Characteristics of Predation and Losses in the New York Sheep Industry

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ABSTRACT

A questionnaire survey was used in 1985 to obtain data on predation and losses from New York sheep growers. Surveys were returned by 685 growers which was a 40% return rate. The average grower managed 160 acres, including 24 acres of pasture, kept 106 sheep and received 12% of the total family income from sheep farming. Sheep predation occurred on 44% of the farms and dogs were considered the most harmful predator by 88% of the growers with losses. Growers with sheep losses had significantly larger flocks, more acreage in pasture, larger farms and depended more heavily on sheep farming for income than growers without losses ($p < 0.05$). Growers who had reduced their pasture acreage and were planning further reductions had significantly higher losses than growers whose acreage had remained constant or increased and were planning to add more pasture ($p < 0.001$). Growers who had reduced their flock size also had significantly higher losses than those who had increased their flocks ($p < 0.05$). Finally, individuals who would reduce or sell their flock if predation continued had significantly higher losses than growers who planned to use lethal predator control methods to combat future predation ($p > 0.05$).

INTRODUCTION

Although present in New York State since the 1930's (Severinghaus, 1974), coyotes have recently become a concern of the New York sheep industry. Spencer (1983) warned that coyote predation could be a costly problem in the East if its potential were underestimated, and thus, efforts to assess the coyote problem have begun in New York.

A variety of factors have been shown to influence sheep losses to coyotes Large flocks were found to be more susceptible to predation than small flocks (Dorrance and Roy 1976, Meduna 1977), while the rate of loss has varied inversely with flock size (Meduna 1977, Robel et al. 1981). A direct relationship between pasture size and the rate of sheep loss has also been suggested (Robel et al. 1981). Predator population levels and the timing of coyote reproductive cycles have also been suggested to influence the magnitude and/or timing of sheep losses (Cain et al. 1972; Meduna 1977, Brawley 1977). In this study, we examined several of these factors as a basis for characterizing predation and losses in the New York sheep industry.

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METHODS

Information on the New York sheep industry was obtained by using a 56-question survey. Questions characterized growers' farms, flocks and husbandry practices, coyote presence, predation and livestock losses, and growers' predator-control programs. Sheep growers were also asked to rate the importance of various concerns to their business and to identify significant sheep mortality factors. Surveys were mailed to 1712

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growers in late June 1985. Non-respondents received follow-up letters approximately 3 weeks later. Data from incomplete surveys or from growers recently out-of-business were used where appropriate.

Sheep mortality to coyotes may be influenced by coyote distribution and density. Since estimates of county coyote densities were unavailable for New York, a relative index of county coyote populations using harvest levels was developed for comparison with survey-generated data. Individuals who killed coyotes were required to have the pelt tagged by a DEC (Department of Environmental Conservation) representative. Pelt-tagging records for each county for the period 1979-1985 were provided by the DEC. Our coyote population harvest index consisted of individual county totals expressed as a percentage of the statewide total.

Caution is necessary when interpreting harvest data, since harvest statistics reflect both coyote population density and the distribution and success of hunting and trapping efforts. Additional bias in coyote harvest data existed when individuals who took coyotes did not sell the pelts and thus may not have reported their kills to the DEC. However, harvest data was the best information available and was believed to provide an adequate relative index of coyote population levels for comparison with survey-generated results.

Survey responses and coyote population indices were analyzed using the SAS Statistical Package (SAS Inst. 1982). Analysis of variance (ANOVA) and covariance was used to evaluate class effects, and Duncan's Tests were used for factor level comparisons.

RESULTS

The New York Sheep Industry

Surveys were returned by 685 sheep growers, which resulted in a 40% return rate. Active growers comprised 92% of the returns. Assuming that a similar proportion of the statewide sheep growers were active, the number of sheep growers in 1985 was estimated to be 1581.

The average sheep grower owned and operated 135 acres and leased another 26 acres. Despite the size of the average sheep farm (160 acres), the average acreage in pasture was 24 acres. Over 42% of the sheep growers had fewer than 10 acres in pasture, while nearly 30% used 10 to 22 acres. Another 25% of the sheep growers had from 22 to 100 acres of pasture, and only 3% reported more than 100 acres of sheep pasture.

An average of 12% of the total income of New York sheep growers was derived from sheep products. Surprisingly, 27% of the respondents made no income from raising sheep, and only 9% derived more than 35% of their income from farming. The remaining 64% of the sheep growers made between 1 and 35% of their income from sheep farming.

