

## Food Habits of Urban American Kestrels, *Falco sparverius*

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### Introduction

American Kestrels (*Falco sparverius*) have been noted on the campus of Purdue University, West Lafayette, Indiana, since 1932 (14), and have nested there since at least 1979 (3). We noted kestrels nesting on the Purdue campus from 1982-1984. Similarly, nesting in an urban environment has been observed in downtown Oklahoma City (2), and on the University of Oklahoma campus (13). Information on the diet of urban kestrels is limited. On the University of Oklahoma campus, capture of House Sparrows (*Passer domesticus*) was observed. In a residential area of Nevada, Missouri, kestrels ate 5 types of prey; grasshoppers (Orthoptera), Six-lined Race Runners (*Cnemidophorus sexlineatus*), House Sparrows, a Horned Lark (*Eremophila alpestris*), and an American Robin (*Turdus migratorius*) (7). In contrast to the little studied urban American Kestrel, quantitative food habits data are available for the European Kestrel (*Falco tinnunculus*) which was studied on the University of Manchester campus (16).

The purpose of this study was to examine the food habits of urban American Kestrels and the habitats used for hunting. It was of particular interest to see if the abundant House Sparrow population was preyed upon, and whether the kestrels traveled from the urban campus setting to hunt short-grass habitats in surrounding areas. These data are compared with those of more frequently studied rural kestrels.

### Materials and Methods

#### Food Habits Analysis

Pellets and prey parts were routinely collected from beneath a Douglas fir (*Pseudotsuga menziesii*) and an American sycamore (*Platanus occidentalis*) used by American Kestrels as feeding stations on Purdue University campus from winter 1983 through spring 1984. Pellet contents were examined under a dissecting microscope. Prey parts and pellets were identified to major taxa, and to species when possible. Pellet contents were estimated to the nearest 5% of pellet volume if greater than 5%, or 1% if less than 5%. Each prey part was treated as one pellet. For each sample date, pellet contents were combined and averaged, providing a percent volume of the total for each prey type.

In 1982-83 the kestrel's diet contained significant quantities of House Sparrows, and bird-feeder seeds (millet and cracked corn) were consistently associated with these remains. Therefore, millet was dyed with green food coloring and placed daily at an existing bird feeding area from 16 to 28 April 1984. Pellets collected after 16 April were checked for green seed to see if sparrows were being captured on campus.

#### Habitat Analysis

Areas within a 1.64 km radius (maximum radius for American Kestrel pairs ranges from 0.4102 km to 1.8871 km [4]) of the Douglas fir feeding station were cover-mapped

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to determine the relative availability of various habitat types as an indicator of the availability of various prey types. Vegetation was classified as follows: rank grass (bush-hogged occasionally), shrubland, pasture and cropland, large lawns, forest, and residential (including roads, parking lots, buildings, and surrounding small lawns). An Intergraph Interactive Graphics Design systems computer was used for analysis and graphic plotting.

### Kestrel Watches

Coordinated observations of potential kestrel feeding areas were conducted. Some observers were stationed in study area habitats, while one observer remained on top of a parking garage with a view of the feeding station and large areas of campus. Observations of kestrel movements between areas were coordinated between observers with walkie-talkies; the times and directions of flight were recorded. Time, location, activity, and sex data were analyzed to see if males and females hunted different habitats.

## Results

### Food Habits Analysis

During 1983, the kestrel's diet consisted largely of voles, which were present on all sample dates (Table 1). All parts identified to species were Prairie Voles (*Microtus ochrogaster*), but frequently parts could not be identified to species. In winter (February) and spring (March through May), the diet consisted largely of small mammals, mainly voles, although Short-tailed Shrews (*Blarina brevicauda*), a House Mouse (*Mus*

TABLE 1. The diet of American kestrels on Purdue University campus, West Lafayette, Indiana, in 1983. (Data from pellet analysis by % volume technique). (T indicates < 0.5%).

