

# Levels of $^{137}\text{Cs}$ in reindeer bulls in July/August and September and the effect of early slaughter

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## Introduction

Since the first autumn after the Chernobyl nuclear accident, 1986, early slaughter of bulls has been used as a method to prevent reindeer meat from being rejected because of too high levels of radiocesium (Åhman 1986).

The diet of reindeer varies throughout the year. This result in great variations of radiocesium intake and thus great variations of radiocesium levels in reindeer. The *sameby*\* Vilhelmina norra is located in one of the most contaminated areas of Sweden. In summer most reindeer from Vilhelmina norra have levels of  $^{137}\text{Cs}$  below 1500 Bq/kg, which is the current limit for reindeer meat that is offered for sale in Sweden. In winter, reindeer from this area have levels between 5000 and 30000 Bq/kg.

Normally there is no slaughter of reindeer in summer. The bull slaughter starts at the beginning of September and goes on until around September 20. In September the bulls reach their maximum weight and are in good condition before the rut. At this time, however, the levels of radiocesium have started to increase after summer and in more contaminated areas most of the reindeer already have levels above the limit of 1500 Bq/kg.

\* The Swedish word *sameby* represents a union of reindeer herders and the territory where these herders have rights to graze their reindeer (Beach 1990).

In 1987 the Swedish Board of Agriculture decided to stimulate early slaughter by economic compensation for lower carcass weights and for extra work connected with the gathering of reindeer for slaughter. Since 1987 early slaughter has been put into practice in every *sameby* in the county of Västerbotten. At present the Swedish government pays about 1200 SEK for a rejected reindeer bull with a slaughter weight around 45 kg. The economic compensation to the reindeer owner when the bull is slaughtered in August is about 500 SEK.

In this investigation we studied the effects of early bull slaughter on the number of accepted (< 1500 Bq  $^{137}\text{Cs}$ /kg) carcasses in the whole *sameby* Vilhelmina norra and at selected locations in Vilhelmina norra, Svaipa/Gran and Hotagen during the years 1987 to 1990.

## Material and methods

Analyses of  $^{137}\text{Cs}$  are performed as a routine at all reindeer slaughters in contaminated areas of Sweden. The results are presented in data lists published by «Gammadata mätteknik AB» in Uppsala, a company which carries out many of the analyses.

In Vilhelmina norra samples have been taken from every reindeer slaughtered from July to September each year since the Chernobyl acci-

dent. This material has been used to calculate the results shown in Figure 1.

In Table 1 results are shown from reindeer slaughtered at three field slaughter houses in Svaipa/Gran, Vilhelmina norra and Hotagen, respectively. The reason for picking these locations is that reindeer have been slaughtered at these places in both August and September during most years since Chernobyl and that the fallout differs between the locations. Reindeer from three main areas with levels of different contamination are taken to the slaughter house in Giels (Vilhelmina norra). Reindeer from the Marsfjället area were chosen for Table 1.

## Results and discussion

The effect of early slaughter varies between different locations and also between years at the same location. The effect depends on the radiocesium deposition in the area and on the time of year when the reindeer starts to graze plants with high radiocesium levels (lichens and mushrooms). The results are shown in Figure 1 and Table 1.

Figure 1 shows the number of reindeer slaughtered in Vilhelmina norra in July/August and in September 1986–1990 and the distribution of carcasses with levels of  $^{137}\text{Cs}$  above and below the limit 1500 Bq/kg.

In 1986 all reindeer bulls were slaughtered at normal time in September. Only 7 % had levels of  $^{137}\text{Cs}$  below 1500 Bq/kg. These animals were, however, not accepted for human consumption, since the upper limit for all meat at that time was 300 Bq/kg.

Early bull slaughter was effected in Vilhelmina norra for the first time in July 1987. A slightly larger part of the animals were accepted for human consumption (activity concentrations of  $^{137}\text{Cs}$  below 1500 Bq/kg) in July/ August than in September.

In 1988 radiocesium levels in reindeer started to increase as early as August, owing to the exceptional quantity of mushrooms that year (Hove et al. 1990). Most carcasses (71 %) were accepted at slaughter in July/August but only 14 % were accepted in September.

In 1989 and 1990 most reindeer were slaughtered in August and a large part of these animals (84 and 78 %, respectively) had activity concentrations of  $^{137}\text{Cs}$  below 1500 Bq/kg. Less than 200 bulls were slaughtered in September each of these two years. In September 1989 all

animals, except two, were slaughtered on September 3, and 90 % of the carcasses had levels of  $^{137}\text{Cs}$  below 1500 Bq/kg. (In 1989 radiocesium levels in reindeer started to increase late in the autumn, since there were virtually no mushrooms and green pasture was available until the end of October.) At slaughters in September 1990, 48 % of the carcasses had activity concentrations of  $^{137}\text{Cs}$  below 1500 Bq/kg, and were accepted for human consumption.

Table 1 shows mean values of  $^{137}\text{Cs}$  and the percentage of accepted carcasses (activity con-

Table 1.  $^{137}\text{Cs}$  in reindeer, mean  $\pm$  S.D., from slaughter in three different places in August and September 1987–90.

