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Coyotes: Friends or Foe of Northern Bobwhite in Southern Texas

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COYOTES: FRIEND OR FOE OF NORTHERN BOBWHITE IN SOUTHERN TEXAS

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ABSTRACT

Food habits of 407 coyotes (*Canis latrans*), intermittently collected in southern Texas from March 1994 to January 1997, were determined from coyote stomachs. Mammalian prey was the most prevalent diet item as calculated by frequency of occurrence and aggregate percent methods, followed by insects, vegetation, birds, and reptiles. The remains of northern bobwhite (*Colinus virginianus*) or their eggs were found in only 12 coyote stomachs, which constituted <1% of the coyote diet as calculated by the aggregate percent method. Northern bobwhite appear to be an incidental prey item for coyotes in southern Texas. Therefore, coyote removal programs designed to lessen quail depredation appear unwarranted.

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Key words: *Canis latrans, Colinus virginianus*, coyote, depredation, food habits, northern bobwhite, Texas

INTRODUCTION

Northern bobwhite populations have been declining throughout most of their range and there is concern that bobwhites could be extirpated in the southeastern United States by 2005 (Brennan 1991). Depredation has been reported as the major source of mortality for bobwhites at every life stage (Rollins and Carroll 2001). Coyotes are typically listed among the common predators of bobwhite and their eggs (Beasom 1974, Lehmann 1984:190, Guthery 1995, Hernández et al. 1997, Rollins and Carroll 2001, Wallace 2001).

Coyotes are opportunistic and generalist predators (MacCracken and Hansen 1987) and their diet often differs widely from one area to another (Bekoff 1977). In an extensive literature review of diet across 17 western states, coyote diets averaged 33% lagomorph, 25% carrion, 18% rodent, and 13.5% domestic livestock (Sperry 1941). However, Lehmann (1946) reported that 37% (n = 14) of the coyote diet during spring and summer in southern Texas consisted of bobwhites and their eggs. Lehmann (1946) concluded that coyotes were the primary predator of bobwhite nests in southern Texas; however, his sample sizes were too small to generate little confidence in that conclusion.

My objective was to report coyote food habits from a large sample (n = 407) of coyotes collected in southern Texas. The coyotes used for this report were collected for other research projects.

STUDY AREAS

Coyotes were collected on 7 ranches in southern Texas, which included the Santa Gertrudis Division of the King Ranch (Kleberg Co.), the Callaghan Ranch (Webb Co.), La Mesa Ranch (Webb Co.), Heard Ranch (Webb Co.), Duval Ranch (Duval Co.), Cameron Ranch (La Salle Co.), and La Campana Ranch (McMullen Co.). All collection areas consisted of privately owned rangeland used primarily for cattle and oil production.

Mean annual rainfall for southern Texas is 40–90 cm, increasing from west to east. Temperatures range from 8° C in January to 38° C in July. During the collection period the area experienced average rainfall and temperatures, with 1995 being slightly wetter than average and 1996 being dryer than average (*http://climate.tamu.edu/bclimate_DQ/station_sel/station_nameA.html*).

Originally the region supported a grassland-savannah climax community (Fulbright 2001), but grazing, suppression of fire, and other factors have resulted in plant communities dominated by dense stands of honey mesquite (*Prosopis glandulosa*), blackbrush (*Acacia rigidula*), Texas prickly pear (*Opuntia lindheimeri*), whitebrush (*Aloysia lycioides*), and spiny hackberry (*Celtis pallida*). Potential prey items for coyotes on the study areas included white-tailed deer (*Odocoileus virginianus*), javelina (*Tayassu tajacu*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis virginiana*), armadillo (*Dasypus novemcinctus*), eastern cottontail (*Sylvilagus floridanus*), black-tailed jackrabbit (*Lepus californicus*), eastern woodrat (*Neotoma floridanus*), hispid cotton rat (*Sigmodon hispidus*), hispid pocket mouse (*Chaetodipus hispidus*), Ord's kangaroo rat (*Dipodomys ordii*), fulvous harvest mouse (*Reithrodontomys fulvescens*), deer mouse (*Peromyscus maniculatus*), white-footed mouse (*Peromyscus leucopus*), domestic cattle (*Bos* sp.), northern bobwhite, greater roadrunner (*Geococcyx californianus*), prickly pear fruit, mesquite beans, and a variety of songbirds, reptiles, and insects.

Table 1. Percent of coyote stomachs (i.e., frequency of occurrence) that contained the diet item, analyzed from coyotes collected in southern Texas during 1994–1997.