Date	<i>Microtus</i>	<i>Blarina</i>	Other mammals	<i>Passer</i>	Other birds	Insects	Comment
17 Feb.	54		44			2	<i>Mus</i> , Araneida
22 Feb.	95					5	
17 Mar.	96				1	4	Lepid., Coleop., Scarab.
24 Mar.	28				72	T	
28 Mar.	51				49		
30 Mar.	91			7	1	1	Curcul., Formic. Homop., Scarab.
31 Mar.	48	9		32	10	1	Coleoptera Orthoptera
5 Apr.	38	10			52	T	Coleoptera
7 Apr.	28				72		
11 Apr.	89			3	8		
18 Apr.	38	20		40	2	T	Coleoptera
21 Apr.	60			40			
22 Apr.	23		20	30	26	1	<i>Synaptomys</i> Coleoptera
26 Apr.	99					1	Coleoptera
28 Apr.	98					2	Carabidae Cicindelidae
2 May	26	49		19	6		
24 Jun.	24	10		30	35	1	<i>Carduelis</i> <i>Passerina</i>
5 Jul.	13		20	27	40		<i>Spermophilus</i>
6 Jul.	6	6	10	74	2	1	Coleoptera
12 Jul.	64				31	4	Curculionidae Coleoptera
13 Jul.	60			40			

*musculus*), and a Southern Bog Lemming (*Synaptomys cooperi*) were also eaten. No birds were present in the winter diet. The spring diet contained fewer House Sparrows than other avian species. Insects were present on 69% of the pellet collection dates, although they usually were a very small part of the diet. Beetles (Coleoptera) comprised most of the insects in the winter and spring diet. Ground beetles (Carabidae), scarab beetles (Scarabaeidae), snout beetles (Curculionidae), and tiger beetles (Cicindelidae) were also present. Other insects eaten included representatives of the orders Lepidoptera Homoptera, Orthoptera, and Hymenoptera (ants; Family Formicidae). Spiders (Araneida) were present in the winter diet.

The 1983 summer (June and July) diet was largely birds. House Sparrows were eaten most frequently. An American Goldfinch (*Carduelis tristis*) and an Indigo Bunting (*Passerina cyanea*) were also eaten. Small mammals in the diet were largely voles, although Short-tailed Shrews and a Thirteen-lined Ground Squirrel (*Spermophilus tridecemlineatus*) were also eaten. Beetles, including snout beetles, made up the insect portion of the summer diet.

The diet in 1984 contained mostly birds; House Sparrows were most abundant (Table 2). Winter and early spring diets consisted almost totally of House Sparrows. From 13 April throughout spring, voles were present on every sample date, although birds still dominated the diet. Birds were present in all samples; House Sparrows were present in 87.5% of the samples. Three partially eaten Mourning Dove nestlings (*Zenaida macroura*) were recovered. Dark-eyed Juncos (*Junco hyemalis*) were found in the diet on five separate occasions. A European Starling (*Sturnus vulgarus*) was also eaten. Insects were few.

#### Habitat Analysis

Residential areas comprised 50% of the study area. The remaining area was 15% large lawns, 10% pasture and cropland, 10% forest, 5% shrubland, 5% rank grass, and 5% water (Figure 1). Kestrels hunted two areas off campus, designated as Areas 1 and 2, which were both rank grass habitats. Most vegetation in Area 1 was greater than 1 m tall, and included teasel (*Dipsacus sylvestris*), fescue (*Festuca* sp.), smartweed (*Polygonum* sp.), mint (*Menthus* sp.), goldenrod (*Solidago* sp.), queen anne's

TABLE 2. The diet of American kestrels on Purdue University campus, West Lafayette, Indiana, in 1984. (Data from pellet analysis by % volume technique.)

Date	<i>Microtus</i>	Other mammals	<i>Passer</i>	Other birds	Insects	Comment
21 Feb.			99		1	
24 Feb.	60		40			
12 Mar.			100			
16 Mar.			98		2	
26 Mar.			100			
9 Apr.				100		<i>Sturnus</i>
13 Apr.	60		40			
16 Apr.	41		19	41		<i>Zenaida</i>
17 Apr.	64		12	24		<i>Junco</i>
19 Apr.	47	6	2	45		<i>Junco</i>
20 Apr.	30		20	50		<i>Junco</i>
21 Apr.	15		65	20		<i>Zenaida</i>
24 Apr.	44		56			
25 Apr.	63		36		1	
26 Apr.	7		59	33	1	<i>Junco</i>
1 May	50			44	6	<i>Junco</i>