The average New York sheep grower had a flock of 106 sheep, of which 58 were lambs, 39 aged, and 9 yearlings. Although sheep growers reported flock sizes ranging from 2 to 3400 sheep, 70% of the respondents kept between 10 and 124 sheep. Only 13% of the growers had a flock of more than 200 head.

The frequency distribution of sheep pasture acreage was evaluated and partitioned into 3 groups: less than 20 acres, 20 to 40 acres, and greater than 40 acres. Analysis of variance resulted in highly significant differences among sheep pasture groups for percent income from sheep, flock size, and total acreage (Table 1). On the average, as sheep pasture increased, income from sheep farming, flock size, and total farm acreage increased significantly. Based on these analyses, sheep pasture was used as a covariate in the analysis of variance of sheep grower data to adjust all comparisons for differences in income from sheep farming, flock size, and farm size.

Predation and Losses

Growers ranked predation fourth among a list of concerns of the New

Table 1. Analysis of sheep farm characteristics by groups based on acreage in sheep pasture.

Variable		Acreage in Sheep Pasture[1] <20	20-40	>40
Percent income from sheep	$\bar{x}$	6.2 A	15.2 B	33.2 C
	S.D.	13.5	17.6	30.1
	N	320	99	67
Flock size	$\bar{x}$	45.4	137.2 B	350.0 C
	S.D.	70.8	137.2	509.1
	N	396	121	84
Total acreage	$\bar{x}$	109.2 A	174.3 B	385.3 C
	S.D.	147.6	164.4	386.1
	N	403	121	86

1/ Row means with the same letter are not significantly different ($p>0.05$)

York sheep industry. Low meat and wool prices were the major problem for 31% of the farmers, while high land prices and taxes, and high operating expenses were each rated important by 22% of the respondents. Predation was important to 15% of those polled. Not surprisingly, growers who rated predation important had significantly higher annual losses than those who rated predation as not important ($p < 0.0001$) (Table 2). Among these same concerns, growers rating high operating expenses as important had significantly fewer losses than those who rated this factor as not important ($p <0.0095$).

As a cause of sheep mortality, predation was ranked equal with old age and second only to disease as an important factor to sheep growers (Figure 1). Respondents who indicated predation was an important mortality

Table 2. Comparisons of annual sheep losses to predators for sheep growers grouped by their rating of various concerns to the sheep industry. Acreage in sheep pasture was used as a covariate in the analysis.

Concern	Sheep Grower Rating[1]	N	Mean Annual Losses[2]	S.D.
Low meat/wool prices	I	442	3.7 A	11.0
	N	78	4.1 A	9.8
High land prices and taxes	I	314	3.5 A	9.7
	N	206	4.1 A	12.4
High operating expenses	I	317	2.8 A	7.1
	N	203	5.2 B	14.9
Predation	I	197	8.0 A	16.3
	N	323	1.1 B	3.3

1/ I = Important; N = Not Important
2/ Column means with the same letter are not significantly different ($p>0.05$)

Table 3. Comparisons of annual sheep losses to predators for sheep growers grouped by their rating of various sheep mortality factors. Acreage in sheep pasture was used as a covariate in the analysis.

Factor	Sheep Grower Rating[1/]	N	Mean Annual Losses[2/]	S.D.
Disease	I	332	3.9 A	10.8
	N	141	4.3 A	12.5
Predation	I	169	9.4 A	16.8
	N	304	1.1 B	4.1
Old Age	I	301	3.9 A	10.8
	N	172	4.4 A	12.1
Accidents	I	211	2.3 A	5.6
	N	262	5.5 B	14.2
Weather	I	201	3.8 A	.8
	N	272	4.2 A	12.3
Starvation	I	39	5.7 A	12.1
	N	434	3.9 A	11.2

1/ I = Important; N = Not Important
2/ Column means with the same letter are not significantly different ($p>0.05$)

