was ineffective in reducing subsequent losses of sheep the following year in the two areas of Norway. In addition, the loss of sheep in two bordering counties were significantly correlated to the size of the adjacent Swedish population of bears. I therefore conclude that other measures than shooting marauding bears are needed to reduce the loss of sheep, and that the problems with marauding bears can not be handled as a local problem in Norway, but must be seen as common management issue with Sweden.

Samandrag

Utryddinga av bjørn *Ursus arctos* og ulv *Canis lupus*, samt store reduksjonar i talet på og utbreiing av gaupe *Lynx lynx* og jerv *Gulo gulo* i Noreg, gav bøndene høve til fritt å sleppa sau på utbeite. Denne forma for småfedrift utan tilsyn vart vanleg frå byrjinga av 1900-talet og har vore vanleg sidan. I frå 1980-talet har bjørnestammen i Sverige vakse seg stor og berekraftig og dette har ført til at fleire og fleire bjørnar har trekt inn i Noreg. Sauetapet har difor vakse og vorte eit problem for sauebøndene i grensetraktene til Sverige. Dei vanlegaste konfliktløysande tiltaka har vore å skyta ut bjørn, samt å gje bøndene økonomisk erstatning for tap. Eg har testa om denne utskytinga har hatt nokon effekt på tapet av sau, og i kor stor grad ein kan sjå tapet av sau i grenseområda i samanheng med den veksande bjørnestammen i Sverige. Resultata viser ingen nedgang i tapet av sau året etter at bjørnar er vorte skotne. Ein ser óg ein signifikant samanheng mellom den veksande bjørnestammen i Sverige og tapet av sau på norsk side av grensa. Eg konkluderar difor med at andre tiltak enn å skyta ut bjørn må setjast i verk for å redusera tapet av sau, og at ein ikkje kan sjå dei problema ein har med bjørn i Noreg som lokale tilfelle, men som eit felles forvaltningsansvar med Sverige.

Introduction:

The Scandinavian brown bear *Ursus arctos* population has undergone radical changes in number and distribution during the last 200 years. Around 1850, a viable population of about 3100 occurred in Norway and 1600-1700 in Sweden (Swenson et al. 1995). As the bears depredated livestock, an effort was made to exterminate them, based on the payment of high bounties for the killing of brown bears. This was initiated in Norway in 1733, and some forms of bounties were in affect until 1973 (Swenson et al. 1995). The bounties, combined with better firearms and access, led to high hunting pressure, which eventually caused the bear's extinction as a reproducing species in Norway. The situation was different in Sweden. The Swedish government stopped all bounty payments in 1893, and the population there reached a population low of about 130 bears around 1930 (Swenson et al 1995). From 1942 to 1991 the brown bear population grew at an average of 1.5% a year, and today a healthy population of over 1000 bears occurs throughout much of the country (Swenson et al. 1995, Swenson et al. 2003).

The extinction of brown bears and wolves *Canis lupus* and large reductions in the number and distribution of lynx *Lynx lynx* and wolverines *Gulo gulo* allowed the introduction of free-range grazing without guarding in Norway. Formerly herding was essential for the sheep's survival. The situation was different in Sweden. Few bears cause problems with sheep in Sweden, due to a lower total number of sheep than in Norway and also a different system of grazing, with sheep protected in pastures with electrified fences (Swenson & Andrén in press). The few bears now found in Norway are immigrants from neighbouring countries, or their progeny (Swenson et al. 1998). These bears cause a growing problem for the sheep farmers close to the border, particularly the border with Sweden. Sheep is a major part of the Norwegian brown bear's diet; up to 87% of the total annual energy comes from ungulates, mostly sheep (Dahle et al. 1998).

The conflict caused by brown bears killing sheep is dealt with primarily by shooting marauding bears (Hustad 2000), and compensating farmers economically for lost sheep (Swenson & Andrén in press). However, an evaluation of the effect of shooting marauding bears during 1981-1993 found no lower loss of sheep the year after bears were killed (Sagør et al. 1997). This sensational result caused an uproar from different farm organizations and from rural politicians (Malmo 1996).

