

BARN OWL FOOD HABITS IN INDIANA

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ABSTRACT: Pellets from barn owls (*Tyto alba*) were collected in Indiana from 1983 to 1987. Skulls, mandibles, palate fragments, and non-principal prey parts were identified and tallied. Prey biomass was estimated using weights from the literature. Of the 12,905 prey items identified, 66% of them were voles (*Microtus* spp. and *Synaptomys cooperi*). Major prey buffer species were deer mice (*Peromyscus* sp.) and short-tailed shrews (*Blarina brevicauda*). Regional examination of food habits was conducted on 16 areas, and vole dependence ranged from 31% to 80%. The meadow vole (*M. pennsylvanicus*) was the most important prey species in all but the southwestern counties, where the prairie vole (*M. ochrogaster*) was most important. Seasonally, food habits varied only slightly. The mean weight per prey item was lower in Indiana than were those reported for other States.

INTRODUCTION

The common barn owl (*Tyto alba pratincola*) is on endangered species lists in 7 midwestern states (Rosenburg, 1986), and its decline has been attributed to changes in agricultural practices (Colvin, 1985). Past research in the Ohio Valley and the eastern United States has revealed that the meadow vole (*Microtus pennsylvanicus*) is the primary prey of the barn owl (Colvin and McLean, 1986; Pearson and Pearson, 1947; Rosenburg, 1986). Analysis of small collections of barn owl pellets from Indiana supported this finding (Castrale, *et al.*, 1983). Until now, however, a statewide analysis of barn owl food habits has not been reported. Variations in barn owl foods from 24 counties in Indiana and notes on incidental small mammal occurrences are reported in this paper.

METHODS

In 1983, the Nongame and Endangered Wildlife Program of the Indiana Department of Natural Resources initiated a search for barn owls by eliciting public reports. Report areas were searched and barn owl presence was verified by pellets. Nest boxes were placed in barns in most of these areas, and pellets were gathered during searches and nest box examinations. From October, 1983, to March, 1987, 2539 pellets and 4 pellet masses were collected from Indiana nest and roost sites. Pellets were air dried, labelled, and stored in plastic bags in a cool location. Pellets were sorted by date and locality. Groups of fewer than ten pellets were dissected by hand. Large groups of pellets were crumbed and placed

in a heated solution of 2% NaOH at a rate of 100 ml pellets to 1000 ml solution (Schueler, 1972), until bones were easily separated from dissolved hair.

All skulls, palate fragments, and mandibles were tallied as were all parts not recognized as vole, shrew, or mouse. Collections from Indiana State University and published keys (Glass, 1973; Hall, 1981; Mumford and Whitaker, 1982) were used to identify mammalian and avian prey. As a result of tooth loss during chemical digestion, some items had to be classified as unknown voles (*Microtus* spp.), unknown mice (*Peromyscus*, *Mus*, *Zapus* spp.), and unknown shrews (*Sorex* spp.). Limitations of digestion also led to combining deer mice (*Peromyscus maniculatus*) with white-footed mice (*Peromyscus leucopus*) and pine voles (*M. pinetorum*) with prairie voles (*M. ochrogaster*). Counted bird bones included skulls, beaks, femora, sterna, and synsacra. The highest count of prey parts for each prey group was used as the total number of that prey. The total number of unknown species parts was reduced by the number of known species parts which they could have duplicated. Thus, the unknown vole, mouse, and shrew counts are minimum estimates.

