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PREDATOR DEPREDATIONS ON SHEEP IN PENNSYLVANIA

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ABSTRACT: The eastern coyote (*Canis latrans*) has become common and widespread in many eastern states. We surveyed 331 sheep producers in Pennsylvania (PA); 22% reported predator losses in 1991, primarily to dogs and coyotes. Losses were heaviest in the southwest part of PA and producers reporting losses tended to have more sheep and more acreage in pasture. To reduce losses, producers used lambing sheds, fences, guard dogs and donkeys, confinement of sheep, trapping, and shooting. It appears that we can expect greater depredations in the future because of increased coyote numbers and a relatively low level of protection of sheep; however, most sheep losses were to old age, disease, lambing problems, and accidents.

Key words: animal damage, coyotes, dogs, livestock, predation, sheep

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The eastern coyote has become common and widespread in the eastern United States and Canada, in large part because of vacated niches — by wolves (*Canis lupus*), mountain lions (*Felis concolor*), lynx (*Felis lynx*), and bobcats (*Felis rufus*) — and alteration of habitats by humans (Chambers 1987, Moore and Parker 1992). We documented the growing numbers and widespread distribution of coyotes in PA (Witmer and Hayden 1992). Although the eastern coyote is believed to primarily feed on deer (*Odocoileus virginianus*) and lagomorphs (*Lepus* spp. and *Sylvilagus* spp.) (Harrison 1992), there is a concern about the potential for significant impacts to sheep and other livestock (Slate 1987, Hilton 1992, Witmer and Hayden 1992). Substantial losses have been documented in New York (Tomsa and Forbes 1989) and other livestock of the United States (USDA 1991, Connolly 1992a, 1992b). Some authors believe that coyote predation has been a significant factor in the decline of the sheep industry in the United States (Terrill 1986, Hilton 1992). Sheep production is a sizeable industry in PA with about 3,000 producers in the state (James Sheeder, PA Sheep and Woolgrowers Association, pers. commun.). The numbers of sheep increased yearly from 1985 to 1989 when 134,000 sheep were raised in PA (Mark Hudson, PA Dept. of Agriculture, pers. commun.).

Surveys provide a valid methodology for wildlife managers to help assess problem areas, to direct research efforts, and to establish or modify wildlife control programs (Crabb et al. 1987, Craven et al. 1992). Surveys, especially mail surveys, are an easy and cost effective way of obtaining useful information from a large number of people over a large geographic area (Crabb et al. 1987). It is important, however, to avoid biases in surveys and to word questions carefully (Crabb et al. 1987). Furthermore, one must ensure that the public and the media are aware of survey limitations and that the findings or conclusions are properly interpreted and used (Craven et al. 1992). Surveys have been used in numerous states to learn more about sheep losses to predators (for

example, Nass 1977, Robe] et al. 1981, Schaefer et al. 1981, Mass et al. 1984, Jahnke et al. 1988, Larson and Salmon 1988, Hafer and Hygnstrom 1991).

We surveyed sheep producers in PA in early 1992. Our objectives were to provide information on sheep operations, losses to predators and other factors, and management practices in PA. Hopefully, this information will provide a baseline for comparison with future conditions and provide input for management decisions.

This survey had the support of the PA Department of Agriculture, the PA Game Commission, and the PA Sheep and Woolgrowers Association. David deCalesta, Michael W. Fall and Linda Hardesty provided useful comments on the manuscript. This work was performed while the senior author was on the faculty of the Pennsylvania State University.

METHODS

About 1,150 2-page surveys were mailed to potential sheep producers in early 1992 by the PA Department of Agriculture. The surveys were sent with compliance letters required of sheep producers seeking subsidies or compensation for their production activities. It should be noted that it is possible that many of these persons were no longer raising sheep in PA. The survey requested producers' assistance to learn more about predators, and in particular the coyote, in PA. The information was requested in confidence with only the county of operation required, but most respondents provided names and addresses. Questions were asked regarding sheep production activities in 1990. If sheep were raised, how many? On how many pastures and acreage? Did you have losses to predators? How many losses? To what predators? Were losses reported? The estimated value of losses? Were coyotes sighted on your property? What was the extent of your other (nonpredation) losses of sheep? Which,

it any, management practices did you use to reduce predation losses? Which practices are you contemplating use of in the future if losses continue or increase? Finally, would you like more information made available by state or federal authorities on dealing with coyotes? No follow up surveys or telephone calls to nonrespondents were made because of time constraints, although these are often recommended as part of surveys (Crabb et al. 1987).