	Collection date				
Diet item[1]	Mar 1994 (n = 200)	Jul 1995 (n = 98)	Oct 1997 (n = 42)	Jan 1997 (n = 67)	Total (n = 407)
Rodent	41.5[2]	9.2	9.5	41.8	30.5
Lagomorph	32.0	14.3	11.9	34.3	26.0
Insect	0.0	59.2	45.2	0.0	18.9
Vegetation	8.0	37.8	28.6	0.0	16.0
Misc. bird	3.0	7.1	11.9	9.0	5.9
(Bobwhites)	(3.0)	(3.1)	(2.4)	(3.0)	(2.9)
Livestock	1.5	6.1	4.8	10.4	4.4
Misc. reptile	0.0	7.1	19.0	0.0	3.7
Misc. mammal	0.5	6.1	4.8	3.0	2.7
White-tailed deer	0.0	8.2	0.0	0.0	2.0
Empty	15.5	10.2	14.3	13.4	13.8
Mean no. of diet items/stomach	1.0	1.6	1.5	1.1	1.2

[1] Common diet items found in coyote stomachs consisted of Ord's kangaroo rats, cotton rats, woodrats, hispid pocket mice, black-tailed jackrabbits, eastern cottontails, grasshoppers and beetles within the Families Locustidae and Carabidae, respectively, mesquite beans, prickly pear fruit, Texas persimmons, agarito barberries, acorns, livestock, northern bobwhites, roadrunners, sandhill cranes, ravens, skunks, armadillos, 6-lined racers, and bullsnakes.

[2] Proportion of stomachs that contained the diet item as calculated from the number of stomachs that contained the diet item/number of stomachs examined.

METHODS

Coyotes were collected by aerial and ground hunting during March 1994, July 1995, January 1997, and October 1997. Coyotes were field necropsied, their stomachs excised and kept on wet ice until they could be frozen at −23° C.

In the laboratory, each stomach was thawed and the contents were emptied into a shallow pan for examination. Stomach samples were analyzed by both the frequency of occurrence method (Andelt 1985) and the percent occurrence method (Chamrad and Box 1964). In short, frequency of occurrence was calculated as the proportion of stomachs that contained a particular food item. The overall frequency of occurrence can sum to >100% because coyote stomachs often contain multiple prey items. Percent occurrence was determined using a 100-point frame (Chamrad and Box 1964, Johnson and Hansen 1977). Food items from each sample (one sample = contents of one stomach) were spread onto the frame and 100 random points were selected. Each food item that lay on or closest to each of the 100 random points was identified. Reference samples of available foods from the study areas were used to identify individual food items. Hair was identified to species following Stains (1958) and seeds were identified according to Martin and Barkley (1961).

Due to differential digestibility of food items, coyote food habits are reported by the percent occurrence and frequency of occurrence methods. This is because the importance of common but highly digestible foods (e.g., grasshoppers) often are underestimated in the diet by percent occurrence method alone. Frequency of occurrence data are expressed as the proportion of coyote stomachs that contained a particular food item. Data for percent occurrence is expressed as an aggregate percent due to stomachs of varying weights (Litvaitis et al. 1994). An analysis of seasonal effects on coyote food habits was not performed because of potential confounding effects; seasonal coyote collection did not occur during the same year (i.e., year effects) and specimens were not consistently collected from each ranch each season (i.e., area effects).

RESULTS

Four hundred and seven coyote stomachs were analyzed, of which 56 were empty (Table 1). The number of stomachs analyzed from each collection period was 200, 98, 67, and 42 for March 1994, July 1995, January 1997, and October 1997, respectively.

Mammalian prey, insects, and vegetation comprised nearly 96% of the diet of coyotes from southern Texas. Expressing the diet by the aggregate percent method, lagomorphs (26.6%) and rodents (26.2%) comprised the majority of the diet of coyotes, followed by insects (16.3%), vegetation (11.6%), white-tailed deer fawns (6.7%), livestock (6.3%), miscellaneous birds (3.4%), miscellaneous mammals (1.8%), and miscellaneous reptiles (1.1%). Of the miscellaneous birds, northern bobwhites and their eggs comprised only 0.9% of the coyote diet by the aggregate percent method. Only 12 of the 407 coyote stomachs contained northern bobwhite or their eggs (Table 1).