To estimate biomass of mammalian prey, mean body weights were taken from Mumford and Whitaker (1982) as follows: meadow vole (*Microtus pennsylvanicus* = 38.5 g), prairie vole (*M. ochrogaster* = 35.4 g), pine vole (*M. pinetorum* = 26 g), southern bog lemming (*Synaptomys cooperi* = 27.3 g), deer mouse (*Peromyscus maniculatus* = 16.2 g), white-footed mouse (*P. leucopus* = 21.1 g), house mouse (*Mus musculus* = 17.4 g), meadow jumping mouse (*Zapus hudsonius* = 18.2 g), short-tailed shrew (*Blarina brevicauda* = 16.9 g), least shrew (*Cryptotis parva* = 4.5 g), southeastern shrew (*Sorex longirostris* = 3.1 g), masked shrew (*Sorex cinereus* = 3.7 g), least weasel (*Mustela nivalis* = 38.3 g), eastern mole (*Scalopus aquaticus* = 107.1 g), and big brown bat (*Eptesicus fuscus* = 17 g). Averages of weights were used for the combined groups. Biomass figures for the Norway rat (*Rattus norvegicus*) were calculated from mandible measurements (Morris, 1979), but partial rat jaws were assigned the mean rat weight of 68 g. Young cottontail rabbits (*Sylvilagus floridanus*) were assigned a 90 g biomass (Colvin and McLean, 1986). Occurrences of large mammals were represented by the largest estimate of biomass of any one pellet (250 g). Bird weights were assigned according to the size of the bird parts found and ranged from 30 g to 100 g.

RESULTS

Statewide. A total of 12,905 prey items was identified from the pellets analyzed, and the total biomass of these individuals was 376 kg. Voles (*Microtus* spp. and *Synaptomys cooperi*) were 67.8% of all prey items taken and made up 80.1% of the total biomass. Meadow vole was the most important prey species, comprising 29.7% of the total items (Figure 1) and 39.2% of the total biomass (Figure 2). The prairie vole represented 27.1% of frequency and 28.6% biomass, and unknown voles were an additional 9.6% frequency and 11% biomass. Short-tailed shrew and deer mice made up 9.8% and 8.1% of the frequency and 5.7% and 5.2% of the biomass, respectively. Of 228 *Peromyscus* spp. skulls which could be identified to species, 64% were *P. maniculatus*, and 36% were *P. leucopus*. Due to their small size the house mouse and least shrew comprised less biomass (2.6% and 0.6%) than frequency (4.3% and 4.1%, respectively). Other mammals were less than 2% of the owl diet by frequency or biomass. Of interest are occurrences of big brown bat, least weasel, and young opossum (*Didelphis virginiana*). Red-winged blackbird

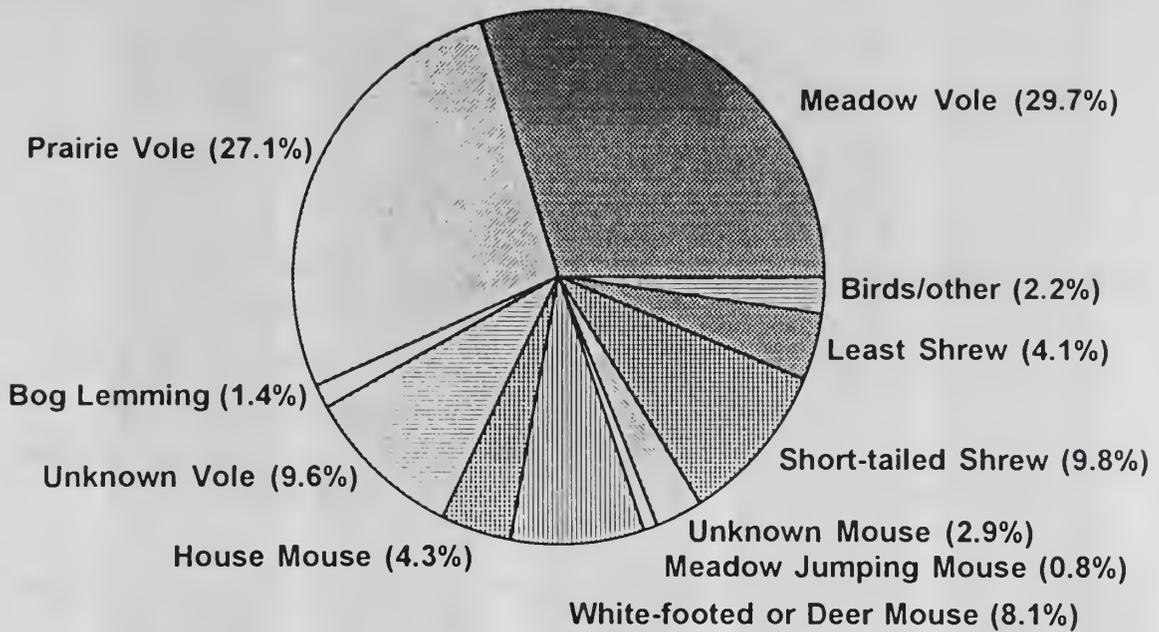


FIGURE 1. Relative Frequency of prey in barn owl pellets by species in Indiana from 1983 to 1987.

