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Spatial and Temporal Variation in the Diet of Coyotes in the Chicago Metropolitan Area

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ABSTRACT.—Coyotes (*Canis latrans*) are an opportunistic predator that have adapted to many human-modified environments. Conflicts between coyotes and humans are an increasing concern for managers in urban areas. We examined the spatial and temporal utilization and availability of natural and human-associated food for coyotes in the Chicago metropolitan area, Illinois, USA. We collected 1429 coyote scats from May 2000 to December 2002, and conducted prey surveys in 2002, in 4 sites that varied in their degree of urban development. Dominant food items included small rodents, white-tailed deer (*Odocoileus virginianus*), fruit, eastern cottontail (*Sylvilagus floridanus*) and birds. Their availability and occurrence in scats varied among sites and seasons. The occurrence of human-associated food items, which was only found in significant amounts in the most developed site, varied seasonally (2–25%). Because coyotes in less-developed areas had lower dietary diversity, these coyotes may have to venture into developed areas when there is a decline in the abundance of major prey species for that specific area.

INTRODUCTION

Coyotes (*Canis latrans*) are opportunistic carnivores that have adapted to urban encroachment into their native habitats. In addition, coyotes have colonized urban areas where coyotes were once absent. Coyotes have been documented in large metropolitan areas from Los Angeles to New York City (Howell, 1982). Although their use of commercial areas is uncommon (Quinn, 1997a; Grinder and Krausman, 2001), coyotes have been found in downtown New York City (Martin, 1999) and multiple coyotes have been observed and captured in or near downtown Chicago (C. Anchor and S. Gehrt, unpubl.). Urban areas can provide habitat for coyotes in city parks, golf courses, wooded areas in residential neighborhoods and abundant water sources from streams, lakes, ponds, wetlands. Urban areas can also provide native prey including rodents, deer, leporids and other small mammals and human-associated foods like domestic pets, garbage, vegetable gardens and pet food (McClure *et al.*, 1995; Quinn, 1997b).

The management and conservation of coyotes in urban areas is helped by an examination of the coyote's reliance on natural and human-associated food items. Because temporal fluctuations of food abundance can alter coyote use of food items (Clark, 1972; Nellis and Keith, 1976; Litvaitis and Shaw, 1980), an understanding of the seasonal use and availability

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of food can also be helpful. Furthermore, because the urban landscape is a matrix of land uses, there may be spatial variation in the use and availability of natural and human-associated food items. Thus, an examination of coyote diets in different areas that vary in their human land-use may help understand the spatial variation of diets.

Understanding coyote diets in urban areas also has important management implications regarding human-coyote conflicts. Coyote use of anthropogenic foods has been suggested as a precursor, or contributor, to aggressive behavior by coyotes toward people (Timm *et al.*, 2004). Diet studies in some cities have shown that human-associated foods are utilized more by urban coyotes (MacCracken, 1982; McClure *et al.*, 1995) than rural coyotes; (Johnson and Hansen 1979; Rose and Polis 1998) and coyote reliance on those foods may contribute to the conflicts. Whereas coyote attacks on people are generally rare, a higher frequency of attacks occurs in the Southwest than elsewhere in the US (Baker and Timm, 1998, Timm *et al.*, 2004). Although coyotes were native to the Chicago metropolitan area, they were rarely observed in the area throughout most of the 20th Century (Gehrt 2004). Through changing land use and decreased persecution, coyotes have recently become more common to the region, much like they have in many metropolitan areas in the Midwest and Eastern United States. Information on coyote diets in these landscapes is important to understand their success in urbanized landscapes.

Our objective was to examine the diet of coyotes in areas that vary in the degree of human land use in the Chicago metropolitan area. We investigated this by seasonally analyzing the dietary diversity found within coyote scats collected in sites with varying degrees of human association. Further, we investigated how availability of prey may influence selection of food items by assessing relative prey abundance among sites and seasons.

METHODS

Our study was conducted in four sites in western Cook and eastern Kane counties in northeastern Illinois. These counties were part of the greater Chicago metropolitan area, which was the third largest metropolitan area in the country with 9.1 million people (U.S. Census Bureau, 2000). Winter temperatures and precipitation averaged -3 C and 3.8 cm/month, respectively, and summer temperatures and precipitation averaged 19 C and 9.9 cm/month, respectively. Some native fauna included white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), voles (*Microtus* spp.), white-footed mice (*Peromyscus* spp.), beaver (*Castor canadensis*), opossum (*Didelphis marsupialus*), eastern cottontail (*Sylvilagus floridanus*) and muskrat (*Ondatra zibethica*). Non-native fauna included house cat (*Felis domesticus*), domestic dog (*Canis familiaris*) and ring-necked pheasant (*Phasianus colchicus*).