Black-tailed jackrabbits and eastern cottontail rabbits comprised the lagomorph category, while Ord's kangaroo rats, cotton rats, woodrats, and hispid pocket mice were the most common rodent species identified. Grasshoppers and beetles in the Families Locustidae and Carabidae, respectively, were the common insects found in the stomachs. Mesquite beans, prickly pear fruit, Texas persimmon (*Diospyros texana*), agarito barberry (*Berberis trifoliolata*), and acorns (*Quercus* sp.) comprised the majority of plant material eaten by coyotes. Livestock (i.e., cattle) remains as carrion in coyote stomachs could not be distinguished from live-killed animals. Bird species found in coyote stomachs were northern bobwhites, roadrunners, sandhill cranes

(*Grus canadensis*), and ravens (*Corvus cryptoleucus*). The miscellaneous mammal group consisted of skunk and armadillo, while the miscellaneous reptiles were 6-lined racers (*Cnemidophorus sexlineatus*) and a bullsnake (*Pituophis melanoleucus*).

DISCUSSION

Northern bobwhites were not a major prey item of coyotes in southern Texas. These findings are consistent with numerous other reports of coyote food habits throughout the United States. Evidence of bobwhite depredation was found in 1.4% of 770 coyote stomachs in Missouri (Korschgen 1957), 2.0% of 168 stomachs in Arkansas (Gipson 1974), 0.2% by volume in 514 scats from Texas (Meinzer et al. 1975), and 0.6% of 311 stomachs and scats from Mississippi and Alabama (Wooding et al. 1984). In other studies where diet items were placed in broader categories than in this paper, birds constituted only 1% of the coyote diet in 6,354 scats from southern Texas (Andelt et al. 1987), 2.4% of the diet in 1,042 scats from California (Barrett 1983), 2.5% of the diet in 831 scats from Idaho (Johnson and Hansen 1979), and 2.0% of prey found in 208 scats from South Dakota (MacCracken and Uresk 1984).

The obvious question is why the seemingly disparate results between Lehmann's (1946) research and more recent studies? I believe the answer was given by Guthery (1995) who stated that Lehmann's (1946) results were biased because of inappropriate statistical procedures. In addition, Lehmann (1946) reported results from a small sample size and relied on circumstantial evidence to determine the species of nest predator. Hernández et al. (1997) demonstrated that the *modus operandi* of nest predators is too similar between several species to confidently distinguish one predator from another based only on nest debris and egg shell fragments.

Often, predator control is suggested as a means to increase production and survival of northern bobwhites (Lehmann 1984:190–196, Reynolds and Tapper 1996, Rollins 1999). However, the results of this study provide evidence that such practices against coyotes will not increase bobwhite populations. Although coyotes may occasionally eat bobwhites or their eggs, there is no evidence that such levels of predation negatively influence the population dynamics of northern bobwhites.

In fact, it is possible that coyotes may inadvertently aid northern bobwhites by reducing the numbers of more serious quail predators. Removal of coyotes can cause a phenomenon known as mesopredator release (Henke and Bryant 1999); an increase in the abundance of smaller-sized (i.e., meso) predators such as raccoons, skunks, badgers (*Taxidea taxus*), gray foxes (*Urocyon cinereoargenteus*), and bobcats (*Lynx rufus*) with the removal of a dominant predator. Henke and Bryant (1999) demonstrated an increase in mesopredator abundance after just 1 year of a seasonal coyote removal program. In at least 1 instance mesopredators were considered more efficient nest predators of northern bobwhites than coyotes (Hernández et al. 1997). Sovada et al. (1995) reported that coyote removal led to a greater abundance of red foxes (*Vulpes vulpes*), which resulted in a greater loss of waterfowl production in the Prairie Pothole region. The possibility of a greater loss of bobwhite production to mesopredators could exist in southern Texas with the implementation of coyote removal. Therefore the benefit of coyotes to bobwhites may actually outweigh the occasional loss of birds to coyotes by depredation.

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LITERATURE CITED

Andelt, W. F. 1985. Behavioral ecology of coyotes in south Texas. Wildlife Monographs 94.

Andelt, W. F., J. G. Kie, F. F. Knowlton, and K. Cardwell. 1987. Variation in coyote diets associated with season and successional changes in vegetation. Journal of Wildlife Management 51:273–277.

Barrett, R. H. 1983. Food habits of coyotes, *Canis latrans*, in eastern Tehama County, California. California Fish and Game 69:184–196.

Beasom, S. L. 1974. Intensive short-term predator removal as a game management tool. Transactions of the North American Wildlife and Natural Resources Conference 39:230–240.

Bekoff, M. 1977. The coyote, *Canis latrans*. Mammalian Species 79:1–9.