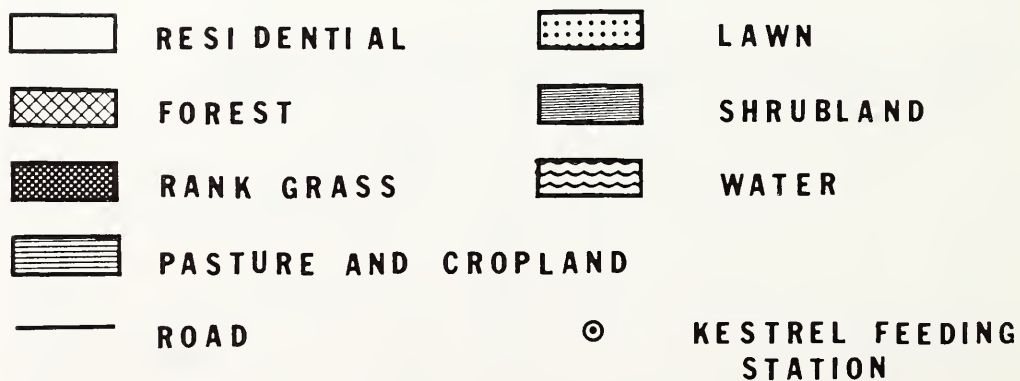
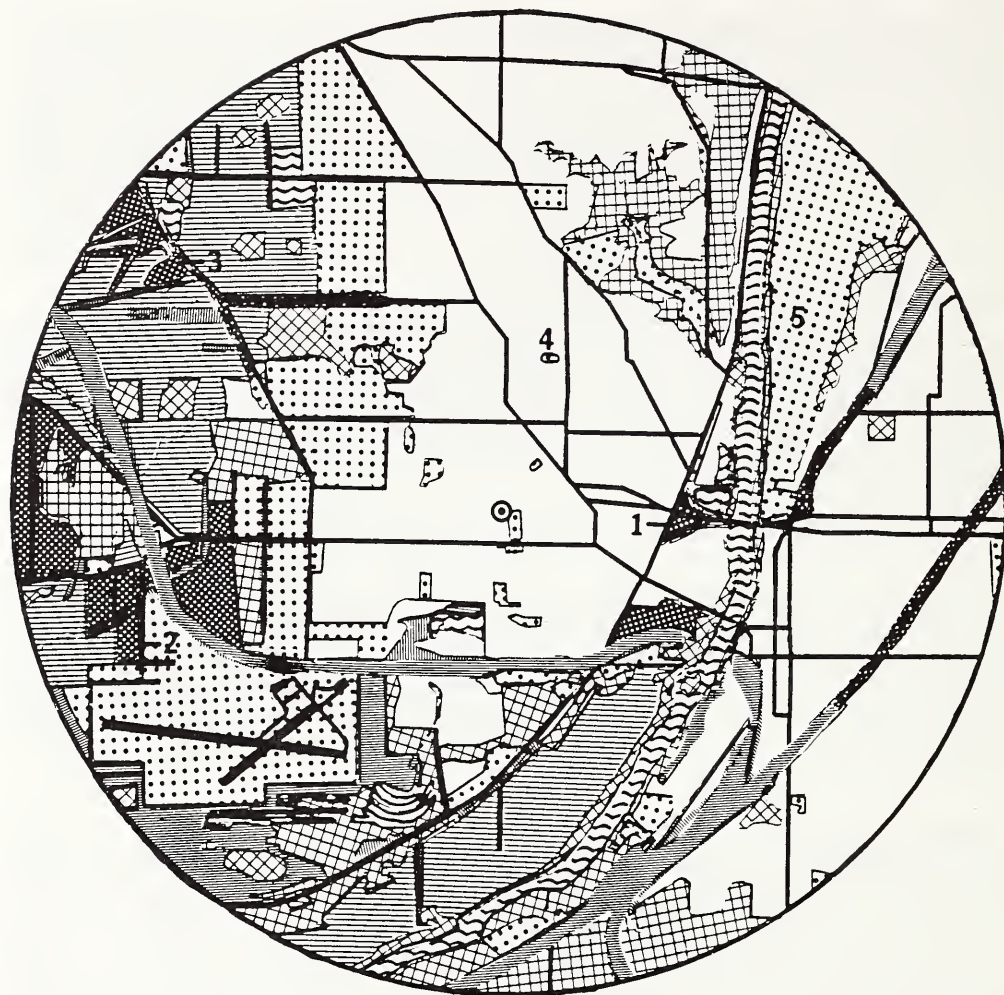


FIGURE 1. Habitat types within a 1.64 km radius of the Douglas fir feeding station on Purdue University campus, West Lafayette, Indiana. Five known hunting areas are labeled with numerals.

lace (*Daucus carota*), and a few scattered smooth sumac (*Rhus glabra*) and tree-of-heaven (*Ailanthus altissima*). Vegetation in Area 2 was less than 1 m tall, and included fescue, clover (*Trifolium* sp.), mint, and dandelion (*Taraxacum* sp.).

