Predation Losses of Domestic Sheep in Alberta

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Highlight: *This paper provides estimates of predation losses of domestic sheep in Alberta in 1974. These estimates were obtained from personal interviews. Unlike the United States, Alberta had a predator control program which emphasized the use of toxicants. Province-wide predation losses averaged 1.6% of the ewes and 2.8% of the lambs. However, predation losses varied widely among five major ecosystems; i.e., between 0.8% of the lambs and ewes in the southern parkland and 3.2% of the ewes in the northern parkland and 6.8% of the lambs in the mixed forest. Predation accounted for 24 and 18% of the total annual mortality of lambs and ewes, respectively. Thirty-nine percent of the flocks had no predation losses and another 31% of the flocks had predation losses of 3% or less. Larger flocks tended to be more susceptible to predation than smaller flocks. Coyotes, dogs, and other large predators were reported to have caused 88, 8, and 4% of predation losses, respectively.*

This paper provides estimates of predation losses of domestic sheep (*Ovis aries*) in Alberta in 1974. These estimates are important in planning and evaluating predator control programs. Predator control programs in Alberta emphasized the use of toxicants, while all toxicants were banned for predator control in the United States during 1972–75. Thus, estimates of predation losses in Alberta may provide a useful comparison for studies of predation losses in the western United States where predator control programs were markedly different (Magleby, 1975) or where there was no predator control, as reported by Henne (1975) for a sheep ranch in Montana.

Methods

Five percent of the members of the Alberta Provincial Sheep Breeders Association were selected for personal interviews to obtain estimates of domestic sheep mortality in 1974. Members were asked the total numbers of ewes and lambs in their flocks in 1974 and numbers of sheep lost from disease, lambing, predation, and other causes (e.g., bloat, handling, poisonous plants). Members were also asked seven questions on management and predator control.

The Alberta Provincial Sheep Breeders Association maintains regional lists of members arranged by alphabetical order. Every twentieth member on these lists was selected for personal interview. Obviously, this method of selecting producers for personal interview was not random. However, we know of no reason why our sample was not representative of the sheep producers in Alberta.

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Data on flock size and sheep mortality in Alberta were separated into five major ecosystems; i.e., mixed forest, foothills, prairie, northern parkland, and southern parkland (Fig. 1). There were no sheep producers in the mountain ecosystem. These divisions follow the ecosystems of the *Atlas of Alberta* (Anonymous, 1969:38), except

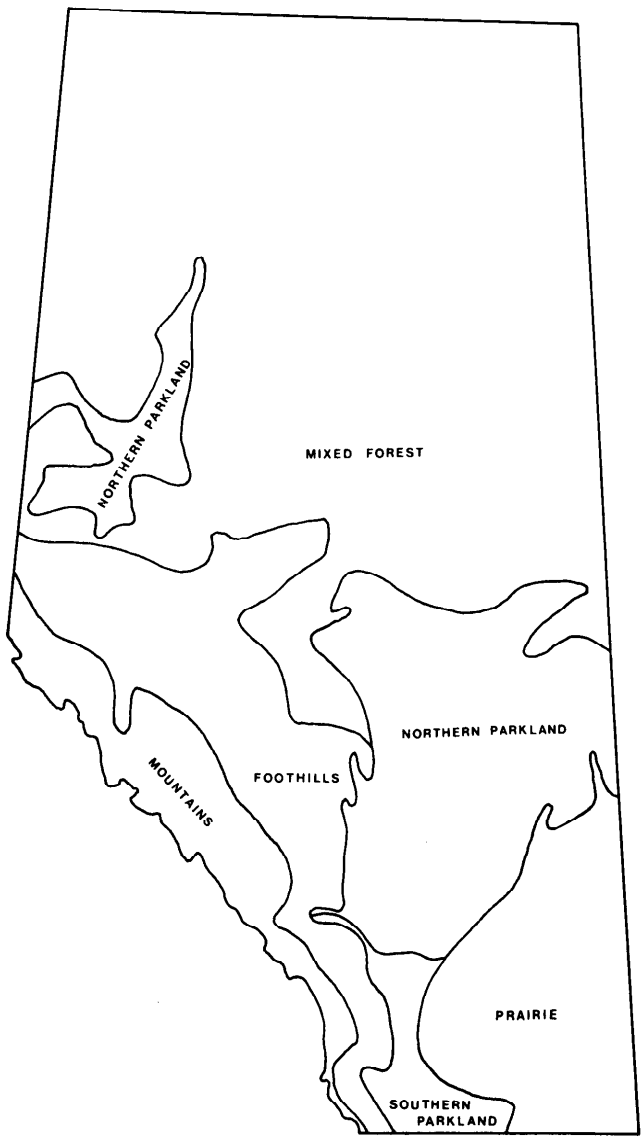

Fig. 1. *Ecosystems of Alberta (Anonymous, 1969:38).*

that we subdivided the parkland into a northern and southern unit separated by the Bow River. We had previous knowledge that flock size and management practices differed markedly between the northern and southern parkland.