Because the results of Sagør et al. (1997) are so controversial in Norway, I have reexamined this phenomenon for a new period, and with an independent test of the hypothesis: (1) *The killing of marauding bears during 1994- 2001 reduced the loss of ewes*

during the following year. Because the brown bear is an important factor in the loss of free-ranging sheep, and the increase in number of bears in Norway is a result of immigration primarily from Sweden, I asked whether changes in loss of sheep were related to the size of the adjacent bear population in Sweden, i.e.: (2) *There is a correlation between the size of the Swedish brown bear population and the loss of free-ranging sheep in the bordering Norwegian counties of Nord-Trøndelag and Hedmark.*

Materials and Methods

I analysed data on loss of sheep, number of bears killed, and year of kill from two Norwegian counties, Hedmark and Nord-Trøndelag, lying next to the two areas for brown bear reproduction in Sweden, the southern Scandinavian subpopulation (SSS) and the central Scandinavian subpopulation (CSS) (Swenson et al. 1998). I also analyzed data on the number of ewes killed and the estimated size of the bear population from the adjacent Swedish counties of Jämtland and Dalarna for the period 1980-2001.

In Hedmark the data were from the municipalities of Grue, Åsnes, Våler, Elverum, Trysil, Åmot, Stor-Elvdal, Rendalen and Engerdal, which comprises the entire administratively-defined core area for brown bears in southeastern Norway. In Nord-Trøndelag data were from the municipalities of Lierne, Namskogan and Snåsa, because only they had complete data for the relevant period.

Hypothesis 1: *The killing of marauding bears during 1994 – 2001 reduced the loss of ewes during the following year.* From 1994 to 2001 the data on loss of free-ranging sheep in both counties were reported as “sheep”, i.e. without specifying age or sex. Because brown bears prefer ewes (Aanes et al. 1996), I calculated the numbers of ewes lost. In Nord-Trøndelag I used the average ratio from 1992 and 1993, when data were available for both “ewes” and “ewes and lambs” to calculate the number of ewes lost in 1994 to 2001 for each municipality. In Hedmark I had only the combined data for the whole period. Here I used the ewe/lamb ratio provided by farmers that applied for compensation for sheep killed by marauding bears. It is not legal for rams to graze on open range in Norway.

The data on shot bears in Nord-Trøndelag and Hedmark in Norway came from the Directorate for Nature Management, Trondheim. In Sweden, data from Jämtland (except for Härjedalen Municipality, which is a part of another sub-population of brown bears) and Dalarna came from Naturvårdsverket, Stockholm.

Hypothesis 2: *There is a correlation between the size of the Swedish brown bear population and the loss of free-ranging sheep in the bordering Norwegian counties of Nord-*

Trøndelag and Hedmark. The loss of ewes was estimated in the same manner as described for Hypothesis 1. The size of the two subpopulations of brown bears was estimated in the counties Dalarna and Jämtland. Hedmark lies west of Dalarna (SSS), where the population of bears increased by approximately 17 % per year in the period 1991-1997, when hunting was restrictive, and approximately 3 % per year in the period 1997-2001, after the hunting quotas had been increased (Sæther et al. 1998, J. E. Swenson, pers. comm.). I have poorer data on the expansion of the population in Jämtland (CSS), but assumed an increase of 10 % per year for the whole period.

Results

I found no short-term effect of the killing of marauding brown bears. The data were normally distributed (Kolmogorov-Smirnov Normality Test, Nord-Trøndelag, $P > 0.15$; Hedmark, $P > 0.15$), and a regression analysis showed no relation between change in loss from year t to year $t+1$ ($\ln(\text{loss}_{\text{year } t+1}/\text{loss}_{\text{year } t})$) and the number of marauding brown bears killed in year t for either Nord-Trøndelag ($F = 0.87$, $df = 6$, $P = 0.39$) or Hedmark ($F = 1.10$, $df = 6$, $P = 0.34$). Also when tested against the total number of bears killed in the Norwegian county and the adjacent Swedish county, the same result was found (Nord-Trøndelag and Jämtland, $F = 1.48$, $df = 6$, $P = 0.27$, Fig.1), (Hedmark, $F = 0.12$, $df = 6$, $P = 0.74$, Fig.2).

