

Seasonal Coyote Diet Composition at a Low-Productivity Site

Author(s): Morgan B. Swingen, Christopher S. DePerno and Christopher E. Moorman

Source: Southeastern Naturalist, 14(2):397-404.

Published By: Eagle Hill Institute

DOI: <http://dx.doi.org/10.1656/058.014.0219>

URL: <http://www.bioone.org/doi/full/10.1656/058.014.0219>

BioOne (www.bioone.org) is a nonprofit, online aggregation of core research in the biological, ecological, and environmental sciences. BioOne provides a sustainable online platform for over 170 journals and books published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Web site, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/page/terms_of_use.

Usage of BioOne content is strictly limited to personal, educational, and non-commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

Seasonal Coyote Diet Composition at a Low-Productivity Site

Morgan B. Swingen^{1,*}, Christopher S. DePerno¹, and Christopher E. Moorman¹

Abstract - *Canis latrans* (Coyote) recently expanded its range into the southeastern US, where local data on Coyote diets are lacking. We studied Coyote diets in a low-productivity area where food resources may be scarce. We determined Coyote diet composition through analysis of 315 scats collected at Fort Bragg Military Installation, Fort Bragg, NC, between May 2011 and July 2012. *Odocoileus virginianus* (White-tailed Deer) was the most common mammalian food item, occurring in 14.9% of all scats and 42.5% of winter scats. Soft-mast occurrence in Coyote diets was greatest in the fall, when *Diospyros virginiana* (Persimmon) occurred in most Coyote scats (95.7%). Coyotes on our low-productivity study site shifted their diets throughout the year based on the availability of food items and had a diet diversity similar to what has been reported for animals elsewhere in the species' range.

Introduction

The ability of *Canis latrans* (Say) (Coyote) to adapt foraging strategies to spatial and temporal variation in food resources likely facilitated its expansion into the eastern US (Parker 1995). Coyotes are omnivores; primary food items include mammals, insects, and fruit, but relative proportions of these items vary regionally (McVey et al. 2013, Stratman and Pelton 1997, Turner et al. 2011, Wooding et al. 1984). For example, lagomorphs were the most common food item in south Texas, whereas *Odocoileus virginianus* (White-tailed Deer) and rodents were the most commonly occurring food items in West Virginia (Crimmins et al. 2012, Windberg and Mitchell 2013). Also, Coyote diets vary seasonally as the availability of food items changes (e.g., Morey et al. 2007, O'Donoghue et al. 1998, Schrecengost et al. 2008). Generally, White-tailed Deer occurrence in Coyote diets is greatest during the fawning period (Blanton and Hill 1989, Schrecengost et al. 2008, Wooding et al. 1984), and soft-mast occurrence often follows local fruiting phenology (Andelt et al. 1987, Chamberlain and Leopold 1999, Schrecengost et al. 2008).

The effects of Coyote predation on prey species, such as White-tailed Deer, are unknown in low-productivity areas where diversity and abundance of food sources may be lower than at sites with greater productivity. In low-productivity sites, nutritional carrying capacities of White-tailed Deer are low, often resulting in low deer densities (Shea and Osborne 1995). Hence, high proportions of White-tailed Deer in Coyote diets in low-productivity regions could suggest greater impact on White-tailed Deer populations because of the lower reproductive potential.

Our objectives were to determine the seasonal composition of Coyote diets and investigate the potential impact of Coyotes on prey species at a low-productivity

¹Fisheries, Wildlife, and Conservation Biology Program, Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC 27695. *Corresponding author - mbelfelt@ncsu.edu.

site. We expected seasonal changes in Coyote diets to follow regional phenology, and diets to contain a greater number of food items than on higher-productivity sites because of lower overall abundance of individual food items.

