Prey Composition of Barn Owl Pellets Collected in Oklahoma

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Abstract: We examined the prey composition of Barn Owl (*Tyto alba*) pellets from 26 counties in Oklahoma across five regions. A total of 49,186 pellets was collected from 1978 through 1992, representing 58,937 total prey items. The majority (98.6%) of the prey items were mammals, although birds, snakes, and invertebrates were also found. The most frequently encountered species were *Sigmodon hispidus* (n = 21,472), *Peromyscus* spp. (n = 9077), and *Chaetodipus hispidus* (n = 7381). Dietary composition by region broadly reflected published accounts of relative abundances of small mammal in each region. These results lead us to suggest that Barn Owls are generalist predators of small mammals across Oklahoma.

Introduction

Barn Owls (*Tyto alba*) are widely distributed on every continent except Antarctica (Marti 1992), making this species ideal for study of regional prey preferences. They feed primarily on small mammals (Askew et al. 2007, Velarde et al. 2007, Santos-Moreno and Alfaro Espinosa 2009), although fishes were most common in a Nevada study (Bogiatto et al. 2006). Taylor (1994) mentioned that individual Barn Owls occasionally focus on bird species such as Leach's Storm-Petrel (*Oceanodroma leucorhoa*) and Red-winged Blackbird (*Agelaius phoeniceus*). Barn Owls cannot easily digest bones, feathers, or fur and eject these remains as a pellet (Glue 1974). Numerous studies have used the remains from these pellets to evaluate the composition of the prey species community (Yom-Tov and Wool 1997, Shehab and Al Charabi 2006, Velarde et al. 2007).

However, these studies have not examined how prey composition may differ across ecological gradients. In Oklahoma, for example, many species, including birds, amphibians, reptiles, and mammals reach their eastern or western range limits (Blair and Hubbell 1938, Caire et al. 1989, Reinking 2004, Sievert and Sievert 2006). In contrast, Barn Owls are common in grasslands and some open forests in western Oklahoma, and are uncommon to rare in the northeast and southeast, probably due to lack of habitat (Reinking 2004). We

examined how Barn Owl prey diversity might vary across the state of Oklahoma.

Methods

We grouped Oklahoma counties into five areas: the panhandle, northwest, southwest, central, and northeast. The panhandle (Cimarron County) is characterized by low precipitation and shortgrass prairie and sagebrush (Woods et al. 2005). Cimarron County receives an average of only 438.4 mm of precipitation (Oklahoma Climatological Society 2014). The northwest (Alfalfa, Blaine, Custer, Dewey, Ellis, Major, Roger Mills, Woods, and Woodward counties) consists of mixed grass prairie and cropland, with precipitation increasing eastward (Woods et al. 2005) and receives an average of 716.3 mm of precipitation. The southwest (Beckham, Caddo, Comanche, Cotton, Greer, Harmon, Jackson, Jefferson, Kiowa, Tillman, and Washita counties) consists of mixed grass prairie integrating cross-timbers in the east (Woods et al. 2005). This region receives similar amounts of precipitation as northwestern Oklahoma, an average of 770.5 mm of precipitation per year. The central (Oklahoma County) region consists mostly of cross-timbers with mixed grass prairie in the west (Woods et al. 2005). Oklahoma County receives an average of 919.7 mm of precipitation annually. The northeast (Cherokee, Ottawa, Tulsa, and Wagoner counties) is composed of the oak-hickory and tallgrass prairie regions with higher amounts of rainfall (Woods et al. 2005) and receives an average of 1137.2 mm of precipitation annually.

Paul Wilson collected pellets across Oklahoma from 1978 through 1992 (Fig. 1). A total of 49,186 Barn Owl pellets was collected in 26 counties: Alfalfa (n = 2,846); Beckham (n = 1,750); Blaine (n = 1,314); Caddo (n = 46); Cherokee (n = 126); Cimarron (n = 387); Comanche (n = 196); Cotton (n = 1,489); Custer (n = 3,582); Dewey (n = 1,179); Ellis (n = 110); Greer (n = 16,439); Harmon (n = 3,378); Jackson (n = 5,231); Jefferson (n = 3,076); Kiowa (n = 298); Major (n = 1,395); Oklahoma (n = 675); Ottawa (n= 164); Roger Mills (n = 1); Tillman (n = 3,406); Tulsa (n = 467); Wagoner (n = 346); Washita (n = 251); Woods (n = 49); and Woodward (n = 985; Fig. 1) which represent 7 of 12 level III ecoregions in Oklahoma. Level III ecoregions are divisions nested within coarser level I and II ecoregions created by the Commission of Environmental Cooperation (CEC 1997). From west to east, High Plains, Southwestern Tablelands, Central Great Plains, Cross Timbers, Central Irregular Plains, Ozark Highlands, and Boston Mountains ecoregions are represented (Woods et al. 2005).