Scat collection and prey surveys were completed in two public forest preserves, one private preserve and a collection of city parks in Schaumburg, Illinois, USA. A concurrent radiotelemetry project estimated each study site contained two to three coyote packs, plus transients (Morey, 2004). Although some movements of radiocollared coyotes occurred between sites, little home range overlap between sites was evident. The two public forest preserves were Ned Brown Forest Preserve (NB) and Poplar Creek Forest Preserve (PC). Both forest preserves were open to the public and received considerable recreational use in the summer; NB received 1.5 million visitors/year, mostly during non-winter months (Prange *et al.*, 2003). Ned Brown Forest Preserve was 1499 ha and located 5 km west of Chicago O'Hare International Airport. Habitats included mature second growth oak (*Quercus* spp.), sugar maple (*Acer saccharum*) and basswood (*Tilia americana*) forests (66%), open water (15%), old agricultural fields (10%) and paved roads, parking lots and picnic

areas (9%). The area was surrounded by medium-density residential and high-density commercial areas and was bordered on two sides by 8-lane highways. Major uses of the area included picnicking, hiking and biking. The 1825 ha PC received considerably fewer visitors per year. Habitats included old agricultural fields (49%), forests (28%), active agricultural fields (17%), open water (4%) and paved roads, parking lots and picnic areas (2%). Medium-density housing, a commercial area and an 8-lane highway bordered the preserve. Picnicking, hiking and biking were major uses in this area. Refuse was present at picnic groves during warm months at both forest preserves (Gehrt, 2004).

The 495 ha Max McGraw Wildlife Foundation (MM) was managed as a private natural area and hunting and fishing preserve. Habitats included forests (46%), agricultural areas (22%), grasslands (15%) and wetlands and open water (13%) and roads, parking lots and buildings (4%). Forests included second growth oak, maple (*Acer* spp.) and hickory (*Carya* spp.) communities. The property was adjacent to a gravel pit and areas of intense public use that included 2 small amusement parks. Private property in the center of MM included a restaurant, miniature golf area, small shopping plaza and a small residential area consisting of approximately 50 homes. Primary activities in MM included upland game bird hunting and fishing. Coyotes were not hunted or controlled on the property during the study. The Max McGraw Wildlife Foundation site along with PC and NB were the least developed urban study sites. Schaumburg (SCH) was between NB and PC and had the most urban development. It consisted of a human population of 75,400. It was 14.4 km from the city of Chicago and surrounded by 6 cities (population range: 23,100 [Roselle] to 49,500 [Hoffman Estates]). Primary land uses within this area was medium-density residential and commercial use. It included 58 small city parks, two golf courses, four small natural areas and a water treatment plant.

Dietary utilization was determined by collecting coyote scats within 2 m of fixed routes consisting of roads and pedestrian paths at the four study sites between May 2000 and December 2002. The length of scat-routes varied from 9.0 to 13.3 km. We collected scats at least bimonthly, except in winter when logistics limited the collection to monthly. We stored scats individually in plastic bags in a freezer until analyzed. We dried scats at 50 C for 48 h, separated manually, and food items were identified from keys (Schopmeyer, 1974; Adorjan and Kolenosky, 1969; Moore *et al.*, 1974) and a reference collection of bones and dorsal hairs. ''The percentage of occurrence of food items in all scats was used for analyses. A food item occurring < 10% in an individual scat was not counted because small prey items can be overestimated when the percentage of occurrence technique is used (Martin *et al.* 1946; Weaver and Hoffman 1979).

We examined dietary differences among sites using contingency tables and chi-square analyses with Statistical Analysis Software (SAS Institute Inc., 2001). We used Shannon-Weaver index (Colwell and Futuyma, 1971) to estimate dietary diversity among biological seasons and sites. We defined biological seasons as: breeding (Jan. 1–Apr. 30), pup-rearing (May 1–Aug. 31) and dispersal (Sept. 1–Dec. 31) (adapted from Laundre and Keller, 1981). We used a *t*-test (Hutcheson, 1970) to examine differences in diversity indices among sites and seasons.

We determined relative prey abundance by conducting roadside counts of possible coyote prey and small mammal trapping along each scat route for three consecutive days in the middle of each biological season in 2002. The Institutional Animal Care and Use Committee at Utah State University approved all animal-handling techniques (protocol #1061). Roadside counts were surveyed in a vehicle traveling 15–25 kph on scat routes in forest preserves and on roads adjacent to scat routes in SCH. Morning roadside counts produce

the highest counts for lagomorphs (Newman, 1959; Kline, 1965) and urban domestic cats (Hasple and Calhoon, 1993), therefore roadside counts were started 30 mins before sunrise and lasted until approximately 30 minutes past sunrise. The survey direction was alternated each survey. To reduce environmental conditions influencing prey counts, counts were not conducted in winds >15 kph or during rain (Kline, 1965). We reported an index of the number of animals seen/km for each site and season.