(*Agelaius phoeniceus*), starling (*Sturnus vulgaris*), rock dove (*Columba livia*), and other birds figured in the diet at less than 2% frequency.

Regional variation. Thirteen counties were chosen for evaluation of food habits as determined by total biomass of the pellet samples ($N > 2.5$ kg). Vole use ranged from 31% to 80% total frequency and from 46% to 89% total biomass. Except in certain areas, the food habits of barn owls were similar across the State. Meadow vole was the most important prey species except in southwest Indiana (Davies, Gibson, Perry, Spencer, and Sullivan Counties), where prairie voles were more important. In Floyd County, the meadow vole and prairie vole were of equal importance as barn owl food, but in Perry County, the meadow vole was not used at all.

The short-tailed shrew was 10% or more of the diet by both frequency and biomass in Floyd, Lake, Sullivan, Switzerland, and Washington Counties. Deer mice and white-footed mice composed 10% or more of the frequency and biomass in Davies and Lake Counties. The Lake County sample also included more than 10% Norway rat.

Seasonal food habits. Collections of pellets from a family of barn owls in Spencer County were made weekly from January, 1986, to March, 1987 and were analyzed in monthly groups. Voles represented from 81% to 94% of the total biomass of the owls' diets (Figure 3). Prairie voles were the staple food source (46% frequency and 50% biomass). The only noteworthy seasonal change in diet was the lowered use of the meadow vole from April to June of 1986. Combined frequency of other species remained under 20% for all months.

The prey biomass of two families of barn owls from winter 1985-86 to winter 1986-87 in Orange County is represented in Figure 4. Vole use ranged from 55% to 83% of the total biomass. The meadow vole was the major food source and was utilized more in winter. Mice were more frequently used than either shrews or

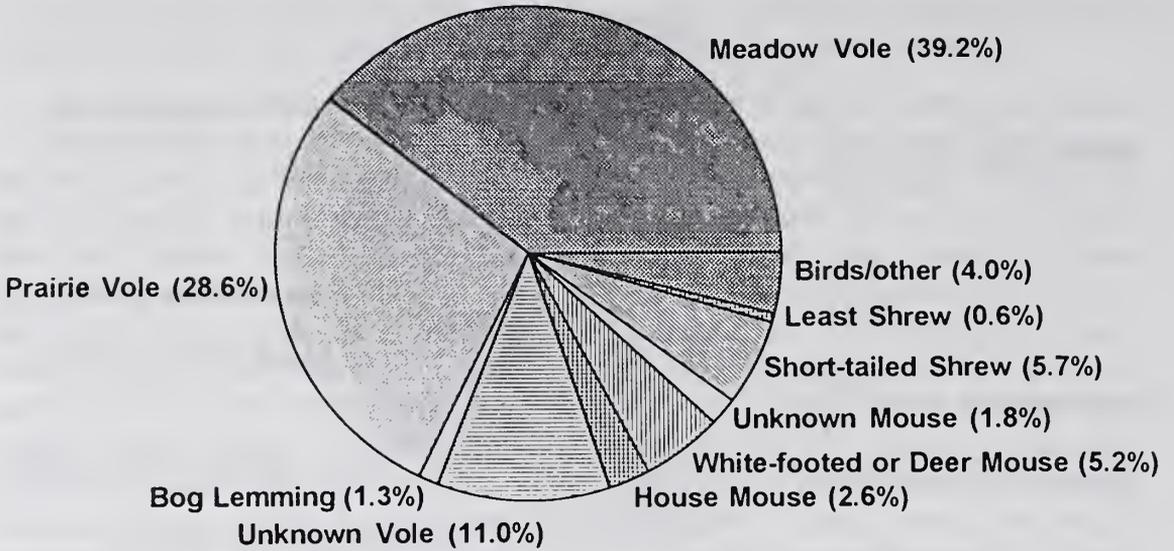


FIGURE 2. Relative biomass of prey in barn owl pellets by species in Indiana from 1983 to 1987.