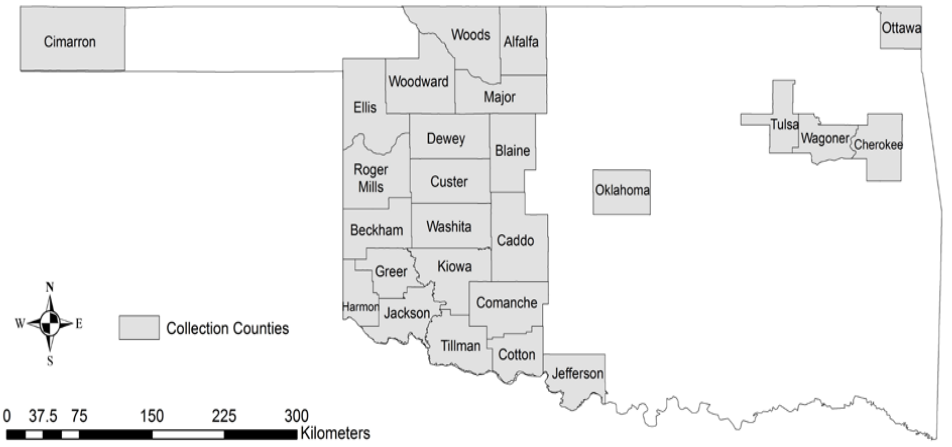
Pellets were soaked in water and dissected individually. Number of prey items were counted based on the number of similar bone structures (i.e. mandibles or parts of the cranium) that the pellet contained (Yom-Tov and Wool 1997). Complete, or mostly complete skulls were identified using Hall (1981). Prey fragments were identified to the lowest reliable taxonomic level. After identification, skulls were placed in the University of Central Oklahoma Natural History Museum. For the identified species or groups, we recorded the average body mass referencing Schmidly (2004) and Poole (2005), averaging masses for prey items identified only to genus. We did not include mass for items that we were unable to identify beyond family.

Results

We identified 58,937 prey. The majority (98.6%) were mammals, whereas 1.4% were birds (Table 1). In addition to mammals and birds, six snakes, six crayfish, and four insects were identified, representing only 0.03% of the prey species.

Of the species identified, 84.5% (n = 49,829) were Cricetidae (New World mice), 5.9% (n = 3,497) were Soricidae (shrews), 3.0% (n = 1,769) were Geomyidae (pocket gophers), 2.7% (n = 1,590) were Heteromyidae (pocket mice and kangaroo rats), and 1.6% (n = 919) were Leporidae (rabbits). Muridae (Old World rats and mice), Talpidae (moles), Vespertilionidae (bats), and Mephitidae (skunks) represented less than 1% of the prey total. In Oklahoma, Barn Owls fed predominantly on *Sigmodon hispidus* (36.4%, n = 21,472), *Peromyscus* spp.

Fig. 1. Oklahoma counties where Barn Owl pellets were collected from 1978-1992.



(15.4%, n = 9,077), and *Chaetodipus hispidus* (12.5%, n = 7,381), regardless of region. Introduced rodents such as *Mus musculus* (n = 6 or 0.01%), *Rattus rattus* (n = 206 or 0.35%), or *R. norvegicus* (n = 49 or 0.08%; Table 1) were not important components of the diet. Among avian prey, passeriforms accounted for 1.4% (n = 806) of the prey items identified. Remains from Falconiformes (falcons), Columbiformes (pigeons and doves), Strigiformes (owls), and Piciformes (woodpeckers) accounted for only 0.1% of the prey items.