We conducted small-mammal trapping using M-4 museum special traps (Woodstream Corporation, Lititz, PA). Ten trap-transects were spaced approximately 0.2 km apart along or near scat collection routes in each site. Spacing between transects was systematically determined by the length of the scat route; longer scat routes had a greater distance between transects. To reduce disturbances of traps in areas of high human use, transects in parking or picnic areas were moved to the nearest area with low human use. Each transect contained 10 traps spaced 5 m apart. Traps were baited with a peanut butter-rolled oats mixture and operated for three consecutive nights, with trap inspection every morning. We created indices of total captures per unit of trap effort for each site in each biological season. We qualitatively compared indices from trap and roadside surveys with scat results to examine use versus relative abundance among sites and seasons.

<center>RESULTS</center>

We collected 1429 coyote scats in the four study sites. Small rodents (voles and white-footed mice) constituted the highest frequency of occurrence in all seasons and sites (Table 1); all small rodents were grouped together in the results. Small rodents were followed by deer, fruit, eastern cottontail (cottontail), bird, raccoon, grass, invertebrate, human-associated food items, muskrat, house cat and unidentified food items. Bird occurrence was not identified to species. Fruits identified in scats were mulberrys (*Morus alba*), crabapples (*Malus sp.*) and chokecherrys (*Prunus sp.*). Human-associated food included fast food wrappers, pieces of rubber, candy wrappers, plastic, string, aluminum foil and dog food. Other food items that occurred in < 1% of scats included corn, eastern gray squirrel (*Sciurus carolinensis*), eastern fox squirrel (*S. niger*), coyote, domestic dog, eastern chipmunk (*Tamias striatus*), opossum and short-tailed shrew (*Blarina bravicauda*).

Seasonal fluctuations of each of the top 3 food groups and top three mammal species were similar among years. Therefore, we combined data across years to examine for site and seasonal differences among food items. There was a difference in overall diet between sites for the top five food items ($\chi^2_{12} = 535.15$, P < 0.001). There was also a difference between sites in the occurrence of rodents ($\chi^2_{12} = 181.21$, P < 0.001). Rodent occurrence was highest in NB (Table 1), where it was 2 to 3 times higher than other sites, even though rodents were ranked as one of the top-ranked food items in other sites. Deer occurrence differed between sites ($\chi^2_3 = 77.80$, P < 0.001), with the highest occurrence in PC (Table 1). Cottontail occurrence also differed among sites ($\chi^2_3 = 78.71$, P < 0.001), with the highest occurrence in PC and SCH. The occurrences of birds ($\chi^2_3 = 205.61$, P < 0.001) and plant items ($\chi^2_3 = 167.05$, P < 0.001) were different among sites; they were ranked highest in MM (Table 1). Human-associated food items, which included domestic cats for this comparison, differed between sites ($\chi^2_3 = 72.46$, P < 0.001), with the highest occurrence in SCH (Table 1).

Site differences were also shown by the range of Shannon-Weaver indices among sites (Table 2). The SCH and MM had a pattern of higher dietary diversity than NB and PC for all seasons except pup-rearing (Table 3). Although not different from the second ranking, the developed site, SCH, had the highest dietary diversity across all seasons (Table 3). Ned

Table 1.—Percent occurrence of food items found in coyote scats collected in four study sites in the Chicago metropolitan area, Illinois, May 2000–December 2002. Study sites: NB = Ned Brown Forest Preserve, PC = Poplar Creek Forest Preserve, MM = Max McGraw Wildlife Foundation, SCH = Village of Schaumburg

	NB	PC	MM	SCH	All Sites
Small rodents	73.8	37.2	27.9	31.3	41.8
White-tailed deer	16.9	35.1	13.6	10.0	22.0
Fruit	8.0	12.5	44.2	30.7	22.7
Eastern cottontail	9.8	27.5	8.6	25.3	17.7
Bird species	3.7	4.7	32.9	8.0	13.1
Raccoon	9.2	5.2	13.4	4.7	8.5
Grass species	5.2	6.5	5.0	10.0	6.2
Invertebrate	1.2	2.6	7.9	7.3	4.3
Human-associated	2.1	2.8	1.0	10.7	1.9
Muskrat	4.6	0.7	0.2	1.3	1.5
Domestic cat	1.2	0.4	0.5	6.7	1.3
Unknown	0.6	0.7	0.7	3.3	1.0
# of Scats	325	535	419	150	1,429

Brown Forest Preserve had a lower dietary diversity than other sites except during pup-rearing. The equitability indices showed that small Shannon-Weaver indices were due to overrepresentation of some food items. The low Shannon-Weaver indices for NB were due to a high use of rodents during the breeding and dispersal seasons (Fig. 1).

