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Food Habits of the Northern Saw-whet Owl in Central Iowa: Effects of Roost Location[1]

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During the period 1979-89, 900 northern saw-whet owl (*Aegolius acadicus*) pellets with identifable remains of prey were collected at 18 central Iowa locations. *Peromyscus* were the most frequent prey consumed, comprising 81.2% of all prey items. Other prey species were voles (*Microtus*), western harvest mice (*Reithrodontomys megalotis*), shrews (*Blarina brevicauda*, *Sorex cinereus*, and *Cryptotis parva*), and a single unidentified bird. *Peromyscus* comprised the largest proportion of pellets from different successional stages. There were significant differences for four prey groups (*Peromyscus*, *Microtus*, *Reithrodontomys*, and shrews) among years. *Peromyscus* and *R. megalotis* showed significant differences among locations. *Microtus* and shrews were variable in the diet and showed no consistent patterns.
INDEX DESCRIPTORS: food habits, Iowa, northern saw-whet owl

The northern saw-whet owl is a rare migrant and winter resident in Iowa (Dinsmore et al. 1984). During winter, this species prefers to roost in areas with scattered red cedar (*Juniperus virginiana* L.) or thick cedar groves, although other species of conifers are used (Swengel and Swengel 1987). Because of this preference, food habits are easy to monitor by collecting pellets.

There are several published reports on the food habits of northern saw-whet owls in the central United States (Errington 1932; Scott 1938; Mumford and Zusi 1958; Weller et al. 1963; McCabe 1972; Swengel and Swengel 1987). The main prey in northern saw-whet owl pellets collected near Coralville Reservoir in Johnson County, Iowa were white-footed and deer mice (*Peromyscus*) (Weller et al. 1963). Errington (1932), Scott (1938), McCabe (1972), and Swengel and Swengel (1987) also noted that *Peromyscus* were the main prey taken by northern saw-whet owls in the central United States. *P. maniculatus* was the most frequent prey item taken in studies in Oregon (Boula 1982) and British Columbia (Cannings 1987). In Washington, *P. maniculatus* was the second most abundant prey item after *Microtus* (Grove 1985).

Swengel and Swengel (1987) noted that northern saw-whet owls living in open habitats took 51% *Peromyscus* and 40% *Microtus* compared to 85% *Peromyscus* and 5% *Microtus* among owls inhabiting dense forests in the same region. *Peromyscus* tend to occupy a variety of habitats such as meadows, cultivated fields, forests, brushy areas and fence rows (Schwartz and Schwartz 1981). *Microtus* tend to occupy more grassy habitats such as grasslands, fallow fields, and fence rows.

Forbes and Warner (1974) reported the home range of a northern saw-whet owl during a 20-day period to be 114 ha, although only 74 ha were used consistently. Mumford and Zusi (1958) reported a smaller home range of about 41 ha whereas Cannings (1987) reported home ranges of 142 and 159 ha during the breeding season. Hayward and Garton (1984) noted that home ranges of northern saw-whet owls in Idaho were bisected by streams and associated deciduous riparian habitat.

We present the results of an 11-year food habits study of northern saw-whet owls in central Iowa. We report the mean number of identifiable prey items per pellet and the apportionment of identifiable items among several genera in 900 pellets collected at roosts in early and late successional stands of timber.

STUDY AREA

During 1979-89, northern saw-whet owl pellets were collected at 18 roosts in six central Iowa counties. Six roosts were sampled in Boone County, one in Guthrie County, four in Hardin County, one in Marshall County, four in Polk County, and two in Story County.

A roost was defined as the area occupied by one or more owls. All roosts were <1 ha. Most roosts were occupied continuously from December through March, although they were sometimes vacated after <1 mo of occupancy. Small (<5 m tall) red cedars were the most common roost site, except for a single roost in a jack pine (*Pinus banksiana* Lamb.) at Grammar Grove Wildlife Area in Marshall County.

The roost habitat descriptions presented here describe the habitat within a 300-m radius of the roost. Based on the work of Forbes and Warner (1974), we assumed that northern saw-whet owls feed and roost within a 300 m radius centered around the core roost area. Nine roosts, such as those in Polk County, were located in early successional woodlands along the shore of a large (>400 ha) lake. These areas were dominated by small <15 cm dbh) trees and brush. Dense, grassy areas dominated the understory. Predominant tree species included red cedar, honey locust (*Gleditsia triacanthos* L.), black walnut (*Juglans nigra* L.), and burr oak (*Quercus macrocarpa* Michx.). Numerous low brush and grassy areas were also common in these areas. The other nine roosts were located in late successional woodlands, such as those at Ledges State Park and Camp Hantesa in Boone County. Many of these roosts were located within 300-m of a small (<2 m wide) stream. These areas included numerous large (>25 cm dbh) trees and little or no brush. The understory was very open and consisted mostly of leaf litter. Dominant tree species at these sites included red oak (*Quercus rubra* L.), white oak (*Q. alba* L.), sugar maple (*Acer saccharum* Marsh.), basswood (*Tilia americana* L.), and American elm (*Ulmus americana* L.). These sites were often devoid of any brush or understory layer.