Brennan, L. A. 1991. How can we reverse the northern bobwhite population decline? Wildlife Society Bulletin 19:544–555.

Chamrad, A. D., and T. W. Box. 1964. A point frame for sampling rumen contents. Journal of Wildlife Management 28: 473–477.

Fulbright, T. E. 2001. Human-induced vegetation changes in the Tamaulipan scrub of La Frontera. Pages 166–175 *in* G. L. Webster and C. J. Bahre, eds. Changing plant life of La Frontera. University of New Mexico Press, Albuquerque.

Gipson, P. S. 1974. Food habits of coyotes in Arkansas. Journal of Wildlife Management 38:848–853.

Guthery, F. S. 1995. Coyotes and upland gamebirds. Pages 104–107 *in* D. Rollins, C. Richardson, T. Blankenship, K. Canon, and S. E. Henke, eds. Coyotes in the southwest: a compendium of our knowledge. Texas Parks and Wildlife Department, Austin.

Henke, S. E., and F. C. Bryant. 1999. Effect of coyote removal on the faunal community in western Texas. Journal of Wildlife Management 63:1066–1081.

Hernández, F., D. Rollins, and R. Cantu. 1997. Evaluating evidence to identify ground-nest predators in west Texas. Wildlife Society Bulletin 25:826–831.

Johnson, M. K., and R. M. Hansen. 1977. Comparison of point frame and hand separation of coyote scats. Journal of Wildlife Management 41:319–320.

Johnson, M. K., and R. M. Hansen. 1979. Coyote food habits

on the Idaho National Engineering Laboratory. Journal of Wildlife Management 43:951–956.

Korschgen, L. J. 1957. Food habits of the coyote in Missouri. Journal of Wildlife Management 21:424–435.

Lehmann, V. W. 1946. Bobwhite quail reproduction in southwestern Texas. Journal of Wildlife Management 10:111–123.

Lehmann, V. W. 1984. Bobwhites in the Rio Grande Plain of Texas. Texas A&M University Press, College Station.

Litvaitis, J. A., K. Titus, and E. M. Anderson. 1994. Measuring vertebrate use of terrestrial habitats and foods. Pages 254–274 *in* T. A. Bookhout, ed. Research and management techniques for wildlife and habitats. The Wildlife Society, Bethesda, Maryland.

MacCracken, J. G., and D. W. Uresk. 1984. Coyote foods in the Black Hills, South Dakota. Journal of Wildlife Management 48:1420–1423.

MacCracken, J. G., and R. M. Hansen. 1987. Coyote feeding strategies in southeastern Idaho: optimal foraging by an opportunistic predator? Journal of Wildlife Management 51: 278–285.

Martin, A. C., and W. D. Barkley. 1961. Seed identification manual. University of California Press, Berkley and Los Angeles.

Meinzer, W. P., D. N. Ueckert, and J. T. Flinders. 1975. Food-niche of coyotes in the Rolling Plains of Texas. Journal of Range Management 28:22–27.

Reynolds, J. C., and S. C. Tapper. 1996. Control of mammalian predators in game management and conservation. Mammalian Review 26:127–156.

Rollins, D. 1999. Is there a place for predator control in quail management? Pages 45–48 *in* K. A. Cearley, editor. Preserving Texas' quail heritage into the 21st century. Texas Agriculture Extension Service, Abilene, Texas.

Rollins, D., and J. P. Carroll. 2001. Impacts of predation on quail. Pages 84–101 *in* T. F. Ginnett and S. E. Henke, eds. The role of predator control as a tool in game management. Texas Agricultural Extension Service, San Angelo, Texas.

Sovada, M. A., A. B. Sargeant, and J. W. Grier. 1995. Differential effects of coyotes and red foxes on duck nest success. Journal of Wildlife Management 59:1–9.

Sperry, C. C. 1941. Food habits of the coyote. United States Department of Interior, Fish & Wildlife Service Research Bulletin 4, Washington, D. C.

Stains, H. J. 1958. Field key to guard hair of middle western furbearers. Journal of Wildlife Management 22:95–97.

Wallace M. C. 2001. Turkey, quail, and predators in the Rolling Plains, Texas. Pages 139–143 *in* T. F. Ginnett and S. E. Henke, eds. The role of predator control as a tool in game management. Texas Agricultural Extension Service, San Angelo, Texas.

Wooding, J. B., E. P. Hill, and P. W. Sumner. 1984. Coyote food habits in Mississippi and Alabama. Proceedings of the Southeastern Association of Fish and Wildlife Agencies 38: 126–133.