PERCEPTIONS AND KNOWLEDGE OF ALABAMA FRUIT AND VEGETABLE PRODUCERS TOWARDS COYOTES

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ABSTRACT: Members of the Alabama Fruit and Vegetable Producers Association (AFVP) were surveyed in 1992-1993 to assess their attitudes and knowledge of coyotes and the amount of perceived damage caused by coyotes. A mail-back questionnaire was developed and pilot tested. The revised questionnaire was sent to all members (N = 84) of the AFVP; individuals whose main income is the production of fruits and vegetables. Seventy-seven percent (n = 61) of those surveyed returned completed questionnaires. Tests for nonresponse bias were conducted and results showed no significant difference. Attitudes were assessed using a Likert scale where 1 = respondents favoring maximum protection of coyotes and 5 = maximum control of coyotes. Data analysis suggests that attitudes of fruit and vegetable producers towards coyotes is neither maximum protection nor maximum control (x=3.61). However, their attitudes do lean toward the maximum control side of the scale. In addition, knowledge about coyotes and perceived threat by coyotes did not affect producer's attitudes (x^2 = 261.12, P = 0.54; x^2 = 904.50, P = 0.37, respectively), however, those with coyote damage more strongly favored control.

Key Words: attitudes, coyote (Canis latrans), fruit and vegetable producers, human dimensions, knowledge, wildlife damage.

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Coyotes (Canis latrans) have become both common and controversial throughout Alabama. Coyotes have been in the southeast since the 1920's (Anonymous 1929), but in the last 20 years, their population has steadily increased (Kennedy 1987). With this increase, has come an increase in coyote/human interactions, ranging from coyotes damaging or killing livestock to feeding on crops. A recent study of Alabama county extension agents (Armstrong 1991) listed the coyote as one of the top 4 species in perceived damage in the state. Agents received an average of about 14.5 calls per year about coyotes compared to about 16 calls per year for white-tailed deer (Odocoileus virginianus), the species cited most often in damage complaints. Research in the southeast has focused on coyote food habits and the effect coyotes have on other wildlife species (Wooding et al. 1984, Lee and Kennedy 1986, Blanton and Hill 1989, Hoerath and Causey 1991). Jones (1987:320) stated, "Because the coyote is a relatively recent inhabitant of the Southeast, there is considerable concern about the impact of coyotes on livestock, crops, wildlife, pets, and people." A deficiency in information about economic and actual damage caused by coyotes has resulted in an increased interest in coyote research by many agribusiness organizations and state wildlife management agencies.

We provide relevant information concerning the impact of coyotes on crops and people by evaluating the knowledge and attitudes of Alabama fruit and vegetable producers towards coyotes and by discussing perceived economic losses caused by coyotes.

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METHODS

Surveys have been proposed and used to determine the extent of animal damage (Crabb et al. 1987). We developed a mail-back questionnaire using established guidelines (Dillman 1978, Converse and Presser 1986, Fowler 1988). Each questionnaire consisted of 4 sections: (1) attitudes toward coyotes; (2) nature and extent of damage; (3) knowledge of coyotes; and (4) demographics of respondents. The attitudinal section was subdivided into 3 parts: (1) 10

statements to solicit respondents attitudes towards coyotes; (2) a list of 9 items (7 animals, 1 fruit, and 1 vegetable) were provided to determine how serious respondents considered coyotes a threat to these items; and (3) a list of 8 animal species were provided for respondents to rank from 1 to 8, with 1 being the most liked animal and 8 being the least like animal. Damage information requested included livestock species or crops being damaged, species believed to be causing damage, number or amount of livestock species or crops damaged, estimated economic loss, and time of year damage occurred. We also asked participants what coyote control methods they had implemented and to rate the effectiveness of each. Respondent's knowledge of coyotes and coyote behavior relative to predation were measured using 11 questions. Demographics consisted of respondent's age, number of years farming\ranching, highest educational level completed, how far farm\ranch was from nearest town, number of acres land owned and\or leased, variety of crops or breeds of livestock, and whether or not coyote educational materials had been received.

The questionnaire was pilot tested twice and Cronbach's alpha (Crocker and Algina 1986) used to estimate score reliability on the attitudinal scale, threat scale, and knowledge scale. Items not contributing to overall reliability were modified or removed. Reliability estimates for the attitudinal, threat, and knowledge scales were 0.93, 0.91, and 0.59, respectively. The questionnaire was reviewed by 2 survey design experts and 3 wildlife damage management experts who rated items for content validity.

