

Winter Food Habits of Red Foxes and Coyotes in Central Kentucky

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Abstract: Carcasses of 60 coyotes (*Canis latrans*) and 72 red foxes (*Vulpes vulpes*) were collected from November 1986 to February 1987 in the Bluegrass and Knobs region of central Kentucky. Stomach content analysis revealed that diets were similar between the 2 species, with a Horn's index of overlap = 0.81. Coyotes consumed a small variety of relatively large prey items (i.e., items occurred at high frequencies in the stomachs); whereas red foxes ingested a large variety of small prey items. Major dietary items were small mammals (76% of red fox diets, 57% of coyote's) and cottontail rabbit (18% of red fox's, 22% of coyote's). Cattle were a major diet item for coyotes but not for red foxes (28% and 8%, respectively).

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 45:97-103

In the past 15-20 years the coyote (*Canis latrans*) has become established in the southeastern United States (Hill et al. 1987). This non-endemic predator is now common throughout all of Kentucky except in the eastern mountainous region (Servello et al. 1989).

Although coyotes and red foxes (*Vulpes vulpes*) are sympatric throughout much of their range, several researchers suggest that a negative relationship between the number of coyotes and red foxes may exist. Voight and Earle (1983), Sargeant et al. (1987), and Harrison et al. (1989) provided evidence of spatial exclusion of red foxes from coyotes' territories. Aggressive behavior of coyotes toward red foxes is thought to influence spatial separation (Dekker 1983, Voight and Earle 1983). Competition for resources may be one reason why coyotes tend to exclude red foxes from the center of their home ranges (Major and Sherburne 1987).

In Kentucky there have been no reported dietary studies concerning red foxes and coyotes. The objective of this study was to determine the food habits of sympatric red foxes and coyotes during a probable period of dietary competition (i.e. winter).

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Methods

Carcasses of coyotes and red foxes were collected from 15 contiguous central Kentucky counties in the Bluegrass and Knobs section of the Western Mixed Mesophytic Forest vegetation type (Braun 1950). The region supports land use practices mainly related to small-scale farming and livestock operations, horse farms, and timber harvesting activities. Animals were collected from fur trappers, fur dealers, Lincoln County Farm Bureau Federation personnel, and Kentucky Department of Fish and Wildlife Resources (KDFWR) officials between November 1986 and February 1987. Stomachs were removed as soon as the animals were collected, labeled according to date and county of harvest, and frozen until analyzed. Red foxes and coyotes were taken from the same county and from the same individuals when possible in an attempt to collect sympatric animals. Stomach contents were prepared for dietary analysis following the procedures of Korschgen (1980). Mammalian prey items were identified based on hair morphology (Moore et al. 1974) and skeletal remains (Glass 1973). Bird and plant remains were identified using museum and herbarium reference material. Dietary data were analyzed using frequency of occurrence for each food item expressed as a percentage of stomachs that contained food (Bowyer et al. 1983). Horn's (1966) index of community overlap was calculated to determine the degree of dietary overlap. Percent occurrence of food items that were shared by both species and had a minimum occurrence in each diet of 5% were classified as major food items. A Chi-square test was used to determine if significant differences existed between red fox and coyote diets for the major food items. If significant at the $P < 0.05$ level, Bonferroni confidence intervals (Neu et al. 1974) were used to determine which major food item was significantly consumed.

KDFWR Wildlife Damage Survey Reports for 1986 and 1987 (Hedges 1987, 1988) were examined to determine the extent of coyote and red fox depredation on livestock in those counties from which stomach samples were collected.

Results

Eighty-three red fox and 66 coyote stomachs were collected from 15 counties in central Kentucky. Eleven (13%) of the red fox and 6 (9%) coyote stomachs were empty and thus not used in the analysis.

Red foxes consumed a larger variety of food items ($N = 29$) than coyotes ($N = 18$) (Table 1). Coyotes exhibited a higher percent occurrence for 10 of 13 food items common to the diet of both species, while red foxes had a higher percent occurrence for 3 items. Horn's (1966) index of overlap for all identified food items in the diets of both species was 0.81, where 0.0 = no overlap and 1.0 = complete overlap.

Small mammals were the primary food item in red fox stomachs (76% occurrence), followed by cottontail rabbit (*Sylvilagus floridanus*, 18%), cattle (*Bos bos*, 8%), Virginia opossum (*Didelphis virginiana*, 8%), and unknown mammals (7%).

Table 1. Percent occurrence (% Occ.) of items identified in the stomachs of red foxes and coyotes collected in central Kentucky, November 1986–January 1987.