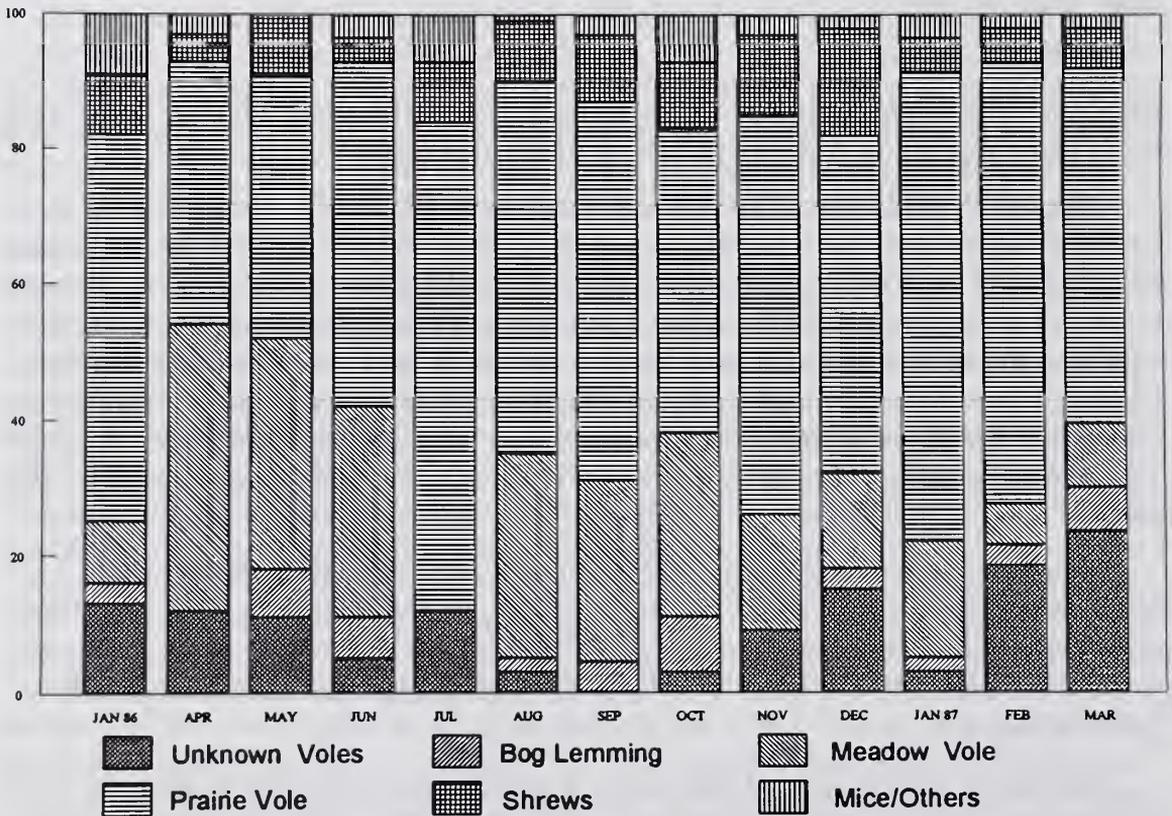


FIGURE 3. Monthly relative biomass of barn owl prey on the Spencer County area from January 1986 to March 1987.

prairie voles. During spring and fall, birds and unknown large mammals were more frequently fed upon.