Subsequently, we mailed questionnaires to all (N = 84) the members of the Alabama Fruit and Vegetable Producers Association (AFVP). This comprises the entire membership of AFVP; individuals whose main income is the production of fruits and vegetables. In October 1992, 84 mail-back questionnaires were sent out. Each participant was sent a cover letter, a questionnaire, and a self-addressed postage-paid envelope. Ten days after initial mailing, a postcard reminder was sent to all participants. After three weeks, nonrespondents were sent a second cover letter and a replacement questionnaire. In addition, 10% (n = 30) of the nonrespondents for the complete study (the complete study consisted of surveying 3 Alabama agribusiness organizations: Alabama Cattleman's Association; Alabama Lamb, Wool, and Mohair Association; and Alabama Fruit and Vegetable Producers Association) were surveyed by telephone to assess nonresponse bias.

Data Analysis

Data were analyzed using SPSS/PC+ statistical package (SPSS, Inc. 1990). ONEWAY ANOVA, MANOVA, Kruskal-Wallis, crosstabs and frequencies were used to analyze survey results and test scores. Attitudinal, threat (which was a subsection of the attitudinal portion of the questionnaire), and knowledge scores were calculated. These scores were correlated with relevant survey questions to determine the extent to which landowner perceptions about coyote damage are influenced by landowner knowledge of coyotes, as measured by the knowledge-question portion of survey.

Test Score Calculations and Scales

Attitudinal scores, gathered from the 10 statements to solicit respondents attitudes towards coyotes, calculated for each group of producers were based on a scale of 1 to 5 where 1 = maximum protection of coyotes and 5 = maximum control of coyotes. Mean attitudinal scores were calculated for each respondent by separately summing the points to the attitudinal statements and dividing by 10. Mean scores for the sample group were tabulated by summing the attitudinal scores of each respondent and dividing by the number of respondents.

Mean threat scores, gathered from the second subsection of the attitudinal portion of the questionnaire, were based on a scale of 1 to 4 with 1 meaning coyotes were a very serious threat, 2 a serious threat, 3 a minor threat, and 4 no threat. Individual threat scores were calculated by summing up points from each listed item and dividing by 9. Mean threat scores for the group were determined by summing the means of respondents and dividing by the number of respondents. Overall mean threat scores for each listed item were drawn from the frequency results.

Data obtained from knowledge questions were transformed to reflect either a correct or incorrect response. A score of 1 was given for a correct answer, and 0 represented an incorrect answer. Knowledge scores were calculated for each respondent by separately summing the points to the knowledge questions and dividing by 11. Mean scores for the sample group were tabulated by summing the

knowledge scores of each respondent and dividing by the number of respondents.

Response Rate

Of the 84 fruit and vegetable producers used for the survey, 2 had either moved and did not leave a forwarding address or had retired from active agribusiness. Seventy-seven percent (n = 61) of the remaining 79 producers surveyed returned useable questionnaires. Thirty nonrespondents from the complete study were contacted to test for nonresponse bias and results showed no significant difference.

RESULTS

Mean attitudinal score was 3.61 and was higher (i.e. favored coyote control) for respondents with damage than for those without damage ($F = 12.30$, $df = 1$, $P = 0.001$) (Table 1). Threat score and knowledge score did not have a significant affect on attitudinal score ($x^2 = 904.50$, $P = 0.37$; $x^2 = 261.12$, $P = 0.54$, respectively).

Table 1. Mean survey scores for Alabama fruit and vegetable producers with coyote damage (CDMG, n = 23) and without coyote damage (NCDMG, n = 38).

	Fruit and Vegetable Producers[a]	
Scores	CDMG	NCDMG
Attitude	4.09	3.30
Threat	2.28	3.00
Knowledge	0.43	0.31

[a] Means within rows differ; $P \leq 0.05$.

Most respondents (50%) felt coyotes in Alabama are not beneficial to the environment and have a substantial impact on wildlife. Forty percent of the respondents thought coyotes should be eradicated from Alabama. Over 60% of all respondents disagreed that nonlethal methods should be used to remove coyotes. Respondents (50%) heavily favored unlimited shooting and trapping of all coyotes in Alabama. Less than 30% of the producers responding considered selectively removing individual coyotes known to have killed or damaged livestock or crops to be an adequate control approach.