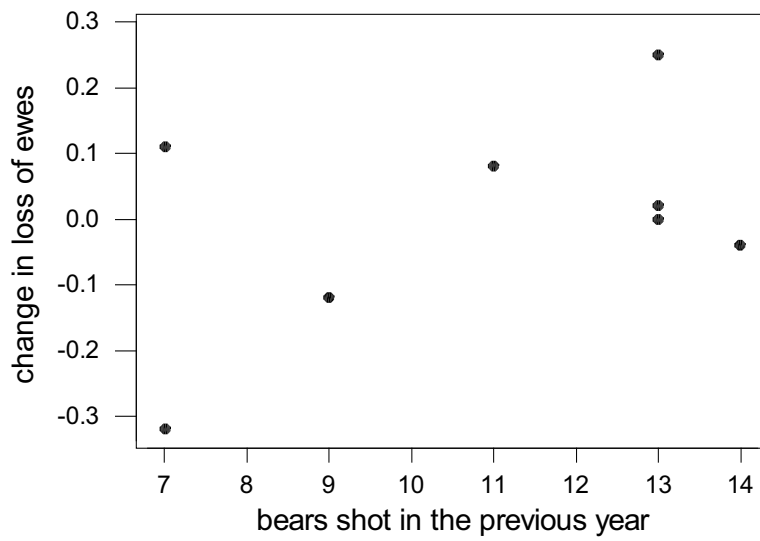


Fig.1. Change in loss of ewes in Nord-Trøndelag in relation to the number of bears shot in the previous year in Nord-Trøndelag (Norway) and Jämtland (Sweden) counties.

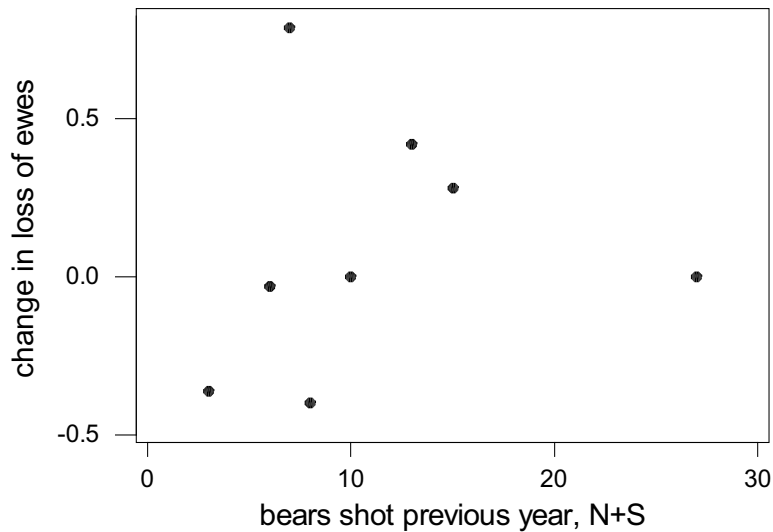


Fig.2. Change in loss of ewes in Hedmark in relation to the number of bears shot in the previous year in Hedmark (Norway) and Dalarna (Sweden) counties.

The percentage of ewes lost in Hedmark County, Norway, varied annually during 1992 – 2001, but was higher during the last 5 years than the first 5 years ($U = 1.0$, $P = 0.01$). In the adjacent county, Dalarna, Sweden, the brown bear population almost tripled in size during the period 1991 – 2001. The size of the population in Dalarna explained 54 % of the variation in the percentage of ewes lost in Hedmark County ($r = 0.73$, $P = 0.01$).