Prey species distribution. No mammal species were found in pellets collected outside of the geographic ranges delineated by Hall (1981), but findings in counties where Mumford and Whitaker (1982) had not reported them are included

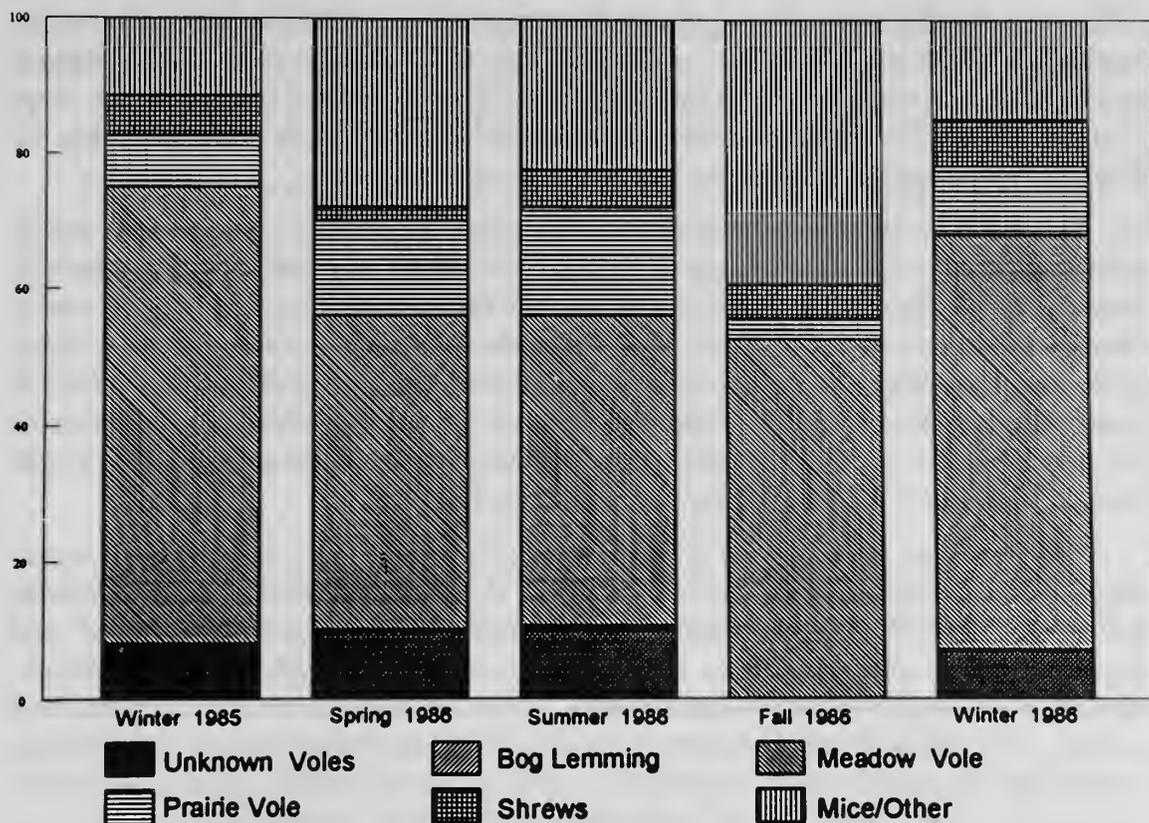


FIGURE 4. Seasonal relative biomass of Barn Owl prey on the Orange County area from December 1985 to March 1987.

here. The meadow vole was found in Daviess, Floyd, Lawrence, Orange, Spencer, Warrick, and Washington County pellets. The southern bog lemming was found in Gibson, Johnson, Orange, Owen, and Spencer County pellets. The meadow jumping mouse was taken by owls in Clark, Jennings, Perry, Sullivan, Switzerland, and Washington Counties. New records for the southeastern shrew include Jennings, Lake, and Orange Counties. The masked shrew was found in Orange and Switzerland County pellets. The location of the masked shrew in Orange County is noteworthy, because Cudmore and Whitaker (1984) had commented on its absence from south-central Indiana. The short-tailed shrew was found in Floyd County, the least shrew was found in Clark and Switzerland Counties, and a least weasel was found in Orange County.