Predation losses were compared in confined, semiconfined, and range flocks. Confined flocks were those kept in pens or sheds throughout the year. Semiconfined flocks were allowed to graze during the day, but were returned to pens or sheds at night. Range flocks were those on pasture throughout the grazing season.

An arcsin square-root transformation was performed on mortality rates to approximate a normal distribution. Ranked means were then tested for significant differences with Student's *t*-test.

Results

Of the 89 sheep producers selected for personal interviews, 75 had sheep, one had sheep but would not be interviewed, eight had no sheep in 1974, and five could not be found. The 75 producers that had sheep had a total of 11, 880 ewes and 13,614 lambs.

If the membership of the Alberta Provincial Sheep Breeders Association reflected a representative sample of sheep producers, then approximately two-thirds of the sheep in Alberta were in the southern parkland (34%) and prairie (29%) (Table 1). Flocks averaged 158 ewes and 182 lambs, province-wide. However, mean flock size differed markedly among the ecosystems, being highest in the prairie and lowest in the northern parkland (Table 1).

Annual mortality of domestic sheep in Alberta is shown in Table 2. Province-wide predation losses averaged 1.6% of the ewes and 2.8% of the lambs. However, predation losses differed significantly among the five ecosystems in the agricultural areas of Alberta. Predation rates of ewes varied between 0.8% in the southern parkland and 3.2% in the northern parkland. Predation of lambs was particularly high in the mixed forest, averaging 6.8%, while in the southern parkland predation losses averaged only 0.8%.

Annual mortality of domestic sheep in Alberta averaged 6.6% for ewes and 15.7% for lambs. Annual mortality of the ewes did not differ significantly among the five ecosystems, varying between 5.1 and 9.1%. Mortality of lambs was significantly lower in the southern parkland (9.6%), prairie (10.9%), and foothills (12.1%), than in the mixed forest (20.5%) and northern parkland (31.2%) (Table 2).

Province-wide, predation accounted for 24 and 18% of the total mortality of ewes and lambs, respectively. Again, there was considerable variability among the five ecosystems; i.e., between 8 and 33% for lambs and 15 and 37% for ewes. For comparison, 24.6% of the total losses of sheep was attributed to predation in Colorado, Wyoming, Montana, and Texas during 1966–69 (Reynolds and Gustad, 1971). In Idaho, Early and Roetheli (1974) estimated that predation accounted for 25.0 and 33.0% of the total mortality of ewes and 21.4 and 24.7% of the total mortality of lambs during 1970–71 and 1972–73, respectively. Magleby (1975) estimated sheep losses for 15 western states during 1974; from his data, we calculated that predation accounted for 33 and 68% of the total mortality of stock sheep and docked lambs, respectively.

Table 1. Mean flock size in Alberta, 1974. Number of sheep producers interviewed are in parentheses.

Ecosystem	Flock size		Percent of sheep
	Ewes	Lambs	
Prairie	290	325	29 (12)
Southern parkland	258	328	34 (15)
Northern parkland	82	92	23 (33)
Mixed forest	125	107	8 (9)
Foothills	115	134	6 (6)
Means and totals	158	182	100 (75)

The coyote was the major predator of domestic sheep and was reported to have caused 88% of predator-related losses. Coyotes, dogs, and other predators (wolves, black bears, and mountain lions) were reported to have caused 77, 15, and 8% of the predator losses of ewes and 95, 3, and 2% of the predator losses of lambs, respectively. These data are similar to reports of predation investigated and confirmed by Alberta government personnel; coyotes, dogs, and other predators were reported to have caused 89, 8, and 3%, respectively, of 1,427 confirmed predator losses of domestic sheep during 1974.

Coyotes tended to prey on lambs ($X^2 = 88.8$, 1 d.f., $P < .025$); lambs comprised 71% of 511 sheep killed by coyotes and 31% of 42 sheep killed by dogs. Very little predation occurred during the winter; of the 608 sheep killed by predators, 1, 26, 40, and 33% were lost during winter, spring, summer, and fall, respectively.