In Nord-Trøndelag County, Norway, the percentage of ewes lost increased throughout the period 1982 – 2001, and the size of the brown bear population in the adjacent Swedish county Jämtland, explained 75 % of the variation in percentage of ewes lost ($r = 0.87$, $P < 0.001$). However during 1992 – 2001, the percentage lost was relatively stable in spite of the fact that the brown bear population in Jämtland more than doubled. For this period there was no relation between the percentage of ewes lost in Nord-Trøndelag, and the size of the brown bear population in Jämtland ($r = 0.42$, $df = 8$, $P = 0.22$).

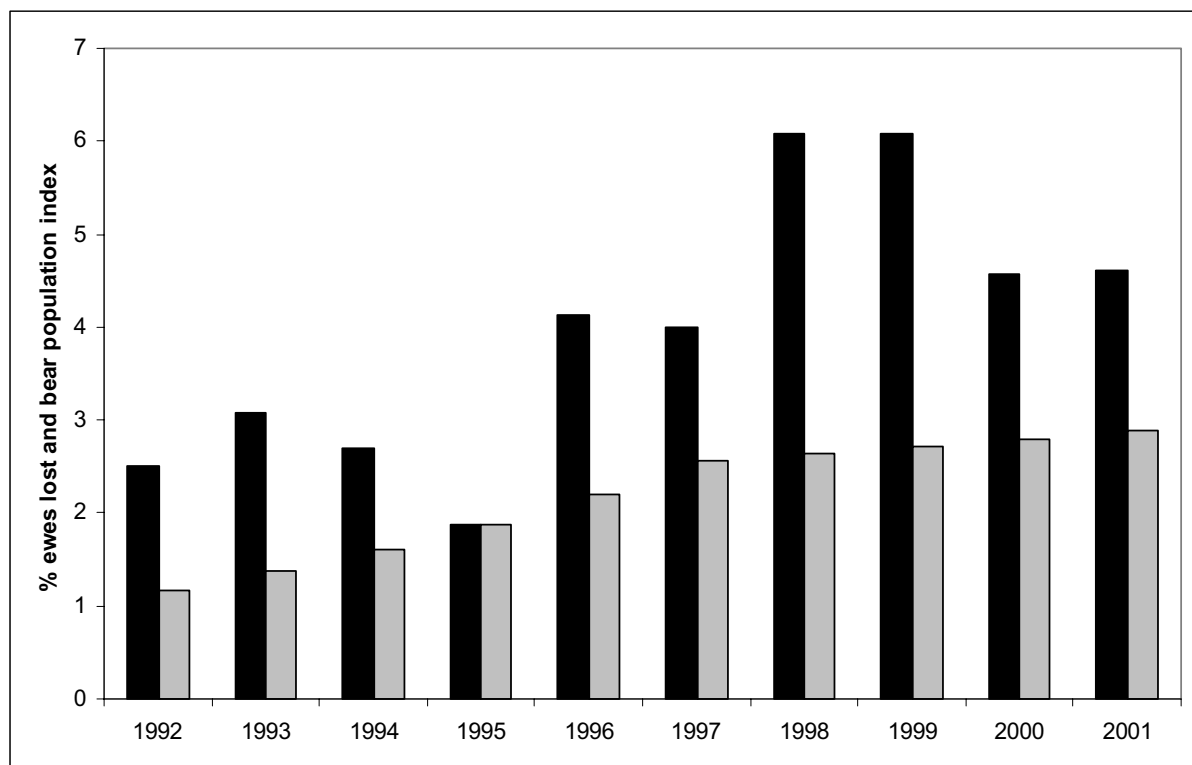


Fig.3. The percentage loss of ewes in Hedmark County, Norway (black column) and the relative number of bears in adjacent Dalarna County, Sweden (gray column) during 1992-2001. The number of bears is given relative to the number in 1991, which was set to 1.