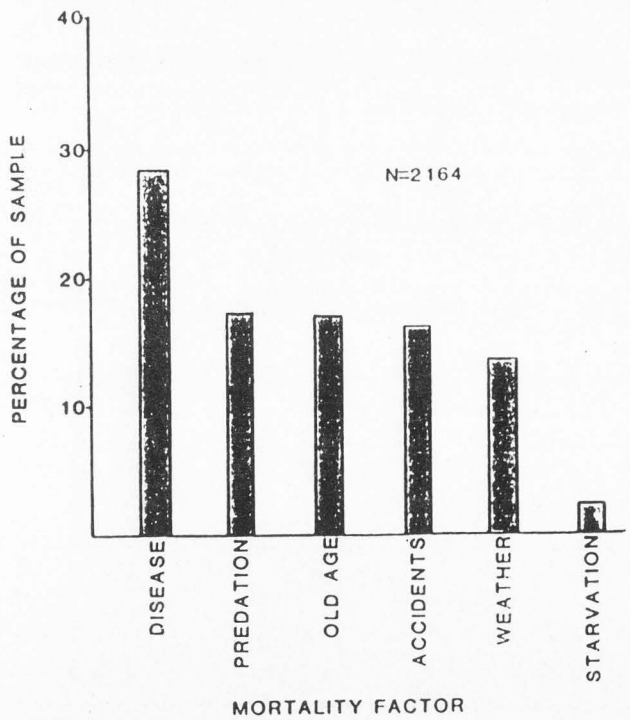

Figure 1. Relative importance of several sheep mortality factors as rated by sheep growers from New York.

factor had significantly greater losses ($p < 0.0001$) (Table 3) than those who ranked other factors as more critical. Also, significantly fewer predation losses were suffered by growers rating accidents more important ($p < 0.0047$).

Sheep predation was a widespread phenomenon among New York sheep growers, with 44% of all respondents reporting losses. An overwhelming majority (88%) of the respondents with sheep losses indicated that dogs had caused the most harm to their flocks, while only 6% identified coyotes as most harmful. The secondary role of coyotes to dogs as major sheep predators in New York was further supported by the lack of a significant relationship between coyote harvest distribution (Figure 2) and the distribution of sheep losses (Figure 3).

Predation represented an average annual income loss of $462 (N = 175) to sheep growers reporting losses. Most of these growers (38%) lost $100 to

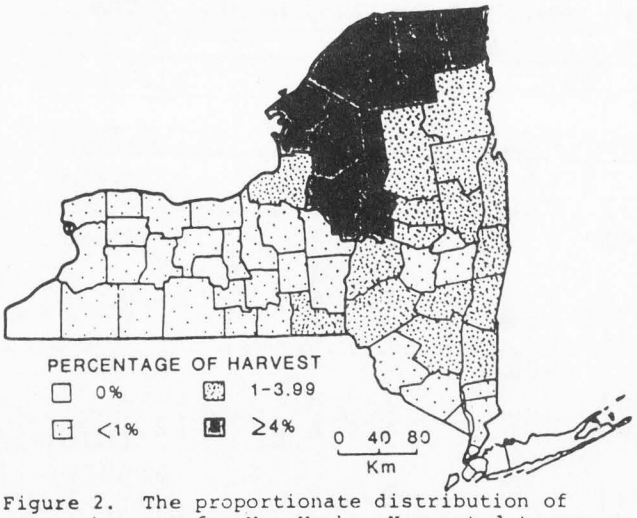

Figure 2. The proportionate distribution of coyote harvest for New York. Harvest data were provided by the NY Dept. of Env. Cons. from pelt tagging records for 1979-1985.

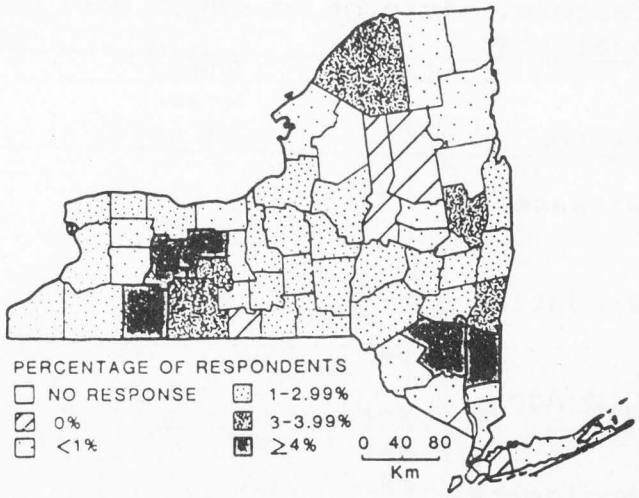

Figure 3. Summary of the proportionate distribution of respondents with sheep losses to predators in New York.

$200 each year, while 28% had more than $400 in annual damage. Only 15% of the sheep growers valued their losses at less than $100. The reported total annual loss value was $80,810, which was extrapolated to produce an estimated statewide annual loss value for predator-killed sheep of $201,800. This figure was considered a conservative estimate, since losses from growers recently out of business were excluded from the calculations.

Whether or not a grower experienced sheep losses was in part linked to the size of his operation. Respondents with losses obtained significantly more of their income from sheep, and had significantly larger flocks, total acreage, and acreage in sheep pasture as well (Table 4).

Growers reported a seasonal change in predation, with more respondents suffering lamb than adult losses during the spring, while the reverse was true the rest of the year (Figure 4). The majority of the growers had losses

Table 4. Comparison of sheep grower farm and flock characteristics for growers with and without predation losses.