Mean threat score was 2.72. A majority (53%) of the respondents stated that coyotes were a very serious threat or a serious threat to sheep, goats, domestic fowl (e.g., chickens), wild turkeys (Meleagris gallopavo), quail (Colinus virginianus), and fruits (e.g., watermelons). Cattle, white-tailed deer, and vegetables (e.g., corn) were perceived as being slightly threatened or not threatened by coyotes.

The most liked animals for the AFVP were dogs, cows, white-tailed deer, and sheep. Least liked animals were coyotes, skunks (Mephitis mephitis or Spilogale putorius), foxes (Vuples vulpes or Urocyon cinereoargenteus), and raccoons (Procyon lotor), with the coyote being the least liked overall.

Coyote damage was reported by 23 (38%) respondents. Average annual estimated losses for these 23 respondents were $830 (range = $100 - $2,500; mode = $200). Watermelon, calves, corn, and cantaloupe received the most damage (Table 2). Two respondents suspected coyotes or dogs of damaging irrigation hoses, but could not accurately determine the damaging species. Although many respondents (40%) reported damage from other species, coyotes were still perceived as the most damaging. Other animals causing damage were white-tailed deer, feral and free-ranging dogs, raccoons, armadillos (Dasypus novemcinctus), blackbirds (Icteridae) and squirrels (Sciurus carolinensis).

Several respondents (n = 17) reported having used one or more control measures to stop or reduce coyote damage during the last 12 months (Table 3). Most respondents (60%) reported control measures were ineffective. Of all respondents with coyote damage, less than 5% had sought out any educational material about coyotes or coyote control measures or had attended any coyote workshops.

Mean knowledge score was low, with the AFVP scoring 0.36. Of the eleven knowledge questions asked, all but two were answered incorrectly or with "Don't Know" over half the time (Table 4). Weight of coyotes in Alabama and food habits of coyotes in Alabama were the two questions answered correctly over half the time. Many respondents answered "Don't Know" to most

Table 2. Estimates of economic loss of crops and livestock to coyotes in Alabama, 1992 by fruit and vegetable producers reporting damage.

Commodity Damaged	n[a]	$\bar{x}$ ($)	Total ($)
Watermelon	7	1,271	8,900
Calves	4	950	3,800
Corn	2	550	1,100
Cantaloupe	1	1,000	1,000
Sheep	1	375	375
Goats	1	200	200
Miscellaneous Fruits and Vegetables	1	1,200	1,200

[a] Number of respondents reporting financial losses.

questions.

DISCUSSION

Attitudes for the AFVP showed partiality toward maximum control of coyotes. This partiality was more evident when the sample population was subdivided into respondents with coyote damage and those without. Respondents with coyote damage had scores closer to maximum control of coyotes than those with no damage (Table 1). Similar results have been reported (Buys 1975, Kellert 1980, 1985, Hafer and Hygnstrom 1991). However, differences exist between the populations surveyed. In the other studies, respondents were accustomed to coyote interactions because they lived in areas inhabited by coyotes for hundreds of years. Coyotes have only been a problem in Alabama for the last 15 to 20 years. However, Alabama agricultural producers already have attitudes towards the coyote similar to producers in the midwest and western parts of the United States. Further indication of a dislike for coyotes was evident in the rank order of animals, where the coyote was the least-liked animal.

Table 3. Coyote control methods used by Alabama fruit and vegetable producers with coyote damage (CDMG, $\underline{n}$ = 23) and without coyote damage (NCDMG, $\underline{n}$ = 38).

Control Method	Fruit and Vegetable Producers CDMG n[a] (%)	NCDMG n (%)
None	13 (57)	31 (82)
Trap	3 (13)	2 (5)
Shoot	5 (22)	2 (5)
Fence	3 (13)	1 (3)
Guard Dog	2 (9)	3 (8)
Scare Devices	4 (17)	1 (3)

[a] Number of respondents reporting use of control method.

Partiality toward maximum control of coyotes received stronger confirmation when respondents were asked which types of control they preferred. Most respondents (50%) stated that as many coyotes as possible should be shot or trapped. Although these methods do not guarantee discontinuation of damage, it is possible that producers receive some satisfaction from killing the animals doing damage. Nonlethal control methods (e.g., live-trapping and relocating coyotes) and hunting or poisoning only depredating coyotes were not preferred by respondents. Kellert (1980, 1985) reported similar results for the lethal control measures used by sheep and cattle producers, but both Kellert (1980, 1985) and Arthur (1981) reported the general public disapproved of such methods.