DISCUSSION

Barn owl diets consisted of 70% to 90% voles in biomass on most of the areas studied. Of the 13 counties examined for comparison of regional food habits, two were somewhat different. The Lake County site is the northernmost record of a barn owl in Indiana in recent history (Iverson, 1988). Although Lake County is intensively farmed, the habitat near the roost site included a 2-mile strip of grass and brush bounded by a ditch. A single owl was observed there for one summer, and its diet reflected a lack of voles. Mice, shrews, rabbits, and rats made up a larger portion of its diet (67% by frequency) than was found elsewhere. Owls at an intensively farmed Daviess County site also depended more on mice and shrews (30% and 13% by frequency, respectively) than owls of other areas. Midwestern barn owls are dependent on marshes, thick grasslands, undergrazed pastures, old

fields, hay fields, and fallow ground to hunt voles in (Colvin, 1985). Barn owl habitat in Ohio has decreased markedly due to a change from early century practices of crop rotation which included hay-fallow to modern intensive row crops (Colvin, 1985). The Lake and Daviess County barn owl diets were probably influenced by marginal habitat and/or low vole availability.

Prairie voles replaced the meadow vole as the most important prey in southwestern Indiana. These findings correlate with Mumford and Whitaker (1982), who found meadow voles scarce southwest of a line from Clark to Vigo County. Orange County is along this range overlap. Owl diets there changed from using more meadow voles (54% total vole frequency) in 1982 (Castrale, *et al.*, 1983) to using more prairie voles (73% total vole frequency) in 1986. This area may provide prey alternatives for barn owls during low meadow vole years, especially if population cycles of the two vole species are asynchronous.

The seasonal variation of meadow and prairie vole use in Spencer County may reflect a preference for the meadow vole due to its optimal size as suggested by Colvin (1985). If the owls prefer the lowland meadow vole to the upland (and smaller) prairie vole, then they may hunt lowland areas during wetter periods. The Spencer County owl diet during July, 1986, indicates a greater proportion of prairie voles and mice than meadow voles. Shifting habitat use during the fledging period and nearby mowing operations may have induced this change. However, comments on prey populations and habitat use can only be speculative.

In Indiana, the mean weight per prey item was 29.0 g. Colvin and McLean (1986) calculated mean weights per prey item in New Jersey and Ohio of 38 g and 30 g, respectively. From Rosenberg's data (1986), the author estimated a mean of 32 g per prey item for Virginia, and Marti (1974) found an average of 46 g in Colorado. The Virginia, Ohio, and Indiana study areas were marginal in habitat compared to the New Jersey and Colorado areas. If barn owls of other areas are feeding on larger food items, then the birds of Indiana and Ohio are feeding less efficiently and are at greater risk during periods of low vole availability.

Barn owls appear to require voles in the Midwest to survive. They need a continuous food supply for at least 18 weeks in order to reproduce successfully (Otteni, *et al.*, 1972). Glue (1967) found that owl diets change from voles to less preferred prey, when thick stands of grass were cut or grazed. Thus, the owl-vole-grassland concept is fundamental for proper management of the common barn owl (Colvin and McLean, 1986). The minimum amount of grassland required to sustain a breeding pair of barn owls varies from 97 hectares in Virginia (Rosenburg, 1986) to 39 hectares within a 288 m radius in Ohio (Colvin, personal communication). However, Colvin suggests that even in the most ideal habitat, owls may not survive in a low prey year. Future research should attempt to estimate the minimum required habitat to sustain Barn Owls during a low ebb of the prey cycle in the Midwest.

The barn owls of Indiana are restricted primarily to the southern half of the State (Iverson, 1988). The reason for this is suspected to be both the avoidance of northern temperatures and snowfall and the more abundant small farms, abandoned farms, grassland-reclaimed coal mines, and idle land in the south. The region of meadow-prairie vole overlap may also provide a more stable food supply. Recommendations for preserving the common barn owl in Indiana as a nesting

species must include the maintenance of large areas of grassland, marsh, or hayfield.

ACKNOWLEDGMENTS

The author wishes to thank Chris Iverson of the Indiana Department of Natural Resources for the Opportunity to conduct this study. A Nongame and Endangered Wildlife Small Grant from the Indiana Department of Natural Resources funded this research. Thanks are due Scott Johnson and John Castrale (IDNR) and Don Whitehead (Indiana University) for manuscript assistance. Thanks to John Whitaker, Jr. (Indiana State University), Russ Mumford (Purdue University), an Dave Hudak (U.S. Fish & Wildlife Service) for technical assistance and to Max Dawson for pellet collections and advise.

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