Wagner (1972), after analyzing data from Nielson and Curle (1970), estimated that four-fifths of the ranchers sustained predator losses of 2.5% or less in Utah in 1968–69. Results from Alberta were similar. A frequency distribution of the number of sheep producers with different rates of predation takes the form of a Poisson (Fig. 2). Twenty-nine (39%) of the 75 producers had no predation losses and an additional 23 producers (31%)

Table 2. Annual mortality (%) of domestic sheep in Alberta, 1974.[1]

Age class	Mortality factor	Ecosystem					
		Mixed forest	Northern parkland	Foothills	Prairie	Southern parkland	Province-wide
Ewes	Predation	1.9[a,b]	3.2[b]	2.4[a,b]	1.1[a,b]	0.8[a]	1.6
	Lambing[2]	0.0	1.0	0.0	0.9	0.7	0.7
	Disease[2]	1.2	3.9	2.9	3.6	1.6	2.7
	Other factors[2,3]	2.0	1.0	3.4	1.1	2.1	1.6
	Totals[2]	5.1	9.1	8.7	6.7	5.2	6.6
Lambs	Predation	6.8[a]	4.1[a]	3.6[a]	3.2[a,b]	0.8[b]	2.8
	Birth[2]	5.5	14.0	3.4	4.6	6.7	7.4
	Disease	7.7[a]	12.2[a]	1.5[a,b]	2.8[a,b]	0.8[b]	4.5
	Other factors[2,3]	0.5	0.9	3.6	0.3	1.3	1.0
	Totals	20.5[a]	31.2[a]	12.1[b]	10.9[b]	9.6[b]	15.7

[1]Table values in rows followed by the same letter are on significatly different ($p<.05$).
[2]Table values in these rows are not significantly different.
[3]Other factors include bloat, handling, and poisonous plants.

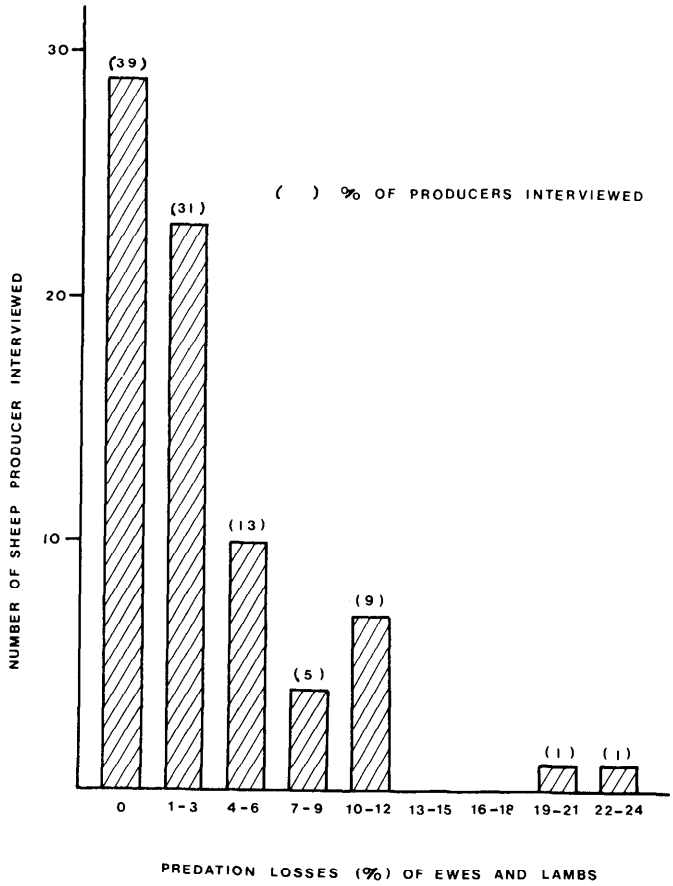

Fig. 2. *Frequency distribution of the number of sheep producers with different predation losses (%) of ewes and lambs.*

had predation losses of 3% or less. The most severe losses were attributed to dogs; one producer reported losses from dogs of 19% and another reported losses of 24%. The maximum predation rate attributed to coyotes was 12%; i.e., 26 lambs and 16 ewes were reported taken from a flock of 87 lambs and 253 ewes.

Larger flocks tended to be more susceptible to predation than smaller flocks. Producers reporting predator losses had an average flock size of 181 ewes and 208 lambs, while producers with no predation losses had an average flock size of 114 ewes and 140 lambs. These differences were significant ($P<.05$) and suggest that predator losses were related, at least in part, to management practices. However, mortality from lambing, disease, and other factors did not differ significantly between flocks with, and without, predation losses.