Fear of coyote damage was evident from the threat scores and respondents with perceived coyote damage rated the coyote as a greater threat than those without perceived damage. Although respondents with perceived coyote damage feel the coyote is a threat they did not seem to put much effort into damage control methods. Respondents were also concerned about the coyotes effect on local wildlife populations (e.g., white-tailed deer, wild turkeys,

Table 4. Alabama fruit and vegetable producers' mean knowledge scores for individual questions concerning their knowledge of coyotes, 1992.

Question Category	Fruit and Vegetable Producers
Multiple Choice	
Coat color	0.33
Weight (Size)	0.64
Food habits	0.54
Track	0.33
Tail position	0.48
How long in AL.	0.03
Introduced into AL.	0.38
True-False	
Deer nos. low where coyote nos.high	0.39
Hybridization with dogs	0.25
Increased no. coyotes have decreased no. deer	0.48
Winter food habits	0.08

quail, and rabbits (Sylvilagus floridanus). Studies conducted in Alabama and in other southeastern states (Wooding et al. 1984, Lee and Kennedy 1986, Blanton and Hill 1989, Hoerath and Causey 1991) have shown that coyotes do not significantly impact population sizes of these animals although they are a part of the coyote's food habits.

The economic loss estimates may not be accurate estimates of damage for several reasons. First, these data represent estimates from producers not wildlife damage professionals. Second, producers may have attributed damage by feral or free-ranging dogs to the coyote. Third, coyotes may have been scavenging on livestock that died from natural causes. However, these results do represent producer's perceptions of coyote damage and thus warrant consideration.

Results from our study show that coyotes are perceived to be damaging and/or killing calves, sheep, goats, watermelons, corn, and other types of fruits and vegetables. These results appear to be consistent with those of other studies from the southeast (Jones 1987, Armstrong 1991). Control or removal of depredating coyotes is difficult in many of these situations. First, high numbers of coyotes exist in Alabama due to excellent habitat. Second, human and pet densities in Alabama make many western control measures unsuitable. Third, coyote populations have the reproductive capacity to recover rapidly following a reduction of numbers (U. S. Fish and Wildlife Service 1978).

Current Alabama regulations regarding coyote control allow most non-lethal methods (e.g., fencing, scare devices, etc.), trapping with a #2 leg-hold trap, and shooting during the day. Poisoning of coyotes and spotlighting is illegal in Alabama. None of the fruit and vegetable respondents were utilizing poisons as a control method but we did receive several comments regarding the non-selectivity of poisoning. We also received several calls from agricultural producers inquiring about what types of poisons were available for controlling coyotes. Control methods most used were shooting, trapping, and fencing.

Agricultural producers in Alabama lacked basic knowledge about coyotes, which is understandable since the coyote has not been a nuisance species in the state for very long. Most respondents believe the coyote to be a recent inhabitant of the state. The Alabama Agricultural Cooperative Extension Service (ACES) has produced a bulletin entitled "Coyote Control In Alabama," and also offers coyote workshops throughout the state. The problem lies not in a lack of educational materials but more with a lack of distributing these materials and letting producers know they are available. As previously mentioned, knowledge or a lack thereof about coyotes did not affect the respondent's attitude towards coyotes, but it may affect control efforts.

A high proportion of returned questionnaires included comments by respondents; most were positive and thanked us for allowing them to participate in the research. There were a few comments stating that the respondent wished we would eradicate the coyote from Alabama because it was a useless menace, but these were atypical. Two respondents stated that white-tailed deer were causing more damage on their crops than coyotes, and one respondent was worried about coyotes being a vector for rabies. Approximately 30% of the respondents asked to receive results from our study and others

asked for coyote educational material.

MANAGEMENT IMPLICATIONS

As a result of information collected through this survey, it appears that an increase in education about coyotes is needed in the state. Educational materials are available and it is just a matter of distributing them to the people. Another area that needs to be emphasized is legal control methods of coyotes. As mentioned previously, we have received several calls from agricultural producers who want to know what type of poison is effective on coyotes. An emphasis on legal control methods should be stressed by all wildlife professionals within the state of Alabama. Research is needed to evaluate the educational materials produced by the ACES and to acquire an actual economic assessment of losses due to coyotes.

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