Field-site description

We conducted our study at Fort Bragg Military Installation (FBMI) in the Sandhills region of central North Carolina. The Sandhills area is considered to be a low-productivity community because of its well-drained sandy soils that limit water availability for plants (Mitchell et al. 1999, Sorrie et al. 2006). FBMI covers ~65,000 ha and contains one of the largest contiguous remnants of *Pinus palustris* (Mill.) (Longleaf Pine)–*Aristida stricta* (Michx.) (Wiregrass) ecosystem in the Southeast. The most abundant plant-community type at FBMI is the pine–scrub *Quercus* (oak) sandhill (as described by Sorrie et al. 2006), which consists mainly of a Longleaf Pine canopy, oak subcanopy, and Wiregrass ground layer, with an open-canopy structure maintained by fire. The understory in Sandhills Longleaf Pine forests has especially low productivity compared to other grasslands due to competition with trees in this water-limited forest system (Mitchell et al. 1999). Other common plant communities at FBMI include riparian areas dominated by shrubs and trees, and disturbed areas with ruderal plants, mainly in open drop-zones for parachuting and other military training activities (Sorrie et al. 2006).

Land management at FBMI is driven by efforts to restore and maintain habitat for the federally endangered *Picoides borealis* (Vieillot) (Red-cockaded Woodpecker). Prescribed burns are conducted on a 3-y return interval to maintain the open Longleaf Pine forest required by this species. Prior to 1989, burning was conducted exclusively during the dormant season, but growing-season burns now make up the majority of planned burns in forested cover types on FBMI (Lashley et al. 2014).

Methods

We opportunistically collected Coyote scat samples estimated to be <1 week old along roads and firebreaks from May 2011 through June 2012. We identified scats based on size, shape, odor, and associated tracks. *Canis lupus familiaris* L. (Domestic Dog), *Vulpes vulpes* L. (Red Fox), and *Urocyon cinereoargenteus* (Schreber) (Gray Fox) were uncommon in collection areas, as evidenced by a concurrent camera-trap study at FBMI (B. Will, North Carolina State University, Raleigh, NC, unpubl. data). We placed Coyote scats in plastic bags and stored them at -30 °C until analysis. We categorized the scats into 4 seasons based on food-availability cycles: summer (May–July), fall (August–October), winter (November–January), and spring (February–April). We hand-washed the scats in nylon mesh, dried them for ≥48 hours at 50 °C, and manually separated and identified the components. To avoid over-representation of food items, components making up <5% of the total volume of a scat were not included in the analysis. We compared bone, tooth, and nail fragments to specimens housed in the Naturalist

Center at the North Carolina Museum of Natural Sciences, Raleigh, NC. We identified hairs using macroscopic color patterns and by microscopically comparing patterns in the medulla to known hair samples (McVey et al. 2013, Moore et al. 1974). We classified White-tailed Deer remains as fawn rather than adult only if small hooves were present in the scat. We identified insects to Order when possible and categorized feathers as avian. We identified soft-mast food items by comparing seeds to known samples. We excluded from the analysis any non-mast vegetative components or inorganic items (e.g., sticks, pine needles, sand, and rocks) which were assumed to have been either ingested incidentally by the Coyote or collected incidentally with the scat sample.

We calculated percent of scats as the percent of all samples which contained a particular item and percent of occurrence as the percent of occurrences out of the total number of food items (Schrecengost et al. 2008, Turner et al. 2011). We recorded the number of unique food items contained in each scat, which we defined as diet richness (Grigione et al. 2011). We used a Poisson regression with season as a categorical predictor and performed a likelihood-ratio test to determine if season was a significant predictor of diet richness.

Results and Discussion

We analyzed 315 scats containing 590 food items. Seventy-seven scats were from summer, 164 from fall, 40 from winter, and 34 from spring. The majority of scats contained 2 food items (44.1%) or 1 food item (36.2%), and 19.7% of scats contained ≥ 3 food items. Summer had the greatest mean number of food items per scat, and spring the lowest (Table 1), although season was not a significant predictor of diet richness ($\chi^2 = 5.88$, $df = 3$, $P = 0.12$). Coyote diet richness at FBMI was similar to values reported in other studies conducted in the southeastern US, indicating site productivity has relatively little influence on Coyote diet richness. In a Florida suburb, Grigione et al. (2011) reported diet richness (1.69) similar to our results (1.88), although Coyote diet richness in wildland areas (a protected area with 86% natural habitat) was greater (3.18). Schrecengost et al. (2008) reported that in over half of Coyote scats collected in South Carolina, 90% or more of the volume was composed of a single food item, indicating low richness. Similarly, McVey et al. (2013) noted that a single food item composed $>95\%$ of dry volume in 55% of Coyote scats collected in eastern North Carolina. However, comparisons among indices of richness are difficult because many studies, including our own,

Table 1. Seasonal richness (mean # of food items per scat) of Coyote diet at Fort Bragg Military Installation, NC, May 2011–June 2012.