Flocks were classified as confined, semiconfined, and range, in an attempt to determine if predation losses were related to management practices. Surprisingly, predation losses were highest in confined flocks and lowest in range flocks. Predation losses of ewes and lambs in confined, semiconfined, and range flocks differed significantly ($P<.05$). Predation losses in these respective classes averaged 4, 3, 2.1, and 1.4% for ewes and 4.4, 4.3, and 1.5% for lambs. Predation was reported in 17, 81, and 93% of the confined, semiconfined, and range flocks. Thus, the probability of predation was low in confined flocks, but when predation did occur in these flocks, it was particularly severe. Confinement offers the predator an opportunity to kill large numbers of sheep, since the sheep cannot escape. The practice of semiconfining a flock is probably a response to predation losses in past years. Flocks remain on range in areas where predation losses are negligible. Increased predation results in semiconfinement.

Discussion

The real measure of the effectiveness of predator control in Alberta is not available; that is, the numbers of sheep that would have been lost without a predator control program. Predation losses that occur during or after the implementation of a control program can be used as a measure of the effectiveness of that program, provided that other estimates of predator losses are available for comparison. Since predation losses are to be used to evaluate the effectiveness of predator control in Alberta, the 1974 control program is outlined below.

Alberta Agriculture was responsible for the control of coyotes and dogs in the agricultural areas of Alberta in 1974. Eight predator specialists assisted farmers with predator problems. These specialists used a variety of control techniques including strychnine drop baits, cyanide guns (Coyote Getters and M-44's), denning, hounds, snares, and calling and shooting. In addition, Alberta Agriculture supplied approximately 22,000 strychnine cubes to farmers for predator control in 1974. Alberta Agriculture personnel also set 25 sodium fluoroacetate (1080) baits in the southern parkland during winter, 1973–74. Thus, coyote control in Alberta was characterized by (1) an emphasis on the use of toxicants, (2) general population suppression in the southern parkland, and (3) a trouble-shooting control program in most of the province, i.e., most predator control was initiated after predation of domestic livestock had occurred.

Predation losses in Alberta averaged 1.6% of the ewes and 2.8% of the lambs in 1974. These losses were similar to, or slightly less than, predation losses in the United States prior to the ban on toxicants in early 1972. Estimates of predation losses were 2% for ewes and 4–5% for lambs in Utah during 1969–70, as reported by Wagner (1972) from data presented by Nielson and Curle (1970). Predation losses averaged 5.3% of all sheep in Montana, Wyoming, Colorado, and Texas during 1966–69 (Reynolds and Gustad, 1971). During these years, predator control programs in the western United States relied heavily on the use of 1080 (Wagner, 1972). Predation losses in Idaho were estimated to be 2.6% of the ewes and 4.0% of the lambs during 1970–71 and 2.8% of the ewes and 3.8% of the lambs during 1972–73. Although toxicants were banned in early 1972, the use of toxicants during winter, 1971–72, could have affected predation losses in Idaho during 1972–73.

In contrast, predation losses in 1974 averaged 2.0% of the stock sheep and 5.6% of the docked lambs in Idaho and 5.2% of the stock sheep and 11.0% of the docked lambs in Utah. Predation losses in 15 western states during 1974 were estimated at 3.4% of the stock sheep and 8.1% of the docked lambs (Magleby, 1975). Henne (1975) reported predation losses of 8% of the ewes and 29% of the lambs on a ranch in western Montana during March 1974 to March 1975; it must be emphasized that no predator control was practiced and no attempts were made to discourage coyote predation on this ranch during the first 7 months of the study.

The above data suggest that predation losses were generally higher in the United States than in Alberta during 1974. These data also suggest that predation losses in the United States have increased since toxicants were banned for predator control in 1972.

Predation losses varied markedly among the five ecosystems

in the agricultural areas of Alberta, being lowest in the southern parkland and prairie, and highest in the northern parkland and mixed forest. In general, predation rates increased with increased forest cover of the ecosystem. In the mixed forest where predation losses were highest, farmsteads are typically surrounded by forest. Differences in predation losses among ecosystems undoubtedly resulted from a variety of factors; e.g., flock size, management practices, accessibility of flocks to coyotes, and alternate food supplies for coyotes.

Predation losses in the southern parkland were lower than in the other ecosystems of Alberta. Again, these differences probably resulted, at least in part, from differences in habitat and differences in management practices, as discussed above. However, we suspect that the predation losses in the southern parkland were also affected by the intensity of coyote control. Two of the eight predator specialists of Alberta Agriculture were in the southern parkland. In addition, the southern parkland was the only ecosystem in Alberta where 1080 was used for suppression of coyote populations.

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