We evaluated the survey results primarily by comparing percentages of respondents for various categories of interest. We also calculated means and standard deviations for some parameters. We performed a linear regression with losses to predators and coyote sightings.

RESULTS AND DISCUSSION

Three-hundred and thirty-seven (29.3%) responses to the mailed surveys (1,150) were received. We received responses from 62 (93%) of the 67 counties in PA. Of the 337 responses, 331 (98.2%) were usable for analysis (a few persons that responded had not raised sheep in 1990). This response rate is considered good given that no reminder was sent. In Iowa, Schaefer et al. (1981) received a 39% response rate. Larson and Salmon (1988) had a response rate of 28% despite a reminder card being sent. Hafer and Hygnstrom (1991) sent a reminder mailing and then followed up with telephone calls to achieve a final response rate of 61%. Individual sheep producers raised anywhere from 2 to 865 sheep on 0.25 to 800 acres.

Losses to Predators

Twenty-two percent of the sheep producers reported sheep losses to predators. Losses were primarily to dogs (67%), followed by coyotes (18%), foxes (11%), and bears (8%). Other or unknown predators accounted for about 8.5% of losses. This confirms a pattern of losses to free-ranging dogs which has been a long term problem in PA (see, for example, USDA 1991). Other states have reported substantial losses to dogs as well: in California (Larsen and Salmon 1988) and Kansas (Robel et al. 1981). We note, however, that it is easy to confuse dog and coyote kills unless one examines carcasses carefully (see, for example, Wade and Bowns 1982). This is an increase in the number of PA sheep producers reporting losses to coyotes compared to earlier surveys and reports (Witmer and Hayden 1992). Sheep losses to coyotes have increased dramatically in neighboring New York as well (Tomsa and Forbes 1989). Most losses in PA were in the southern part of the state, although losses were reported from almost all parts of the state (Fig. 1). Respondents with losses to predators in 1990 lost, on average, 6.2 sheep (SD=13, n=68) at an average value loss of \$521.05 (SD=1171, n=62) per respondent. Persons reporting losses to predators tended to raise more sheep ($X=131.3$, $SD=167.6$, $n=72$) than those without losses ($X=65.9$, $SD=93.2$, $n=71$), and raised sheep on more acres ($X=54.9$, $SD=102.9$, $n=71$) than those without losses ($X=18.5$, $SD=21.6$, $n=152$). Robel et al. (1981) reported

a similar situation in Kansas. Only 55% of the sheep producers with losses to predators reported those losses to state or federal authorities. This suggests that Connolly (1992a) was correct in surmising that agencies are underestimating losses to predators

The portion (21.1% of producers that saw coyotes on their properties is very similar to the portion (22.1%) that had losses to predators. Coyotes were reported seen in 36 (58%) of the 62 counties from which surveys were received. However, we only found a weak ($r=0.5$, $n=26$) correlation between losses to predators and coyote sightings. This is consistent with the fact that most sheep are reported lost to dogs, not coyotes. Coyotes have become numerous and widespread in PA, as substantiated by the PA Game Commission's Game Take Survey results for 1991: over 4,000 coyotes were harvested by sportsmen (A. Hayden, unpublished data). This is an increase in harvest of over 400% from previous estimates (Witmer and Hayden 1992). We do not know if this level of harvest will stabilize coyote numbers in PA. We can anticipate from the rapidly growing coyote population that sheep losses to coyotes will increase in PA.

Other Sheep Losses

Nonpredator sheep losses were reported by 56% of those surveyed. The source and number of reports of these losses were, in declining order: old age (80), disease (71), lambing problems (35), and accidents (33). Others have also reported losses such as these to be more substantial than losses to predators (for example, Nass 1977, Robel et al. 1981, USDI 1984). Schaefer and others (1981), however, reported a greater portion of sheep losses to predators than to other factors.