Seasonal fluctuations of the top five food categories and human-associated food items showed similar patterns for several sites. Comparisons of the top five food items (small rodents, deer, plants, cottontails, birds) for all sites combined showed seasonal differences ($\chi^2_8 = 272.98$, $P < 0.001$). The lack of adequate sample sizes for some sites in some of the seasons prevented examining contingency tables across seasons within sites. Qualitatively, within seasons and sites, bird occurrence was low among seasons for all sites except MM where it was highest during the breeding season (Fig. 1). Deer was more abundant in PC and NB during the pup-rearing season, and more abundant during the breeding season in MM (Fig. 1). Both small rodents and cottontails occurred in lower frequencies during the pup-rearing season, and fruit higher during the pup-rearing season, for all sites (Fig. 1). Human-associated food items were rarely found in any season except in SCH where they occurred more during the pup-rearing and dispersal seasons (Fig. 1). Dietary diversity was highest during the pup-rearing season in all sites except MM, where it was highest during the dispersal season (Table 4). Dietary diversity was lowest during the breeding season in all sites. All prey surveys were conducted within 2 wks in the middle of each biological season,

Table 2.—Seasonal dietary diversity indices (Shannon-Weaver index) for coyotes in 4 sites in the Chicago metropolitan area, Illinois, May 2000–December 2002. Study sites: NB = Ned Brown Forest Preserve, PC = Poplar Creek Forest Preserve, MM = Max McGraw Wildlife Foundation, SCH = Village of Schaumburg. Numbers in parentheses are equitability indices

Season	NB	PC	MM	SCH
Breeding	1.36 (0.55)	1.60 (0.67)	1.67 (0.73)	1.84 (0.84)
Pup-rearing	2.02 (0.84)	1.89 (0.79)	1.71 (0.74)	2.15 (0.87)
Dispersal	1.45 (0.59)	1.84 (0.77)	1.96 (0.85)	2.01 (0.84)

TABLE 3.—Ranking (4 = highest, 1 = lowest) of dietary diversity indices (Shannon-Weaver index) for coyotes among four study sites during three seasons in the Chicago metropolitan area, Illinois, May 2000–December 2002. Underlined study sites were not significantly different in their rankings ($P <$ 0.05). Study sites: NB = Ned Brown Forest Preserve, PC = Poplar Creek Forest Preserve, MM = Max McGraw Wildlife Foundation, SCH = Village of Schaumburg

| | Ranking | | | |
Season	4	3	2	1
Breeding	SCH	MM	PC	NB
Pup-rearing	SCH	NB	PC	MM
Dispersal	SCH	MM	PC	NB

except for NB when snowfall postponed surveys during the dispersal season until the beginning of December. Average morning temperatures during surveys were -0.5 ± 5.5 C ($\bar{x} \pm$SD) for the breeding season, 21.8 ± 2.6 C for the pup rearing season, and 1.2 ± 5.9 C for the dispersal season. The three main prey species observed during morning roadside-counts were deer, cottontail and pheasant (Fig. 2). Other prey items recorded during counts that were observed in small numbers ($<$ 1 animal / 10 km driven) included domestic cat, raccoon, beaver and opossum. More deer were observed at PC during the breeding season than other sites, but less than MM and NB during pup-rearing and dispersal seasons, respectively (Fig. 2). SCH had very few observations of deer in any season. The highest number of cottontail observations for all sites was during the pup-rearing season. The fewest number of cottontail observations for all sites was during the breeding and dispersal seasons (Fig. 2). Max McGraw Wildlife Foundation was the only site where pheasants were observed (Fig. 2). The number of pheasants observed at MM was relatively constant across seasons, with only a small decrease during the pup-rearing season.

Three hundred trap-nights for small mammal trapping were recorded/season for each study site. Short-tailed shrews represented 1% of captures. White-footed mice and meadow voles constituted 88% of all small rodents trapped and unidentified *Peromyscus* and *Microtus* species made up the remaining 10%. Overall, more small rodents were captured during the pup-rearing season than other seasons for all sites except MM (Fig. 3).

DISCUSSION

Coyotes in the suburbs of Chicago relied on natural food sources, but with high spatial and temporal variability. Small rodents, deer, lagomorphs and plant material, which made up the majority of food items, have been found to be important food sources for rural (Leopold and Krausman, 1986; Toweill and Anthony, 1988; Cypher, 1993) and urban (Atkinson and Shackleton, 1991; Quinn, 1997b; Fedriani *et al.*, 2001) coyotes. Although several urban studies have shown a temporal variation in food item selection, we also found spatial variation within an urban area.