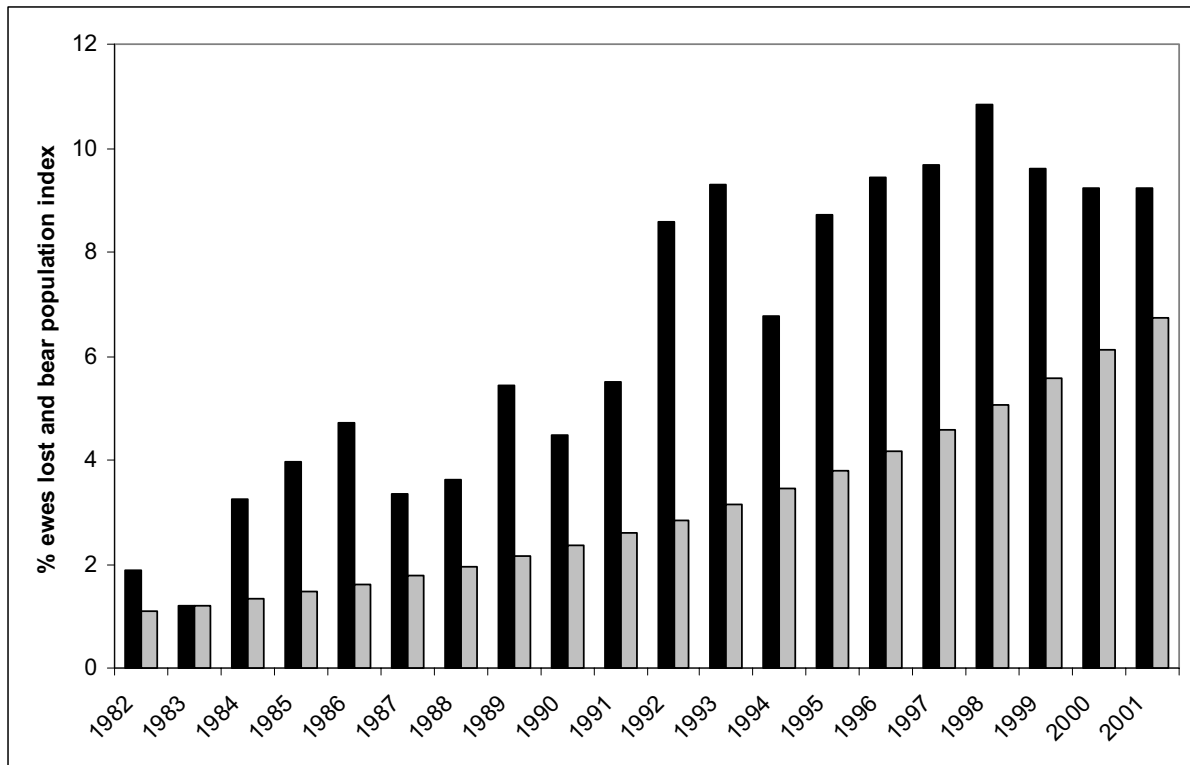


Fig.4. The percentage loss of ewes in Nord-Trøndelag County, Norway (black column) and the relative number of bears in adjacent Jämtland County, Sweden (gray column) during 1982-2001. The number of bears is given relative to the number in 1981, which was set to 1.

Discussion:

Killing of marauding bears.

The shooting of marauding bears at the level experienced in this study (mean of 0.75 per year in both Nord-Trøndelag and Hedmark) was ineffective in reducing subsequent losses of sheep in two areas of Norway. This is the same result Sagør et al. (1997) found in the same areas, but in an earlier period, when 0.85 and 0.38 bears on average were shot annually in Nord-Trøndelag and Hedmark, respectively. The repeatability of the results gives strong support to the conclusion, and will hopefully help end the controversy around it. I concur with Sagør et al. (1997) that this is probably due to the close proximity of bears in Sweden. As the Swedish bear population is growing and expanding, bears that are killed in Norway apparently are replaced constantly by immigrating bears from adjacent reproduction areas (Swenson et al. 1998). This suggests that the killing of marauding bears would only be effective if the dispersal from the Swedish core areas were stopped, or perhaps if the killing of bears in Norway were greatly increased. The Swedish authorities, however, regard today's population of brown bears as their minimum population goal, and plan to allow the bears to increase in

number and distribution (Miljödepartementet 2000). This means that bears will continue to disperse into Norway.