Discussion

The percentage of mammalian prey consumed is similar (usually greater than 90%) to other studies conducted in neighboring states. *Sigmodon hispidus* was commonly consumed in studies by Parmalee (1954), Otteni et al. (1972), Goyer et al. (1981), and Baker (1991). *Microtus* voles, *Peromyscus* spp., *Reithrodontomys* spp., *Chaetodipus hispidus*, and *Cryptotis parva* were often important dietary components, likely representing commonly available species (Wooster 1936, Petitt 1951, Parmalee 1954, Otteni et al. 1972, Goyer et al. 1981, Baker 1991, Gubanyi et al. 1992), which agree with the results of this study (Table 1). *Oryzomys palustris* was identified as a heavily predated species in Texas by Otteni et al. (1972), Goyer et al. (1981), and Baker (1991). This species was not frequently consumed in our study, which may be attributed to lack of information about Barn Owl dietary habits in southeastern Oklahoma.

We examined prey composition by region. The four most commonly encountered mammals are found throughout most of the state (Table 2). In northeastern, central, northwestern, and southwestern Oklahoma, the pellet composition was dominated by *Sigmodon hispidus* (22-68%; Table 2), which is common and abundant throughout Oklahoma (Caire et al. 1989, Clark et al.1989). In contrast, *Peromyscus* spp. dominated the pellet composition in the panhandle (25%; Table 2). *Peromyscus* spp. also are common statewide (Caire et al. 1989). The third most consumed mammal, *Chaetodipus hispidus* (13% of the total pellets; Table 2), is present statewide except for the northeast and southeast corners of the state (Caire et al.

Table 1: Specimens from Barn Owl pellets were identified to lowest possible taxonomic level.

Class	Order	Family	Genus	Species	Number of Specimens	Average Mass (g)
Mammalia	Rodentia	Cricetidae	*Sigmodon*	*Sigmodon hispidus*	21472	115
Mammalia	Rodentia	Cricetidae	*Peromyscus*	*Peromyscus* spp.	9077	24
Mammalia	Rodentia	Heteromyidae	*Chaetodipus*	*Chaetodipus hispidus*	7381	47.5
Mammalia	Rodentia	Cricetidae	*Reithrodontomys*	*Reithrodontomys* spp.	5273	14
Mammalia	Rodentia	Cricetidae	*Microtus*	*Microtus ochrogaster*	3460	40
Mammalia	Soricomorpha	Soricidae	*Cryptotis*	*Cryptotis parva*	3450	5.8
Mammalia	Rodentia	Geomyidae	*Geomys*	*Geomys bursarius*	1768	140
Mammalia	Rodentia	Heteromyidae	*Dipodomys*	*Dipodomys ordii*	1590	65
Mammalia	Rodentia	Cricetidae	*Neotoma*	*Neotoma micropus*	1323	257
Mammalia	Rodentia	Cricetidae	*Onychomys*	*Onychomys leucogaster*	1011	36.5
Mammalia	Rodentia	Heteromyidae	*Perognathus*	*Perognathus flavus*	617	7
Mammalia	Lagomorpha	Leporidae	*Sylvilagus*	*Sylvilagus audubonii*	570	950
Mammalia	Lagomorpha	Leporidae	*Sylvilagus*	*Sylvilagus floridanus*	349	1500
Mammalia	Rodentia	Muridae	*Rattus*	*Rattus rattus*	206	200
Mammalia	Rodentia	Cricetidae	*Microtus*	*Microtus* spp.	187	25.5
Mammalia	Soricomorpha	Talpidae	*Scalopus*	*Scalopus aquaticus*	176	75
Mammalia	Rodentia	Muridae	*Rattus*	*Rattus norvegicus*	49	450
Mammalia	Soricomorpha	Soricidae	*Blarina*	*Blarina brevicauda*	47	24
Mammalia	Chiroptera	Molossidae	*Tadarida*	*Tadarida brasiliensis*	16	12.5
Mammalia	Rodentia	Heteromyidae	*Perognathus*	*Perognathus* spp.	14	12
Mammalia	Rodentia	Cricetidae	*Baiomys*	*Baiomys taylori*	9	7.8
Mammalia	Carnivora	Mephitidae	*Mephitis*	*Mephitis mephitis*	8	4000
Mammalia	Rodentia	Muridae	*Mus*	*Mus musculus*	6	38.5
Mammalia	Rodentia	Cricetidae	*Neotoma*	*Neotoma floridana*	5	275
Mammalia	Rodentia	Cricetidae	*Oryzomys*	*Oryzomys palustris*	2	51
Mammalia	Chiroptera	Vespertilionidae	*Myotis*	*Myotis velifer*	2	13.5
Mammalia	Rodentia	Cricetidae	*Neotoma*	*Neotoma* spp.	1	215
Mammalia	Rodentia	Geomyidae	*Geomys*	*Geomys* spp.	1	114
Mammalia	Soricomorpha	Soricidae	*Notiosorex*	*Notiosorex crawfordi*	1	4.3
Aves	Passeriformes	Fringillidae		Unidentified Fringillidae	408	
Aves	Passeriformes			Unidentified Passeriformes	106	
Aves	Passeriformes	Icteridae	*Sturnella*	*Sturnella* spp.	101	111
Aves	Passeriformes	Icteridae	*Sturnella*	*Sturnella neglecta*	100	102