Small rodents were the dominant food source for coyotes in the study area. Although more rodents were found in scats during the breeding and dispersal seasons, we captured more small-mammals during the pup-rearing season in all sites except MM in 2002. This contrasts to other studies that found the occurrence of rodents correlated with their abundance (Nellis and Keith, 1976; Litvaitis and Shaw, 1980). The decreased use of small rodents by coyotes when their population was high during the pup-rearing season may be due to an increased availability of other food sources. Alternatively, the high occurrence of
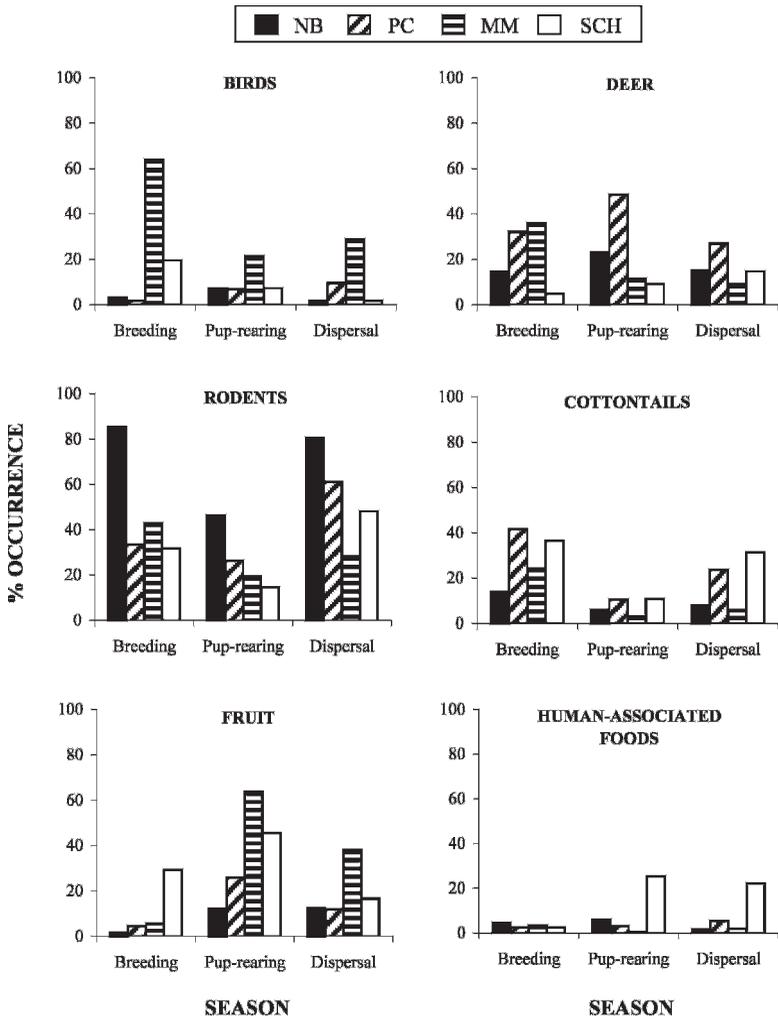
FIG. 1.—Seasonal fluctuations of percent occurrences of the six main food categories in coyote scats collected at four sites in the Chicago metropolitan area, Illinois, May 2000–December 2002. Study sites: NB = Ned Brown Forest Preserve, PC = Poplar Creek Forest Preserve, MM = Max McGraw Wildlife Foundation, SCH = Village of Schaumburg

small rodents in traps and low occurrence in their diet may be due to: increased trap vulnerability of rodents in summer months due to increased activity, a decrease in capture vulnerability by coyotes due to dense vegetation or a preference of different prey by coyotes.