Diet item	Red fox		Coyote	
	% Occ.	(N)	% Occ.	(N)
<i>Peromyscus</i> spp.	35	25	32	19
Voles (<i>Microtus</i> spp.)	44	32	25	15
Shorttail shrew (<i>Blarina brevicauda</i>)	13	9	2	1
Meadow jumping mouse (<i>Zapus hudsonicus</i>)	7	5	3	2
Unknown small mammals	14	10	20	12
Small mammals—total	76	55	57	34
Cottontail rabbit (<i>Sylvilagus floridanus</i>)	18	13	22	13
Cattle (<i>Bos bos</i>)	8	6	28	17
Virginia opossum (<i>Didelphis virginiana</i>)	8	6	2	1
Striped skunk (<i>Mephitis mephitis</i>)	5	4	10	6
Groundhog (<i>Marmota monax</i>)	1	1	3	2
White-tailed deer (<i>Odocoileus virginianus</i>)	1	1	3	2
Muskrat (<i>Ondatra zibethicus</i>)	1	1	3	2
House cat (<i>Felis domestica</i>)	1	1	13	8
Unknown mammals—total	7	5	18	11
Eastern chipmunk (<i>Tamias striatus</i>)	1	1	—	—
Gray squirrel (<i>Sciurus carolinensis</i>)	1	1	—	—
Fox squirrel (<i>Sciurus niger</i>)	1	1	—	—
Gray fox (<i>Urocyon cinereoargenteus</i>)	—	—	2	1
Larger mammals—total	57	41	83	53
Passeriformes	3	2	7	4
Meadowlark (<i>Sturnella magna</i>)	4	3	—	—
Chicken (<i>Gallus gallus</i>)	3	2	—	—
Unknown gallinaceous bird	1	1	—	—
Unknown birds	8	8	3	2
Bird—total	19	14	10	6
Grasshoppers (Orthoptera)	5	4	—	—
Beetles (Coleoptera)	4	3	—	—
Unknown insects	1	1	—	—
Insects—total	11	8	—	—
Pokeweed (<i>Phytolacca americana</i>)	6	4	—	—
Persimmon (<i>Diospyros virginiana</i>)	4	3	—	—
Corn (<i>Zea mays</i>)	1	1	3	2
Unknown plants	3	2	—	—
Plants—total	14	10	3	2

^aN = sample size.

^bSmall mammals refers to adult mammals of total body mass ≤ 50 g.

^cMammals refers to adult mammals of total body mass ≥ 50 g.

Small mammals also were the primary food item consumed by coyotes, occurring in 57% of the stomachs examined, followed by cattle (28%), eastern cottontail rabbit (22%), unknown mammals (18%), and house cat (*Felis domestica*, 13%) (Table 1).

Percent occurrence for the 6 major food items identified in the diets (Fig. 1), was significantly different ($X^2 = 38.55$, $df = 5$, $P < 0.05$) between the 2 species. Bonferroni confidence intervals indicated that small mammals and birds, as a group, occurred significantly more often in red fox diets than in coyote diets. Cattle and other unknown mammals were found to occur significantly more often in the diets of coyotes. Percent occurrence of eastern cottontail rabbit and striped skunk (*Mephitis mephitis*) was not significantly different between red foxes and coyotes.

During January 1986–December 1987, no incident of coyote or red fox predation on livestock in counties sampled in this study were reported to the KDFWR.

Discussion

Even though numerous studies have detailed the food habits of red foxes and coyotes, there is a general lack of information concerning the diets of these 2 canids where they occur in sympatry (Ables 1975, Gier 1975, Green and Flinders 1981). While both species consume a variety of foods, there are apparent geographical preferences for certain diet items. Red foxes in Missouri preferred rabbits (39% occurrence) and rodents (51%, Korschgen 1959), while coyotes in Missouri preferred rabbits (53% occurrence), poultry (15%), livestock (13%), and rodents (32%,

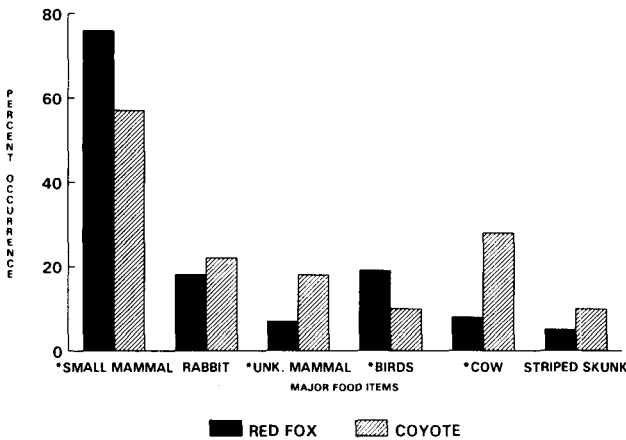


Figure 1. Percent occurrence of major food items in 72 red fox and 60 coyotes stomachs collected in central Kentucky, November 1986–January 1987. Major diet items whose percent occurrence was significantly different ($P < 0.05$) between red foxes and coyotes are indicated by an asterisk. Unknown mammals (Unk. Mammals) refers to all adult mammals of total body mass ≥ 50 g.