Table 1 Continued

Class	Order	Family	Genus	Species	Number of Specimens	Average Mass (g)
Aves				Unidentified Aves	32	
Aves	Passeriformes	Emberizidae		Unidentified Emberizidae	19	
Aves	Passeriformes	Icteridae	*Sturnella*	*Sturnella magna*	7	120
Aves	Strigiformes	Tytonidae	*Tyto*	*Tyto alba*	4	525
Aves	Passeriformes	Icteridae	*Agelaius*	*Agelaius phoeniceus*	4	55
Aves	Columbiformes	Columbidae	*Columba*	*Columba livia*	3	160
Aves	Passeriformes	Cardinalidae	*Cardinalis*	*Cardinalis cardinalis*	3	45
Aves	Passeriformes	Icteridae	*Quiscalus*	*Quiscalus quiscula*	3	108
Aves	Passeriformes	Sturnidae	*Sturnus*	*Sturnus vulgaris*	3	78
Aves	Columbiformes	Columbidae	*Zenaida*	*Zenaida macroura*	2	133
Aves	Piciformes	Picidae	*Colaptes*	*Colaptes auratus*	1	135
Aves	Falconiformes	Falconidae	*Falco*	*Falco sparverius*	1	122.5
Aves	Passeriformes	Passeridae	*Passer*	*Passer domesticus*	1	28
Reptilia	Squamata			Unidentified Serpentes	6	
Decapoda				Unidentified Decapoda	10	
Insecta				Unidentified Insecta	4	

1989). *Reithrodontomys* spp. (9% of the total pellets; Table 2) are found statewide, though *R. fulvescens* and *R. montanus* are more common than *R. humulis* and *R. megalotis* (Caire et al. 1989). *Microtus ochrogaster* (6% of the total pellets; Table 2) is uncommon and found only in the northeastern to north-central part of Oklahoma (Caire et al. 1989).

Table 3 shows the relative mammal abundance reported in previous studies in five areas of Oklahoma where our data were concentrated. We contrasted their studies to the five most consumed species in our study. *Peromyscus* spp. (*P. leucopus* and *P. maniculatus*) and *Sigmodon hispidus* were the most abundant species in the northeast, northwest, and southwest regions, which mirrors the results of our study. *Sigmodon hispidus* was generally less common than *Peromyscus* spp. in the small mammal surveys but was the most common prey item in our study (excluding the Panhandle). This may be attributed to sampling biases in small mammal trapping as well as biases in pellet data. *Peromyscus* spp. may be overrepresented in small mammal trapping, while *Sigmodon hispidus* may be overrepresented in the pellets. Barn Owls could also be feeding preferentially on *Sigmodon hispidus*.

We detected proportionately more *Microtus ochrogaster* than these small mammal surveys indicated, which may mean that Barn Owls disproportionately prey upon *Microtus ochrogaster*, or this species is overrepresented in the diet. Whereas *Microtus ochrogaster* accounted for only 6% of the top five Barn Owl prey items, the species was the second most frequently consumed prey in the northwest, northeast, and central Oklahoma regions (Table 2). *Microtus ochrogaster* is generally uncommon across Oklahoma and is encountered frequently only in northeastern Oklahoma (Table 3). Our data also reflected a larger percentage of *Chaetodipus hispidus* than shown in the abundance studies (13%; Table 3). This supports that *Chaetodipus hispidus* is an important dietary component of Oklahoma Barn Owls. One species of *Reithrodontomys*, *R. montanus*, was abundant only in the northeast (Table 3).