Max McGraw Wildlife Foundation was the only site having food items other than small rodents occurring in high frequencies, possibly due to the lack of rodents or other prey sources. Although the occurrence of small rodents at MM was slightly lower than PC and SCH, the abundance of *Peromyscus* and *Microtus* species in MM was lower than all other sites. Other food items, like bird and plant material, may have supplemented the lower use of rodents at this site.
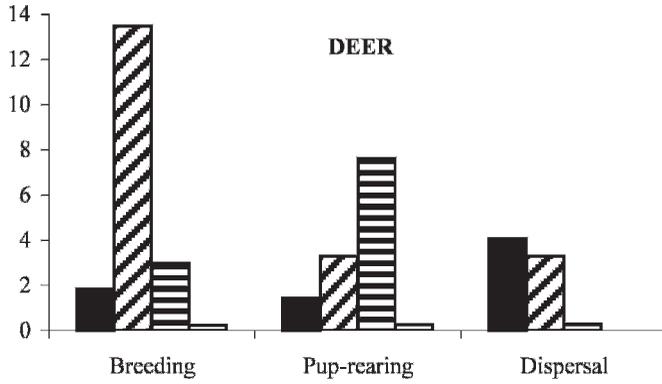
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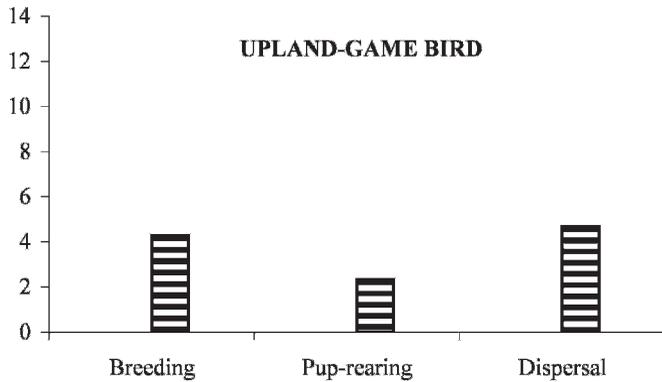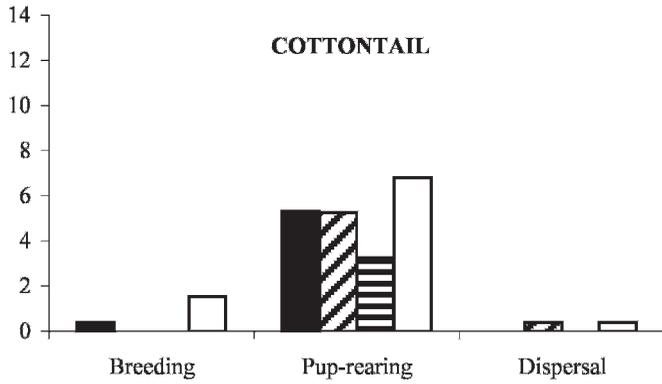
SEASON

TABLE 4.—Ranking (3 = highest, 1 = lowest) of dietary diversity indices (Shannon-Weaver index) for seasonal food habits of coyotes in four study sites in the Chicago metropolitan area, Illinois, May 2000–December 2002. Underlined seasons were not significantly different in their rankings. Study sites: NB = Ned Brown Forest Preserve, PC = Poplar Creek Forest Preserve, MM = Max McGraw Wildlife Foundation, SCH = Village of Schaumburg

	Ranking		
Study Site	3	2	1
NB	Pup-rearing	Dispersal	Breeding
PC	Pup-rearing	Dispersal	Breeding
MM	Dispersal	Pup-rearing	Breeding
SCH	Pup-rearing	Dispersal	Breeding

Deer were an important food source available year round in some study sites. While the killing of mature deer by coyotes is possible (Koehler and Hornocker, 1991; Paquet, 1992; Gese and Grothe, 1995), deer consumption by coyotes often comes from carrion (Ozoga and Harger, 1966; Nellis and Keith, 1976). In our study area, the year-round availability of road-killed deer was probably the main source of carrion and a possible characteristic of urban landscapes. During summer, deer occurrence included fawns. Although we did not discern fawns from adults, we observed several occurrences of fawn remains (*i.e.*, small hooves, teeth, and fawn hairs) in scats. We also observed remains of deer fawns at three coyote dens in our study area. Because coyotes have been found to be a major predator of fawns (Nelson and Woolf, 1987; Smith, 1990; Patterson and Power, 2002), coyotes may be keeping the deer population lower in our study area.

The higher abundance and occurrence of deer in the diet of coyotes at PC was likely due to land management practices. Poplar Creek Forest Preserve differed from other sites in that it lacked an active culling program as found in NB, did not have deer hunting like MM, and did not have small fragmented preserves like SCH. Similar to what Fisher (1980) found, the high deer occurrence at PC may also be due to an open pit used to dispose of management culled deer in the winter months.

Plant material, mostly mulberry fruit found in scats from June through August, occurred in a high percentage of MM and SCH scats; these sites contained more non-native flora than the two forest preserves. However, plant occurrence in scats during the pup-rearing season may be inflated due to increased deposition rates of plant material (Andelt and Andelt, 1984), resulting in the misinterpretation that plant material was more important than non-plant food items among seasons and sites. Despite the possible over-representation of vegetation in scats, it was an important food source during the summer at MM and SCH.

The occurrence of cottontail in scats showed similar trends as rodents. Although PC and SCH had the highest overall occurrences, seasonal trends were similar across all sites.