Variable	Group	N	Variable Mean 1/	S.D.
Percent income from sheep	Loss	228	15.9 A	23.4
	No Loss	258	8.0 B	15.1
Flock size	Loss	281	148.7 A	304.9
	No Loss	320	69.4 B	129.6
Total acreage	Loss	291	198.3 A	234.6
	No Loss	319	127.0 B	205.0
Acreage in sheep pasture	Loss	292	33.5 A	57.7
	No Loss	314	14.1 B	23.3

1/ Column means with the same letter are not significantly different ($p>0.05$)

Table 5. Comparisons of annual sheep losses to predators for growers grouped by their past changes and future plans for sheep pasture acreage and flock size. Acreage in sheep pasture was used as a covariate in these analyses.

Variable	Grouping	N	Mean annual losses[1/]	S.D.
Previous pasture changes	Increase	188	2.7 A	9.9
	No change	284	3.7 A	9.9
	Decrease	36	10.3 B	
Future pasture changes	Increase	166	2.3 A	4.8
	No change	300	4.1 B	12.9
	Decrease	40	7.8 C	12.9
Previous flock changes	Increase	228	3.1 A	9.0
	Decrease	113	4.8 B	12.7
	No change	167	4.2 AB	12.1
Future flock changes	Increase	168	4.1 A	14.0
	Decrease	112	4.1 A	8.3
	No change	224	2.9 A	6.8

[1/] Column means with the same letter are not significantly different ($p>0.05$)

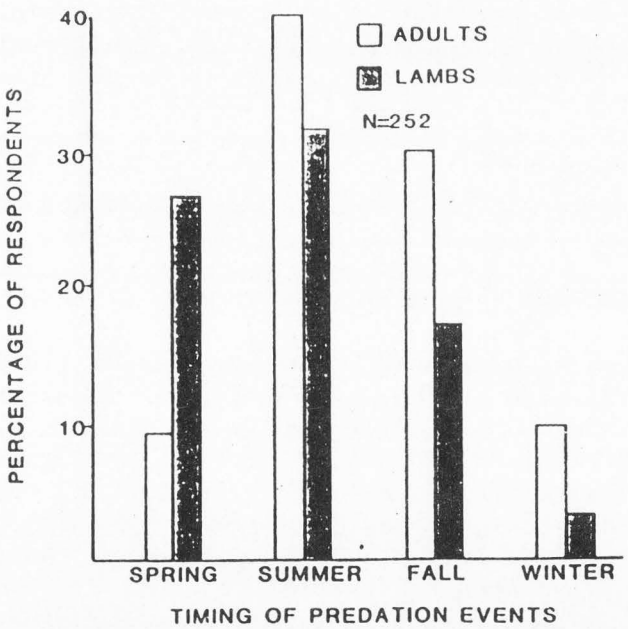

Figure 4. Changes in adult and lamb losses to predators by season in New York.

during the summer months, which also coincided with the time when most respondents had sheep on pasture.

Predation appeared to impact growers' past and future plans for their farms (Table 5). Respondents who had reduced their acreage in sheep pasture had significantly higher annual sheep losses than growers whose acreage had remained constant or had increased ($p < 0.0001$). Significant differences in sheep losses also existed between growers based on their planned future changes in pasture acreage (Table 5) ($p < 0.0009$). Acreage increases were predicted by individuals with fewest losses, while decreased sheep pasture acreage was planned by growers suffering the greatest predation.

Respondents grouped by past changes in flock size also had significantly different annual losses ($p < 0.0492$). Growers who had reduced their flock size reported significantly more losses than individuals who had increased the number of sheep they kept. Losses for individuals whose flock size was

Table 6. Comparison of annual sheep losses to predators for growers by their choice of future actions if predation continues. Acreage in sheep pasture was used as a covariate in the analyses.

Variable	Action	N	Mean annual losses[1/]	S.D.
Action if predation continues	Use lethal methods	47	10.3 A	16.5
	Reduce/sell flock	26	17.0 B	23.3
	Use non-lethal methods	13	17.0 AB	28.9

1/ Column means with the same letter are not significantly different ($p>0.05$)

constant were not significantly different from the other groups. Differences in annual losses were not significant between growers characterized by their planned future changes in flock size.

The impact of predation on actions that growers said they would take if losses continued, was not clear (Table 6). Growers who would take up or continue the use of lethal methods had significantly fewer losses than growers who planned to reduce or sell their flocks. Respondents who planned to attempt to control predation through non-lethal means suffered losses which did not differ significantly from either of the other groups. Losses incurred by these growers were highly variable.