The most abundant mammal for the

Table 2. Five most consumed mammal species in five areas of Oklahoma according to our study.

Panhandle	Percent (%)	Northwest	Percent (%)	Southwest	Percent (%)	Northeast	Percent (%)	Central	Percent (%)	Overall	Percent (%)
Peromyscus spp.	25	*Sigmodon hispidus*	22	*Sigmodon hispidus*	41	*Sigmodon hispidus*	53	*Sigmodon hispidus*	68	*Sigmodon hispidus*	36
Sigmodon hispidus	17	*Microtus ochrogaster*	19	*Peromyscus* spp.	17	*Microtus ochrogaster*	23	*Microtus ochrogaster*	16	*Peromyscus* spp.	15
Reithrodontomys montanus	17	*Peromyscus* spp.	13	*Chaetodipus hispidus*	14	*Cryptotis parva*	6	*Cryptotis parva*	10	*Chaetodipus hispidus*	13
Onychomys leucogaster	11	*Chaetodipus hispidus*	11	*Reithrodontomys montanus*	9	*Peromyscus* spp.	5	*Reithrodontomys* spp.	2	*Reithrodontomys* spp.	9
Chaetodipus hispidus	11	*Dipodomys ordii*	7	*Cryptotis parva*	6	*Reithrodontomys montanus*	5	*Peromyscus* spp.	2	*Microtus ochrogaster*	6

Table 3. Five most abundant mammal species in five areas of Oklahoma contrasted to our study.

Panhandle (Leslie et al. 2008)	Percent (%)	Northwest (Leslie et al. 2008)	Percent (%)	Southwest (Leslie et al. 2008)	Percent (%)	Northeast (Payne and Caire 1999)	Percent (%)	Central (Mitchell and Burns 1964)	Percent (%)	Our Study	Percent (%)
Dipodomys ordii	26	*Peromyscus leucopus*	35	*Peromyscus leucopus*	37	*Peromyscus maniculatus*	28	*Sigmodon hispidus*	76	*Sigmodon hispidus*	36
Onychomys leucogaster	21	*Sigmodon hispidus*	31	*Sigmodon hispidus*	36	*Sigmodon hispidus*	26	*Mus musculus*	9.7	*Peromyscus spp.*	15
Peromyscus maniculatus	15	*Chaetodipus hispidus*	6	*Peromyscus maniculatus*	7	*Peromyscus leucopus*	18	*Peromyscus maniculatus*	6.5	*Chaetodipus hispidus*	13
Perognathus flavus	11	*Dipodomys ordii*	6	*Chaetodipus hispidus*	4	*Microtus ochrogaster*	11	*Peromyscus leucopus*	4.8	*Reithdrodontomys* spp.	9
Chaetodipus hispidus	7	*Peromyscus maniculatus*	5	*Neotoma micropus*	4	*Reithrodontomys montanus*	4	*Cryptotis parva*	1.6	*Microtus ochrogaster*	6

panhandle (Table 3) is *Dipodomys ordii*, which is not reflected in the pellet composition for this study. We suggest that Barn Owls do not actively prey upon kangaroo rats in Oklahoma. Stangl et al. (2005) suggested that *Dipodomys* spp. are generally underrepresented in Barn Owl diets where present. Species within this genus may have well-developed predator avoidance mechanisms that allow them to escape predation by Barn Owls (Stangl et al. 2005).

Barn Owls in Oklahoma consumed 1.4% avian prey. Of this percentage, the majority of species fell in the families Fringillidae and Icteridae (0.69% and 0.56% respectively). While not an important component of the diet compared to small mammals, flocking passerines may have acted as a buffer against low mammal populations, as suggested by Otteni et al. (1972). The percentage of avian prey items present in the pellets is similar to studies from Nebraska, Kansas, and Texas (Petitt 1951, Goyer et al. 1981, Gubanyi et al. 1992).

The diet of Barn Owls in Oklahoma, although relatively diverse, was composed primarily of small mammals and is comparable to many other Barn Owl pellet studies in North America (Marti 1992), especially those of surrounding states. Important prey varied only slightly between regions, suggesting that dietary composition across Oklahoma is similar despite habitat and precipitation differences.

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