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FIG. 2.—Seasonal fluctuations of percent occurrences of the top three prey items observed on roadside counts at four sites in the Chicago Metropolitan Area, Illinois, February 2002–December 2002. Study sites: NB = Ned Brown Forest Preserve, PC = Poplar Creek Forest Preserve, MM = Max McGraw Wildlife Foundation, SCH = Village of Schaumburg
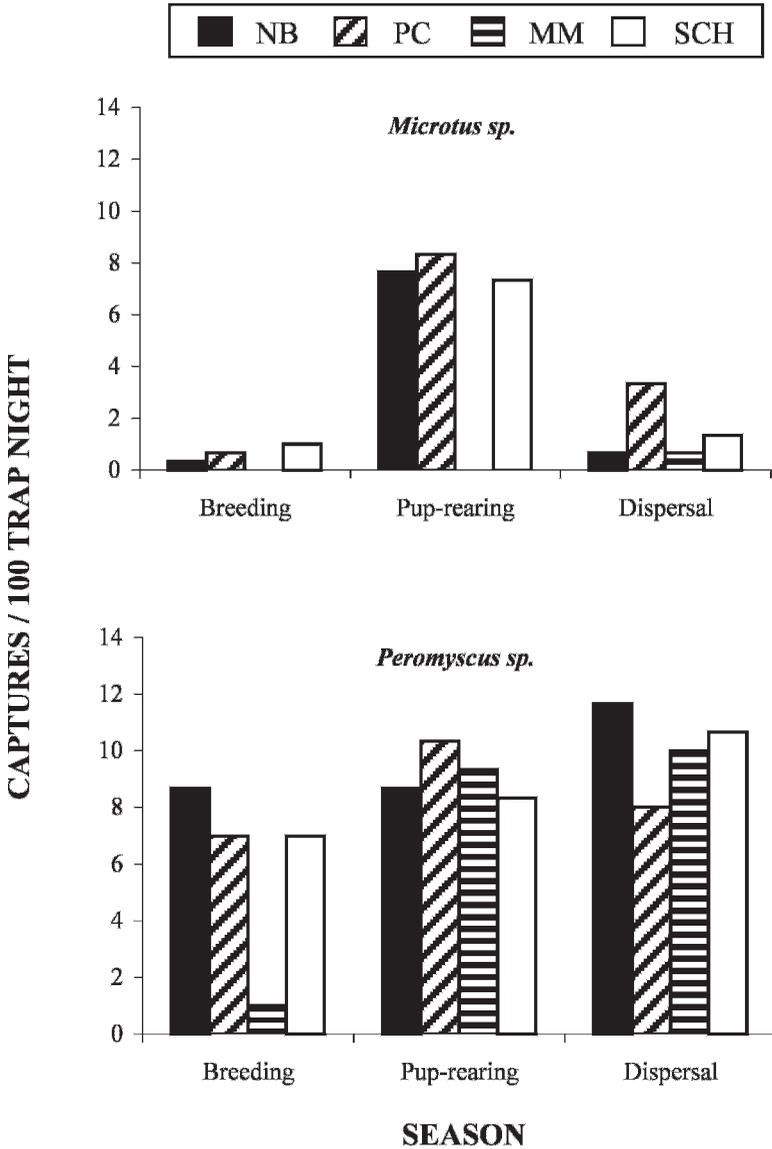
FIG. 3.—Seasonal fluctuations of the top two rodent genus' trapped at four sites in the Chicago metropolitan area, Illinois, February 2002–December 2002. Study sites included: NB = Ned Brown Forest Preserve, PC = Poplar Creek Forest Preserve, MM = Max McGraw Wildlife Foundation, SCH = Village of Schaumburg

Decreased utilization of cottontail by coyotes has been found during summer months (Korschgen, 1957; Andelt, 1985; Leopold and Krausman, 1986). But similarly to rodents, cottontail abundance determined by roadside counts was highest during the pup-rearing season. The low occurrence of cottontail in scats during pup-rearing may be explained by a decrease in capture vulnerability by coyotes during the summer months due

to increased vegetation growth. In addition, the attraction of cottontails to grass along pedestrian paths, roads and picnic areas may have made them more observable during roadside counts.

Birds were an important part of coyote diets only at MM. Although birds were not identified by species in the scat analysis, bird remains in scats at MM were likely from captive-raised pheasants released for hunting from November through March each year. The pheasants released may have been vulnerable to coyotes due to their captive upbringing and lack of exposure to predators. Although pheasants do occur in other parts of northeast Illinois, the lack of observations from roadside counts of pheasants at the other sites showed they were not widely available. Pheasants were the only bird species recorded during prey surveys. Other bird species encountered during prey surveys were aquatic or non-terrestrial, and were determined not to be a prey species for coyotes.