Season	Diet richness (mean \pm SE)
Summer (May–July)	2.14 \pm 0.09
Fall (August–October)	1.76 \pm 0.06
Winter (November–January)	2.08 \pm 0.15
Spring (February–April)	1.65 \pm 0.13
Overall	1.88 \pm 0.05

identify some food items to broader taxonomic groups rather than to species level (e.g., Grigione et al. 2011, Hidalgo-Milhart et al. 2001, Patterson et al. 1998).

In our study, soft mast was the most common food item detected, followed by mammals and insects (Tables 2, 3). Trash, avian, and other categories composed the smallest percent of scats and percent of occurrence. Of scats containing soft mast, 77.7% contained *Diospyros virginiana* (Common Persimmon, hereafter

Table 2. Seasonal composition of Coyote scats showing the percentage of individual scats (*n*) that contained each food item at Fort Bragg Military Installation, NC, May 2011–June 2012. Aves = both bird remains (feathers, etc.) and bird-eggshell fragments; insects identified were mainly *Coleoptera* and *Othoptera*. Other small rodents = *Reithrodontomys humulis* (Audubon & Bachman) (Eastern Harvest Mouse), *Peromyscus* spp. (deer mouse), *Microtus* spp. (vole), and unidentified small rodents. Other mammals = *Castor canadensis* Kuhl (North American Beaver), Coyotes, *Lontra canadensis* (Schreber) (North American River Otter), and unidentified mammals. Other fruit = *Toxicodendron* spp. (poison-oak) and *Prunus* spp. (wild plum). Trash = any anthropogenic material, e.g., plastic packaging, rope, and rubber. Other animals = a juvenile *Pseudemys concinna concinna* (LeConte) (Suwannee Cooter), reptile-eggshell fragments, and snail-shell fragments (Order Gastropoda). Summer = May–July, Fall = August–October, Winter = November–January, and Spring = February–April.

Food item	Season				Overall <i>n</i> = 315
	Summer <i>n</i> = 77	Fall <i>n</i> = 164	Winter <i>n</i> = 40	Spring <i>n</i> = 34	
Aves	6.5	3.0	7.5	11.8	5.4
Insects	72.7	32.3	12.5	35.3	40.0
Mammals					
<i>Didelphis virginiana</i> Kerr (Virginia Opossum)	2.6	0.6	0.0	0.0	1.0
<i>Odocoileus virginianus</i> Zimmermann	26.0	1.2	42.5	23.5	14.9
Adult	14.3	1.2	42.5	23.5	12.1
Fawn	11.7	0.0	0.0	0.0	2.9
<i>Sciurus carolinensis</i> Gmelin (Eastern Gray Squirrel)	1.3	0.0	0.0	2.9	0.6
<i>Sciurus niger</i> L. (Fox Squirrel)	2.6	1.2	0.0	0.0	1.3
Small rodents	7.8	9.1	27.5	32.4	13.7
<i>Scalopus aquaticus</i> L. (Mole)	1.3	0.6	0.0	0.0	0.6
<i>Sigmodon hispidus</i> Say & Ord (Hispid Cotton Rat)	1.3	3.0	17.5	29.4	7.3
Other small rodents	5.2	5.5	10.0	8.8	6.3
<i>Sylvilagus floridanus</i> (J.A. Allen) (Eastern Cottontail)	6.5	10.4	15.0	8.8	9.8
Other mammals	22.1	5.5	15.0	11.8	11.4
Total mammals	58.4	26.2	75.0	76.5	45.7
Soft mast					
<i>Diospyros americana</i> L. (American Persimmon)	1.3	95.7	75.0	0.0	59.7
<i>Gaylussacia</i> spp. (huckleberries)	7.8	1.2	0.0	0.0	2.5
<i>Prunus serotina</i> Ehrh. (Black Cherry)	3.9	0.0	0.0	0.0	1.0
<i>Rubus</i> spp. (blackberries)	27.3	0.0	0.0	0.0	6.7
<i>Vaccinium</i> spp. (blueberries)	2.6	1.2	0.0	0.0	1.3
<i>Vitis</i> spp. (grapes)	0.0	7.9	2.5	0.0	4.4
Other fruit	2.6	0.0	0.0	0.0	0.6
Total soft mast	39.0	98.2	75.0	0.0	70.2
Trash	18.2	5.5	12.5	20.6	11.1
Other animals	1.3	0.6	2.5	0.0	1.0