Kestrels were observed capturing small mammals in Area 1, a small waste area between bridge ramps, and the surrounding residential lawns. In Area 2, many attempted captures of small mammals were observed. Area 2 contained many vole runways and burrow entrances 3.5 cm. in diameter. To the east of Area 2 was a large lawn—an extension of the university airport supporting a large population of Thirteen-lined Ground Squirrels.

Kestrels were also regularly sighted in three areas along the campus periphery. Area 3 was a rank grass area, Area 4 a football field, and Area 5 a golf course and associated athletic fields. Though kestrels from campus were frequently observed heading towards these areas, we cannot be certain whether the birds observed hunting there were campus birds.

Kestrels were observed attempting to capture House Sparrows at a bird feeding station, and at other places on campus. As noted previously, millet and cracked corn were usually present in pellets containing House Sparrow remains, although no green dyed seed was found.

### Discussion

The American Kestrel preys upon a variety of small mammals, birds, insects, and herptiles (6, 8); the diet varies considerably by season and locality (1). House Sparrows are sometimes eaten in an urban environment (14). In a rural Indiana environment kestrels ate the following: 78% insects and spiders, 14% mammals, 6% herptiles, and 3% birds (9). It is evident from the present urban study, despite a lack of data from mid-May through mid-June, that birds and mammals are more heavily preyed upon. It is likely that our method of pellet analysis underestimates the number of insects in the diet, because of their small proportion of non-digestible parts, but our data surely indicate that insects are minor.

Theoretically, predation by an individual raptor will tend to reflect local prey densities of the species within its range that it is adapted to catch (4). Numerous vole runways and burrows in Area 2, and observed captures of mammals in Area 1, testify to the abundance of small mammals in these areas. Small birds were frequently present in Area 2, but the kestrels were never seen attempting to capture them. Small birds, especially House Sparrows, were abundant on Purdue's campus and surrounding residential areas. Pellets containing sparrow remains also contained seeds typically supplied at bird feeders. Kestrels were several times observed attempting to capture sparrows on campus, but were never seen attempting to catch birds in rank grass habitats. Outside the study area, on the northern edge of Lafayette, kestrels were seen flying into town and returning with sparrows. These kestrels regularly hunted a city playground where they were observed catching sparrows on two occasions.

Area 1 was heavily hunted for rodents. Thus small tracts of "waste areas" provide important habitat for urban kestrels. As urbanization continues to reduce the acreage of rural and wild lands, the importance of urban wildlife increases. The proportion of Americans living in urban areas is expected to increase in the future. The major contact many of these people will make with wildlife will be in this urban setting. Unlike many species, the kestrel is relatively tolerant of urban pressures, providing an easily observable and enjoyable urban wildlife experience. Thus, the wise management of resources to benefit kestrels and the urban wildlife enthusiast likely includes those management techniques which provide "waste areas" for kestrel use.

### Behavior

As in previous studies (15, 10, 11), the kestrels were often observing caching and retrieving prey. Unlike the silence noted by Sutton and Tyler (13), frequent calling

accompanied exchange of prey between male and female. Although it has been reported that kestrels do not use the same nest site in consecutive years (5), the kestrels at Purdue have nested in the same cavity for three consecutive years.

On 21 April 1984, in area 2, the male and female alternately hovered and pounced, "leap-frogging" over one another five times while hunting. It is assumed these actions flushed insects or small mammals which were then pursued. Although male kestrels have been found to hunt areas with vegetation taller than 1 m, while females prefer vegetation shorter than 1 m (11), no correlation of sex with vegetation height was found in this study.

### Summary

Several prey items found in this study have not been previously cited in the literature. These included the following: scarab beetle, snout beetle, tiger beetle, Dark-eyed Junco, American Goldfinch, Indigo Bunting, and Southern Bog Lemming. The food habits of urban American Kestrels differed in several ways from the food habits of rural American Kestrels; fewer mammals and insects were eaten, while more birds were eaten. Our data, like the Craighead's (4) suggests that prey is taken as available. It appeared that different habitats frequently were used for capturing different prey types. Birds, mainly House Sparrows, were readily available in most urban areas, while mammals were hunted in rank grass and short grass areas. In an urban situation, areas frequently considered "waste areas" are valuable to this small falcon.

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