In addition, the bear that is killed is probably not always the marauding bear. Bears can move over large areas within a short period of time (Zakrisson 2001) and Waabakken & Maartmann (1994) found that the chance of killing the “guilty” bear declines rapidly within hours after the attack on sheep, especially in the first part of the grazing season. Very few bears are actually killed after a kill permit is issued, due to the difficulty of hunting, the great mobility of the bears, and the high degree of human activity that often occurs with searching for carcasses and hunting, which may scare the marauder away from an area (Hustad 2000).

The size of the Swedish population of brown bears and the loss of sheep in adjacent Norway.

My results indicated a positive correlation between the size of the brown bear population in Sweden and the loss of sheep in the border regions in Norway supporting the conclusion that the ineffectiveness of shooting marauders in Norway is partly due to the large bear populations nearby in Sweden. For the whole period of 1982-2001, the size of the Swedish central subpopulation explained 75% of the variation in the loss of sheep in the adjacent Norwegian county, Nord-Trøndelag. However, in the period 1992-2001, the loss of sheep was relatively stable, and the relationship was no longer significant. In this latter period several preventive measures were initiated in Nord-Trøndelag, such as later release dates for sheep on open range, earlier gathering from open range, fencing and herding with guard dogs, and abandoning sheep raising in some areas with high losses (Lierne Kommune 2000) in addition to the killing of marauding bears. One or a combination of these preventive measures seems to have had an effect on reducing the loss, but which and how is unclear. Similar measures have been tried in Hedmark County, but not to the same extent. There the loss of sheep increased throughout the period, and was correlated with the size of the adjacent subpopulation of bears in Sweden.

Conclusion

Both Sagør et al. (1998) and Swenson & Andrén (in press) conclude that the present system of sheep husbandry in Norway does not work when bears are present. I agree and predict that the problem with bears predating on sheep will continue to grow, given the present Swedish policy regarding bears, unless a radical change in husbandry system is made, because the bear population in Sweden is growing and will continue to do so for some time. The problems will most likely move westwards as the population of brown bears increases, into new areas that

have not yet suffered many problems with bears. The importance of having a husbandry system that works is obvious. Alternative types of livestock might be a way of transforming the agricultural system into a system more compatible with bears and other large predators. Zimmermann et al. (2003) considered cattle to be a good alternative to sheep, when it comes to brown bear predation.

The results clearly show that the loss situation in Norway is very dependent on how the Swedish authorities manage their population of bears. The official policy on brown bears has been handled politically in Norway three times: 1992, 1997 and 2004. The latest proposition suggested a much larger population of bears, than the previous two, and also changed the goals from a “maximum” to a “minimum” number. This is more in accordance with the Swedish policy of 2000. However, problems arise as the Norwegian Parliament also wants an active agricultural production with acceptable economic conditions based on utilizing grazing resources by sheep in the mountains and forests. According to Swenson & Andrén (in press) this is probably impossible if the sheep are free-ranging. There is no reason to believe that the situation will be less problematic in the future, given both the Norwegian and Swedish policy on bears. Hence a system must be developed that either gives relief for the sheep farmer, or for the bear. One strategy would be to have a clearer separation of bear and non-bear areas. This has also been proposed in the latest proposition by the Norwegian Government (Miljøverndepartementet 2004). Of course another strategy would be to try to kill all bears in and entering Norway, and allowing sheep farmers to continue free-ranging sheep husbandry. This would entail a renouncing of the Bern Convention, which states that each contracting party shall take steps to promote national policies for the conservation of wild flora, wild fauna and natural habitats, with particular attention to endangered and vulnerable species, and Article 11, which states that the parties must co-operate in achieving this goal (Bern Convention 1979). This is not really an option, because it is not and has not been Norwegian policy (Miljøverndepartementet 2004).

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