Persimmon), which occurred in 59.7% of scats overall. White-tailed Deer, *Sylvilagus floridanus* (Eastern Cottontail), and *Sigmodon hispidus* (Hispid Cotton Rat) were the most common mammalian food items, occurring in 14.9%, 9.8%, and 7.3% of scats, respectively (Table 2).

We detected seasonal variation in percent of scats and percent of occurrence for the 3 most common categories of food items: soft mast, mammals, and insects. This variation showed high plasticity and reliance on seasonally available foods by Coyotes. Soft-mast prevalence was greatest in fall, when Persimmon fruits

Table 3. Seasonal composition of Coyote scats showing the percentage of each food item out of the total number of food items (n), at Fort Bragg Military Installation, NC, May 2011–June 2012. Aves = both bird remains (feathers, etc.) and bird-eggshell fragments; insects identified were mainly *Coleoptera* and *Othoptera*. Other small rodents = Eastern Harvest Mice, deer mice, voles, and unidentified small rodents. Other mammals = North American Beavers, Coyotes, North American River Otters, and unidentified mammals. Other fruit = poison-oak species and wild plum species. Trash includes any anthropogenic material, e.g., plastic packaging, rope, and rubber. Other animals includes a juvenile Suwannee Cooter, reptile-eggshell fragments, and snail-shell fragments (Order Gastropoda). Summer = May–July, Fall = August–October, Winter = November–January, and Spring = February–April.

Food item	Season				Overall $n = 590$
	Summer $n = 164$	Fall $n = 288$	Winter $n = 83$	Spring $n = 55$	
Aves	3.1	1.7	3.6	7.3	2.9
Insects	34.2	18.4	6.0	21.8	21.4
Mammals					
Virginia Possum	1.2	0.4	0.0	0.0	0.5
White-tailed Deer	12.2	0.7	20.5	14.6	8.0
Adult	6.7	0.7	20.5	14.6	6.4
Fawn	5.5	0.0	0.0	0.0	1.5
Eastern Gray Squirrel	0.6	0.0	0.0	1.8	0.3
Fox Squirrel	1.2	0.7	0.0	0.0	0.7
Small rodents	3.6	5.2	13.2	23.6	7.6
Mole	0.6	0.4	0.0	0.0	0.3
Cotton Rat	0.6	1.7	8.4	18.2	3.9
Other small rodents	2.4	3.1	4.8	5.5	3.4
Eastern Cottontail	3.1	5.9	7.2	5.5	5.3
Other mammals	10.3	3.1	3.6	12.7	6.1
Total mammals	32.3	16.0	45.8	58.2	28.6
Soft mast					
American Persimmon	0.6	54.5	36.1	0.0	31.9
Huckleberries	3.7	0.7	0.0	0.0	1.4
Black Cherry	1.8	0.0	0.0	0.0	0.5
Blackberries	12.8	0.0	0.0	0.0	3.6
Blueberries	1.2	0.7	0.0	0.0	0.7
Grapes	0.0	4.5	1.2	0.0	2.4
Other fruit	1.2	0.0	0.0	0.0	0.3
Total soft mast	21.3	60.4	37.4	0.0	40.7
Trash	8.5	3.1	6.0	12.7	5.9
Other animals	0.6	0.4	1.2	0.0	0.5

typically were abundant, and lowest in spring, when we did not detect any soft mast in Coyote scats. Insects were most common in summer diets (May–July), which coincided with the emergence of many Orthopteran nymphs (Squitier and Capinera 2002). We identified insects in the Orders Orthoptera, Coleoptera, and Hemiptera, composing 55.17%, 43.10%, and 1.72% of insects identified, respectively. Occurrence of mammals in diets was greatest in spring and lowest in fall.