The use of human-associated food items by coyotes in our study area was low compared to coyote studies in western states. Coyotes adapt to urbanized environments by consuming human-associated food items (McCracken, 1982; Fedriani *et al.*, 2001). In western Washington, domestic cats and squirrels (*Sciurus* and *Tamiasciurus* spp. were preyed upon more in urban areas than other mammal species; this contrasted with voles as the most consumed mammal in adjacent mixed-agricultural land (Quinn, 1997b). Near Tucson Arizona, McClure *et al.* (1995) showed a large reliance (35% occurrence) on human-associated food items. In southern California, Shargo (1988) showed a large occurrence of garbage (40.9%) and domestic cat (13.6%) in coyote scats. In the Chicago area, coyotes have been observed foraging in dumpsters and out of fast food bags (P. Morey, pers. obs.). The occurrence of human-associated foods in SCH peaked in pup-rearing and dispersal seasons when people were more active outdoors and probably leaving more trash. There was, however, a potential for garbage consumption by coyotes year-round in SCH that went underutilized. Even though on several occassions we witnessed coyotes pulling garbage out of dumpsters and eating curbside trash, radiotracked coyotes were regularly observed during garbage collection days, traveling through residential areas without feeding on curbside garbage.

Coyotes in forest preserves in our study area used human-associated food items less than in the developed SCH site. The presence of human-associated foods in coyote diets in developed areas may be due to their reduced fear and acclimation to human environments. The lack of human-associated foods in coyote diets in forest preserves may be due to a fear of human environments and their avoidance of such areas. However, human activity in the forest preserves, which was restricted to daylight hours, should not have prevented coyotes from foraging on garbage at night when humans were not present (Gehrt, 2004). The results suggest the lack of utilization of human-associated food items by coyotes in forest preserves had lower contact with humans than animals in SCH.

Coyotes in sites with the most human development had the highest dietary diversity. Fragmented landscapes often have the highest biological diversity (Rosenberg and Raphael, 1986). In southern California, coyotes in areas with higher human occupation had a greater dietary diversity than those in areas with a lower human occupation (Fedriani *et al.*, 2001). Dietary diversity may stabilize coyote populations in developed areas. The diverse prey utilization in developed areas allowed coyotes in these areas to have alternative food choices if a prey population declined. Because many of these alternate food choices were natural food items, this may explain why they do not rely heavily on human-associated food items. In addition, because of the high diversity of food options, coyotes in developed areas may be less likely to use and become habituated to human-associated food sources.

High dietary diversity indices during summer may be due to increased food availability, providing coyotes with more dietary choices. During summer, there was fresh plant material available, more vulnerable young prey and increased human garbage in parks and preserves. These same food items were absent during the winter when the diversity indices were low. Dietary diversity may explain why coyotes used rodents and cottontails less during the pup-rearing months even though they were more abundant. During the rest of the year, they relied on cyclic prey species such as rodents and cottontails when there was a narrower choice of prey species. An implication for this pattern is that during the breeding season when food diversity is low, coyotes, particularly those in less-developed areas, may venture into human landscapes in search of food.

Studying diets of coyotes in urban areas requires an examination of the spatial and temporal variation in the utilization and availability of food resources. There have been very few studies that have examined these two scales together, and none in the environment of the Midwestern United States. We found the main food items for coyotes in the Chicago metropolitan area, depending on where and when scats were collected, varied widely. Our results also showed coyotes in developed areas had different diets than those in less-developed areas. The high diversity of food items in developed areas may explain their low use of human-associated foods, which may reduce conflicts with humans. Baker and Timm (1998) found that coyote conflicts with humans in southern California have been due to coyotes becoming habituated with human-associated food. Conflicts between coyotes and humans in the Chicago metropolitan area may be low because there have been no conflicts with human-associated food. If this is true, other urban areas that also have a high diversity of food may have the same low conflict level between coyotes and humans.

Although the occurrence of coyotes in urban areas may be of concern to some managers and residents, their presence could be beneficial. Coyote predation could reduce deer populations on a local scale that are overpopulated, thereby reducing damage to tree saplings and vehicles. Studies have found the absence of coyotes in an area could also have negative effects on rodent richness and diversity (Henke and Bryant, 1999). Additionally, urban coyotes could reduce rodent populations causing damage to tree seedlings (Ostfeld *et al.*, 1997). Lack of coyotes may also cause meso-predator releases resulting in increased pressure on meso-predator prey (Crooks and Soulé, 1999). Our results have shown that there may be temporal and spatial variation in the conflict and benefit potential that coyotes have within the same urban area. To help determine when, where, or if coyotes in the urban landscape have these potentials, understanding this temporal and spatial variation is helpful.

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