Sameby/ location	date	n	$^{137}\text{Cs}$ kBq/kg < 1500 Bq/kg	
			mean $\pm$ S.D.	%
<b>SVAIPA/GRAN</b>				
Biergenäs	1987-08-24	251	0.36 $\pm$ 0.17	100%
	-09-16	116	0.78 $\pm$ 0.39	93%
	1988-08-23	514	0.90 $\pm$ 0.33	96%
	-09-16	261	1.63 $\pm$ 1.05	47%
	1989-08-22	319	0.29 $\pm$ 0.09	100%
	-09-13	103	0.47 $\pm$ 0.24	99%
	1990-08-23	477	0.33 $\pm$ 0.09	100%
	-09-14	376	0.63 $\pm$ 0.32	97%
<b>VILHELMINA</b>				
NORRA	1987-09-04	333	1.02 $\pm$ 0.36	87%
	-09-15	218	3.94 $\pm$ 1.04	0%
(Marsfjäll)	1988-08-26	219	1.54 $\pm$ 0.84	63%
	-09-16	184	5.71 $\pm$ 2.62	0%
	1989-08-23	350	0.93 $\pm$ 0.25	97%
	-09-03	168	1.03 $\pm$ 0.37	90%
	1990-08-13	302	0.72 $\pm$ 0.16	100%
	-09-15	109	1.82 $\pm$ 1.06	53%
<b>HOTAGEN</b>				
Vinklumpen	1987-08-23	112	0.75 $\pm$ 0.19	100%
	-09-08	184	1.36 $\pm$ 0.50	71%
	1988-08-25	209	1.58 $\pm$ 0.39	49%
	-09-07	199	1.89 $\pm$ 0.51	22%
	1989-08-23	204	0.43 $\pm$ 0.11	100%
	-09-09	257	0.63 $\pm$ 0.28	100%
	1990-08-22	260	0.57 $\pm$ 0.14	100%
	-09-05	239	0.87 $\pm$ 0.29	97%

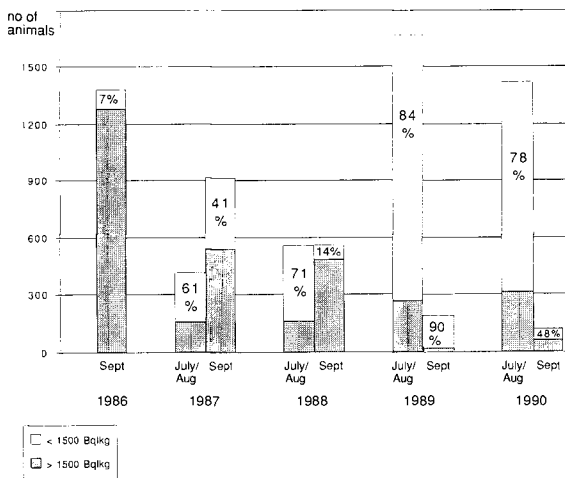


Figure 1. The number of accepted and rejected carcasses (% < 1500 Bq/kg) at reindeer slaughters in Vilhelmina norra in July/August and September 1986–1990.

concentrations < 1500 Bq/kg) at early and normal bull slaughter in Biergenäs (Svapia/Gran), Gielas-Marsfjäll (Vilhelmina norra) and Vinklumpen (Hotagen) from 1987 to 1990.

Reindeer slaughtered in Biergenäs and Vinklumpen had been grazing in areas where the radiocesium fallout was 2–5 kBq <sup>137</sup>Cs/m<sup>2</sup> and 5–10 kBq <sup>137</sup>Cs/m<sup>2</sup>, respectively. At slaughters in August, except from August 1988, all reindeer have had activity concentrations of <sup>137</sup>Cs below the limit 1500 Bq/kg. In September the levels had started to increase, but were still sufficiently low and only few carcasses were rejected because of too high levels of radiocesium. In 1988 radiocesium levels started to increase earlier (as discussed above). In Biergenäs most carcasses were accepted in August, but only 47 % were accepted in September. In Vinklumpen 49 % were accepted in August and as few as 22 % were accepted in September.

In the Marsfjället area (the south eastern part of the summer grazing land in Vilhelmina norra)

the radiocesium fallout was 20–40 kBq <sup>137</sup>Cs/m<sup>2</sup>. Bulls from this area have been slaughtered at three different periods, August 13–26, September 3–4 and September 15–16, however not at all these times each year. At the beginning of September 1987 and 1989 most reindeer from Marsfjället had activity concentrations below 1500 Bq <sup>137</sup>Cs/kg and were accepted for human consumption. In 1987 and 1988 no carcasses were accepted at slaughters in mid September. In 1988 a large part of the carcasses (37 %) were rejected already at the slaughters in August. In 1990 all carcasses were accepted at slaughter in August and 53 % were accepted in mid September.

## Conclusions

In areas with radiocesium fallout below 10 kBq <sup>137</sup>Cs/m<sup>2</sup> bull slaughter could be made at ordinary time of year, except from years like 1988 when the access to mushrooms was exceptionally high. In areas like Vilhelmina norra, where the fallout is over 20 kBq <sup>137</sup>Cs/m<sup>2</sup>, few reindeer have activity concentrations below 1500 Bq <sup>137</sup>Cs/kg in September, the normal time for bull slaughter. In these areas bull slaughter should routinely be made in August (or possibly very early in September) to save as many reindeer carcasses as possible from being rejected due to high levels of radiocesium.

## References:

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