We detected White-tailed Deer in 14.9% of scats, most commonly in winter rather than during the fawning period as many other studies have reported (Hidalgo-Milhart et al. 2001, Schrecengost et al. 2008, Wooding et al. 1984). During summer, we identified White-tailed Deer fawn remains in 9 scats (11.7% of scats and 5.5% of occurrence). However, Chitwood et al. (2015) found that Coyotes depredated 46% of fawns born at FBMI (30 of 65 fawns monitored during 2011 and 2012); thus, neonate White-tailed Deer are apparently an important component of Coyote diets at FBMI. In addition, we likely underestimated the proportion of fawns in scats because we only positively identified those scats with small hooves as containing fawns rather than adult deer. It is notable that while Coyote predation on adult White-tailed Deer in the Southeast appears uncommon (Blanton and Hill 1989, Kilgo et al. 2010), Chitwood et al. (2014) documented multiple instances of Coyote predation on adult White-tailed Deer at FBMI.

Our study documented high consumption of soft-mast by Coyotes during fall and winter when these food items were most available. Persimmon fruits were more common in Coyote diets in our study (95.7% of scats in August–October) than in other published studies conducted in the Southeast, with Schrecengost et al. (2008) reporting that 81% of Coyote scats collected during October contained Persimmon. Concurrent with the high prevalence of soft mast from August–October, occurrence of White-tailed Deer was low in scats (1.2% of scats, 0.7% of occurrence). Schrecengost et al. (2008) noted a similar trend; they found White-tailed Deer occurring in 8%, 3%, and 0% of scats from August, September, and October, respectively. Previous studies have suggested that soft mast may be frequently selected when available because Coyotes may be more efficient at foraging on these items than on mammalian prey (Chamberlain and Leopold 1999). Soft mast may be especially important at FBMI, where White-tailed Deer, rodent, and lagomorph densities all are low (Chitwood et al. 2015; Elfelt 2014; E. Stevenson, North Carolina State University, Raleigh, NC, unpubl. data), therefore requiring greater energy-expenditure by Coyotes during foraging. Coyotes on our low-productivity study site shifted their diets throughout the year based on seasonal food availability, similar to shifts reported elsewhere in the species' range.

Acknowledgments

Funding for this project was provided by the US Department of Defense through the Wildlife Branch at FBMI, and the Department of Forestry and Environmental Resources at North Carolina State University. We thank the many technicians who assisted in field collection of data, and other numerous volunteers for their assistance processing samples in the lab, including A. Schaich Borg, B. Sherrill, C. Farr, B. Peterson, V. Bennett, S. Higdon, and

R. Owens. Thanks to B. Reich for his reviews of earlier drafts. We would also like to thank R. Kays and B. Sherrill for providing lab space and access to other resources at the North Carolina Museum of Natural Sciences.