Korschgen 1957). In Maryland (Hockman and Chapman 1983), Illinois (Knable 1970), and Wisconsin (Errington 1935, Pils and Martin 1978), red foxes selected small mammals (mainly *Microtus* sp.) and rabbits. In Missouri, Korschgen (1959) found rabbits comprised a large portion of the fox's diet during the winter while mice and rats were eaten most often in spring. Schofield (1960), in Michigan, reported white-tailed deer (*Odocoileus virginianus*) carrion was heavily used by red foxes during the winter, while insects and plants were the main food items consumed during the summer.

Gipson (1974) reported that poultry (35% occurrence), persimmons (*Diospyros virginiana*, 23%), insects (11%), rodents (9%), and rabbits (7%) were the major food items consumed by coyotes in Arkansas. In western Tennessee, the diet consisted of rodents (48% occurrence), livestock (35%), plants (27%), and rabbits (24%, Smith and Kennedy 1983). Korschgen (1973) noted seasonal differences in coyote food habits. He found rabbits in 57% of coyote stomachs examined in winter and 14% in spring. Rabbits were the main winter prey item (57%) consumed, but livestock carrion (37%) comprised the bulk of the spring diet.

During the winter months, coyotes and red foxes in central Kentucky and in southeastern Idaho (Green and Flinders 1981) consumed similar food items but in significantly different proportions. In Maine, Major and Sherburne (1987) found the least amount of food overlap among 3 sympatric carnivores was between red foxes and coyotes [as opposed to bobcat (*Felis rufus*) and coyotes], and the calculated overlap was lower than in this study. Competition between red foxes and coyotes for food could occur if preferred food items were in limited supply. Although we did not collect data concerning the relative abundance of prey items, we feel dietary competition between *Canis latrans* and *Vulpes vulpes* is unlikely in central Kentucky because both species consumed a wide variety of food items.

Red foxes consumed a larger number of small mammals species in this study, as well as in southeastern Idaho (Green and Flinders 1981), relative to coyotes. In Maine, Major and Sherburne (1987) reported that red foxes frequently consumed more small mammals than coyotes, despite the relatively low abundance of small mammals. They suggested the reason for such a difference was that red foxes exhibit specialization for small mammals, and that this specialization reflects the fox's body size and energetic needs.

The importance of carrion, particularly livestock, to coyotes and red foxes during the winter months has been documented (Schofield 1960, Korschgen 1973, Weaver 1979, Todd and Keith 1983, Voight 1987). In this study, coyote stomachs which contained cattle remains tended to contain large volumes of meat. Such winter gorging could explain why coyote diets exhibited a low diversity of food items. Farmers in central Kentucky generally do not bury carcasses of dead cattle (pers. observ.). The lack of coyote and red fox depredation complaints to the KDFWR and the presence of cattle remains in the diets of both carnivores indicates that farmer-supplied carrion is available. The low frequency of cattle in red fox stomachs could be related to interference competition between red foxes and coyotes or be a matter of diet selection by red foxes. Major and Sherburne (1987) reported

that interference by coyotes may have discouraged red foxes in Maine from feeding on deer carrion.

Coyotes and red foxes in this study consumed cottontail rabbit and striped skunk with similar frequency. Rabbit has been documented as a major food item for both species (Korschgen 1959, Schofield 1960, Knable 1970, Korschgen 1973, Pils and Martin 1978, Smith and Kennedy 1983). Competition for rabbits and skunks could occur between red foxes and coyotes in central Kentucky if the availability of these prey animals became limited.

Red foxes and coyotes have been described as opportunistic, non-specific predators (Ables 1975, Gier 1975, Green and Flinders 1981, Voight 1987, Voight and Berg 1987). During the winter in central Kentucky, coyotes consumed a smaller variety of food items and larger-sized food items than red foxes, and except for small mammals, these food items were eaten with greater frequency. Red foxes consumed a large variety of relatively small food items. Red foxes in central Kentucky appear to be diverse, efficient hunters of small game, while coyotes are less diverse and utilize larger-sized prey with greater frequency.

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