Managing Predator Losses

A great many methods have been used to reduce losses to predators (Fall 1990). Less than half (9%) of the producers reported using husbandry practices to reduce predator losses. Perhaps predation is not considered a serious enough threat for more producers to implement protective measures. On the other hand, the costs (both direct and indirect) of implementing protective measures may inhibit actions by producers (Jahnke et al. 1988). The most commonly used husbandry practices to reduce predation (and the number of respondents using them) were: lambing sheds (65), fences (57), guard dogs (29), confinement of sheep (22), guard donkeys (8), trapping (8), and shooting (5). Fencing and lambing sheds were the most commonly used husbandry practices to reduce sheep predation in California (Larsen and Salmon 1988), although predator hunting, snaring, and trapping were ranked much higher. It is interesting that nonlethal approaches were used much more than lethal methods for predation reduction in LA PA. This could be related to the higher costs and labor associated with some lethal control methods (Jahnke et al. 1988). Lethal control of predation may be less common in the eastern United States than in western states because of a higher human density and increased concerns about potential hazards to people, pets,

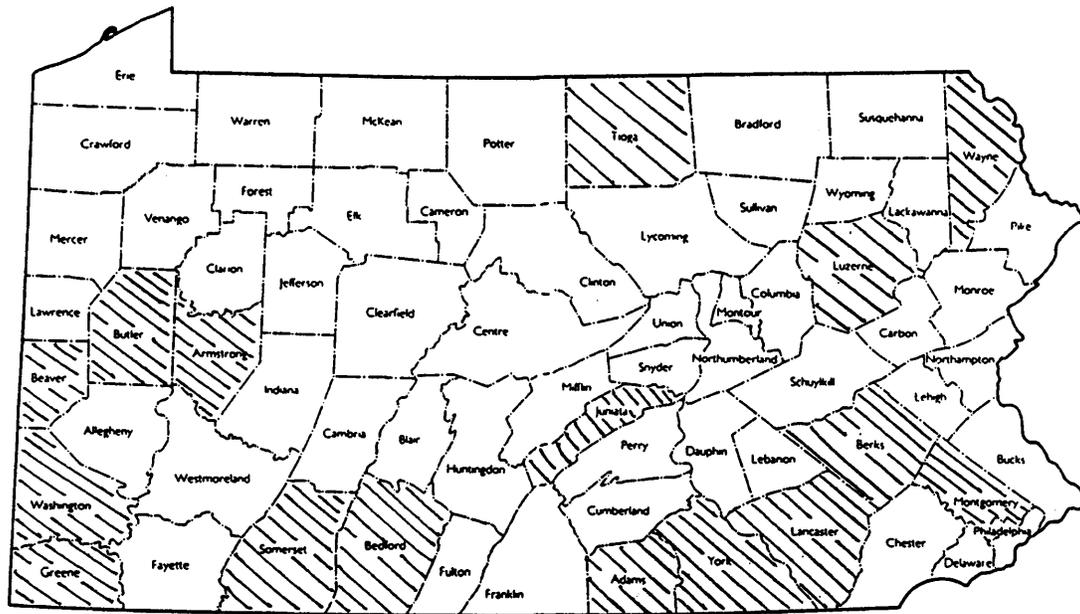


Figure 1. Pennsylvania counties (hatched) with 2 or more sheep producers reporting sheep losses to predators in the 1990 survey.

livestock, and nontarget wildlife (for example, Owens 1987, Tomsa and Forbes 1989). Additionally, the provision of technical information rather than operational assistance has been a more common approach to predator management in the eastern states (Owens 1987). Others have reported effective use of nonlethal methods to reduce predation losses (Robe] et al. 1981, Nass et al. 1984, USDI 1984, Dorrance 1992, Hilton 1992).

Practices not currently used by some survey respondents in PA, but which they will use if losses to predators continue or increase are, in declining order: fences, guard dogs, shooting, and guard donkeys. We note that a lethal method, shooting, has increased its rank from the list of methods currently in use. Additionally, almost half (44%) of the survey respondents indicated that they would like more information made available on dealing with coyotes.

Management Implications

We can expect continued losses of sheep to predators in PA for many reasons; for example, high predator densities and a relatively low portion of sheep producers using husbandry practices to reduce losses to predators. To keep these losses to a tolerable level will require a significant effort by groups and agencies in both the private and public sectors (Larson and Salmon 1988, Witmer and Hayden 1992). Researchers must provide more information on coyote biology and ecology in PA. The PA Game Commission is currently conducting coyote movement, habitat use, and food habit studies. The continued heavy harvest of coyotes may help stabilize or reduce coyote densities in PA. Problem animals (both dogs and coyotes) must be effectively controlled. This will require the availability of persons skilled in removing

problem animals. An increase in the compensation claims program funds will be necessary or perhaps a cost-share program for protective management practices could be implemented. Sheep producers should be provided with additional information on husbandry practices to reduce losses to predators. Perhaps producers could unite with neighbors in cooperative efforts to resolve problems. More technical assistance should be provided -to producers with predation problems. Furthermore, public input on predator and livestock management can be actively sought and used in the decision-making process (Inslerman 1992).

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