DISCUSSION

The problem of assigning livestock and sheep losses to either dogs or coyotes was not addressed in this study. Most questions in the survey did not distinguish between predators to eliminate any potential bias from misidentified kills. In addition, answers to dog and coyote predation questions may have been biased toward increased reporting of dogs as predators. Although the magnitude of this bias could not be investigated, it was considered to originate from the current compensation law for sheep losses to dogs, which may have put some pressure on growers to report losses as dog predation. Additional evidence that coyotes may have been responsible for more losses than those reported was the 92% support by survey respondents for compensation for coyote predation losses.

Growers were consistent in their emphasis on dogs over coyotes as the major predators on sheep. Regression analysis revealed that no significant relationships existed between the statewide number or value of sheep losses and either statewide coyote harvest data or population trends. The relationship between the proportion of the statewide sheep loss value by county and the mean coyote harvest on a county-by-county basis was also not significant.

Predation was considered a critical concern by the New York sheep industry and, specifically, as one of the most important mortality agents acting on livestock, especially sheep. As expected, sheep growers with higher losses emphasized predation as their major problem (Tables 2 and 3), had reduced their flocks and sheep pasture acreage and, in the future, were planning to continue reductions in sheep pasture acreage (Table 5). Further, a portion of the growers with higher losses said they would reduce

Table 7. Summary of coyote harvest trends, pasture and flock changes, and percent of growers with losses by county as reported in the New York sheep industry predator survey.

County	N	Coyote trend 1/	Percent pasture increase	Percent pasture decrease	Percent flock increase	Percent flock decrease	Percent with losses
Cattaraugus	15	12.0	53.3	13.3	40.0	40.0	53.3
Wyoming	10	9.3	66.7	0.0	60.0	40.0	10.0
Sullivan	3	6.4	100.0	0.0	100.0	0.0	66.7
Albany	12	4.0	30.0	0.0	50.0	30.0	58.0
Schenectady	1	4.0	0.0	0.0	0.0	100.0	100.0
Tompkins	16	3.8	18.8	25.0	31.3	31.3	25.0
Schoharie	11	2.7	45.5	9.1	45.5	27.3	45.0
Tioga	8	2.6	62.5	25.0	57.1	28.6	75.0
Orleans	13	2.5	41.7	8.3	53.9	15.4	46.0
Wayne	12	2.2	25.0	0.0	58.3	16.7	25.0
Madison	14	1.7	42.9	0.0	64.3	7.1	36.0
Dutchess	43	1.4	30.2	7.0	33.3	16.7	51.0

1/ Net percent change in coyote harvest between years summarized for the period 1979-1984.

their flocks or sell their businesses if predation continued (Table 6). The economic impact of predation on individual growers and the construction of cost/benefit analyses of predation effects on the sheep industry were not part of this study. However, several inferences about the value of losses and costs of control can be made. The value of sheep losses averaged about $462 per grower with losses, and expenditures for predator control would add to this total. Since the average grower gained only 12% of his income from sheep farming, the impact of predation on the industry (in causing part-time or low-budget growers to absorb losses and take steps to reduce predation) may be acute. Certainly, if the response of many growers to increased predation is to reduce flock size or, ultimately, to quit, the sheep industry in New York will be affected.

As a subgroup within the industry, growers with the highest losses were identified clearly by this study (Table 4). These individuals had an average of 150 sheep, a farm of 200 acres with 34 acres of pasture, and derived 16% of their income from sheep products. For this group, the commitment to sheep growing would appear to be strong and, therefore, their knowledge of methods to control predation and their understanding of the problem will be critical to future management program actions. Further, most growers indicated that they wanted more research on control methods and would attend management workshops.

In New York there is a very real potential for increased sheep losses to canine predators and for increased coyote predation, in particular. Net coyote harvest trends were calculated and counties with positive harvest trends were found to be scattered across the state (Table 7). Although small sample sizes hindered any quantitative analysis, the 12 counties with growing coyote harvests varied widely in farm and flock trends as well as sheep losses. Hopefully, those counties where losses were high and increases in flock and pasture acreage were planned, could be targeted for investigation. Most of the 12 counties appeared to be areas of growth for the sheep industry, yet, where losses were high, some decreases in flock size and pasture acreage had occurred and may have been signs of growers responding

to predation. Interestingly, the 12 counties were located across the midsection of New York, from east to west, and did not include the Adirondack counties where coyote harvests have been substantial. When these trend data for both coyote harvests and sheep farms are jointly considered, the need for prompt and well-considered action by the sheep industry and the agencies is well justified.

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