Literature Cited

- 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.
- Blanton, K.M., and E.P. Hill. 1989. Coyote use of White-tailed Deer fawns in relation to deer density. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 43:470–478.
- Chamberlain, M.J., and B.D. Leopold. 1999. Dietary patterns of sympatric Bobcats and Coyotes in central Mississippi. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 53:204–219.
- Chitwood, M.C., M.A. Lashley, J.C. Kilgo, K. Pollock, C.E. Moorman, and C.S. DePerno. 2015. Do biological and bedsite characteristics influence survival of neonatal White-tailed Deer? *PLOS ONE* 10(3):e0119070. doi:10.1371/journal.pone.0119070.
- Chitwood, M.C., M.A. Lashley, C.E. Moorman, and C.S. DePerno. 2014. Confirmation of Coyote predation on adult female White-tailed Deer in the southeastern United States. *Southeastern Naturalist* 13:N30–N32.
- Crimmins, S.M., J.W. Edwards, and J.M. Houben. 2012. *Canis latrans* (Coyote) habitat use and feeding habits in central West Virginia. *Northeastern Naturalist* 19:411–420.
- Elfelt, M.B. 2014. Coyote movement ecology and food habits at Fort Bragg Military Installation. M.Sc. Thesis. North Carolina State University, Raleigh, NC. 74 pp.
- Grigione, M.M., P. Burman, S. Clavio, S.J. Harper, D. Manning, and R.J. Sarno. 2011. Diet of Florida Coyotes in a protected wildland and suburban habitat. *Urban Ecosystems* 14:655–663.
- Hidalgo-Mihart, M.G., L. Cantú-Salazar, C.A. López-González, E. Martínez-Meyer, and A. González-Romero. 2001. Coyote (*Canis latrans*) food habits in a tropical deciduous forest of western Mexico. *American Midland Naturalist* 146:210–216.
- Kilgo, J.C., H.S. Ray, C. Ruth, and K.V. Miller. 2010. Can Coyotes affect deer populations in southeastern North America? *Journal of Wildlife Management* 74:929–933.
- Lashley, M.A., M.C. Chitwood, A. Prince, M.B. Elfelt, E.L. Kilburg, C.S. DePerno, and C.E. Moorman. 2014. Subtle effects of a managed-fire regime: A case study in the Longleaf Pine ecosystem. *Ecological Indicators* 38:212–217.
- McVey, J.M., D.T. Cobb, R.A. Powell, M.K. Stoskopf, J.H. Bohling, L.P. Waits, and C.E. Moorman. 2013. Diets of sympatric Red Wolves and Coyotes in northeastern North Carolina. *Journal of Mammalogy* 94:1141–1148.
- Mitchell, R.J., L.K. Kirkman, S.D. Pecot, C.A. Wilson, B.J. Palik, and L.R. Boring. 1999. Patterns and controls of ecosystem function in Longleaf Pine–wiregrass savannas. I. Aboveground net primary productivity. *Canadian Journal of Forest Research* 29:743–751.
- Moore, T.D., L.E. Spence, and C.E. Dugnolle. 1974. Identification of the dorsal guard-hairs of some mammals of Wyoming. *Wyoming Game and Fish Department Bulletin* 14. Cheyenne, WY. 177 pp.
- Morey, P.S., E.M. Gese, and S. Gehrt. 2007. Spatial and temporal variation in the diet of Coyotes in the Chicago metropolitan area. *American Midland Naturalist* 158:147–161.

- O'Donoghue, M., S. Boutin, C.J. Krebs, D.L. Murray, and E.J. Hofer. 1998. Behavioral responses of Coyotes and Lynx to the Snowshoe Hare cycle. *Oikos* 82:169–183.
- Parker, G.R. 1995. *Eastern Coyote: The Story of its Success*. Nimbus Publishing, Halifax, NS, Canada.
- Patterson, B.R., L.K. Benjamin, and F. Messier. 1998. Prey switching and feeding habits of eastern Coyotes in relation to Snowshoe Hare and White-tailed Deer densities. *Canadian Journal of Zoology* 76:1885–1897.
- Schreengost, J.D., J.C. Kilgo, D. Mallard, S. Ray, and K.V. Miller. 2008. Seasonal food habits of the Coyote in the South Carolina coastal plain. *Southeastern Naturalist* 7:135–144.
- Shea, S.M., and J.S. Osborne. 1995. Poor-quality habitats. Pp. 193–209, *In* K.V. Miller and R.L. Marchinton (Eds.). *Quality Whitetails: The Why and How of Quality Deer Management*. Stackpole Books, Mechanicsburg, PA. 320 pp.
- Sorrie, B.A., J.B. Gray, and P.J. Crutchfield. 2006. The vascular flora of the Longleaf Pine ecosystem of Fort Bragg and Weymouth Woods, North Carolina. *Castanea* 71:129–161.
- Squitier, J., and J. Capinera. 2002. Observations on the phenology of common Florida grasshoppers (Orthoptera: Acrididae). *Florida Entomologist* 85:227–234.
- Stratman, M.R., and M.R. Pelton. 1997. Food habits of Coyotes in northwestern Florida. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 51:269–275.
- Turner, M.M., A.P. Rockhill, C.S. DePerno, J.A. Jenks, R.W. Klaver, A.R. Jarding, T.W. Grovenburg, and K.H. Pollock. 2011. Evaluating the effect of predators on White-tailed Deer: Movement and diet of Coyotes. *Journal of Wildlife Management* 75:905–912.
- Windberg, L.A., and C.D. Mitchell. 2013. Winter diets of Coyotes in relation to prey abundance in southern Texas. *Journal of Mammalogy* 71:439–447.
- Wooding, J.B., E.P. Hill, and P.W. Sumner. 1984. Coyote food habits in Mississippi and Alabama. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 38:182–188.