METHODS

Pellets were collected beneath known roosts from October through March, frozen, and later dissected to determine the prey species present. To increase reliability, only skulls were used to identify prey items (Schwartz and Schwartz 1981). In this region, two species of *Peromyscus* and two species of *Microtus* are known to occur. Because of the difficulty of identification of these species, the prey remains were only identified to genus. In this paper, *Peromyscus* refers collectively to *P. leucopus* and *P. maniculatus*, *Microtus* refers collectively to *M. ochrogaster* and *M. pennsylvanicus*, and *Reithrodontomys* refers to *R. megalotis*. No live-trapping was done to determine prey abundance.

In this paper, a given year represents a winter season, i.e., 1979 represents the winter of 1979-80. Because many roosts were used irregularly from year to year, sample sizes of pellets are not consistent.

For food habits analysis, each roost location was characterized by the successional stage in the vicinity of the roost. The successional stage was defined as either early or late successional.

We calculated the proportions of each species from all identifiable prey items in our samples. The proportions of each prey species were transformed with the arcsine function before running tests of signifi-

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cance, to insure that the data more closely approached a normal distribution (Sokal and Rohlf 1981: 427). We analyzed the arcsine transformed data with analyses of variance (ANOVA).

RESULTS

Sample sizes ranged from no pellets in 1980 to 745 pellets in 1988. We collected 1,520 pellets, but only 900 (59.2%) had identifiable prey remains. *Peromyscus* were the principle prey taken by northern saw-whet owls. *Peromyscus* accounted for 81.2% of the identifiable prey items. Voles (*Microtus*), western harvest mice (*Reithrodontomys megalotis*), house mice (*Mus musculus*), and shrews (*Blarina brevicauda, Cryptotis parva,* and *Sorex cinereus*) comprised most remaining identifiable prey items. Only one pellet contained any bird remains. In the 900 pellets with identifiable remains, there was a mean of 1.1 (range 1.0-3.0) identifiable prey items per pellet.

Successional Stage Comparison

Pellets were collected from roosts in early successional (n = 382) and late successional (n = 518) stages. There was significant variation among years for all prey groups tested; *Peromyscus* ($F = 4.50$, d.f. = 9, 860, $P = 0.0001$), *Microtus* ($F = 3.27$, d.f. = 9, 860, $P = 0.0006$), *Reithrodontomys* ($F = 3.65$, d.f. = 9, 860, $P = 0.0002$), and shrews ($F = 4.49$, d.f. = 9, 860, $P = 0.0001$) (Fig. 1). However, although variable, the proportion of *Peromyscus* remained dominant over the 10-year period. The proportion of *Microtus* appeared to peak in 1983. *Reithrodontomys* and shrews were each represented in the diet in only 7 of 11 years. Although the ANOVA revealed significant variation, yearly proportions of *Reithrodontomys* and shrews in the diet were always small (*Reithrodontomys:* $\bar{x} = 5.4\% \pm 1.7$ SE, shrews: $\bar{x} = 4.7\%$ 1.9 SE). *Peromyscus* ($F = 16.16$, d.f. = 1, 860, $P = 0.0001$), *Reithrodontomys* ($F = 9.69$, d.f. = 1, 860, $P = 0.0019$), and shrews ($F = 10.46$, d.f. = 1, 860, $P = 0.0013$) varied significantly between different successional stages (Fig. 2). There were also some significant interactions among years and habitat. *Microtus* ($F = 3.18$, d.f. = 6, 860, $P = 0.0043$) and shrews ($F = 4.58$, d.f. = 6, 860, $P = 0.0001$) varied significantly between successional stages within years. Within successional stages, both *Peromyscus* ($F = 2.15$, d.f. = 15, 860, $P = 0.0068$) and *Reithrodontomys* ($F = 4.00$, d.f. = 15, 860, $P = 0.0001$) varied significantly among locations. *Microtus* was most variable of all prey, significantly different among years within locations and successional stages ($F = 2.99$, d.f. = 8, 860, $P = 0.0026$) (Fig. 1).

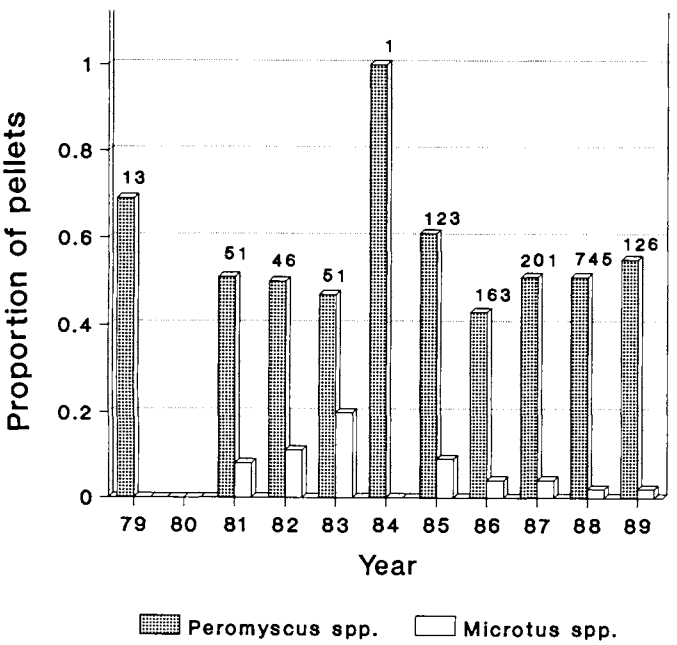

Fig. 1. Proportions of northern saw-whet owl pellets containing *Peromyscus* and *Microtus* in central Iowa, 1979-89. Numbers above each bar represent the number of pellets collected during that year.

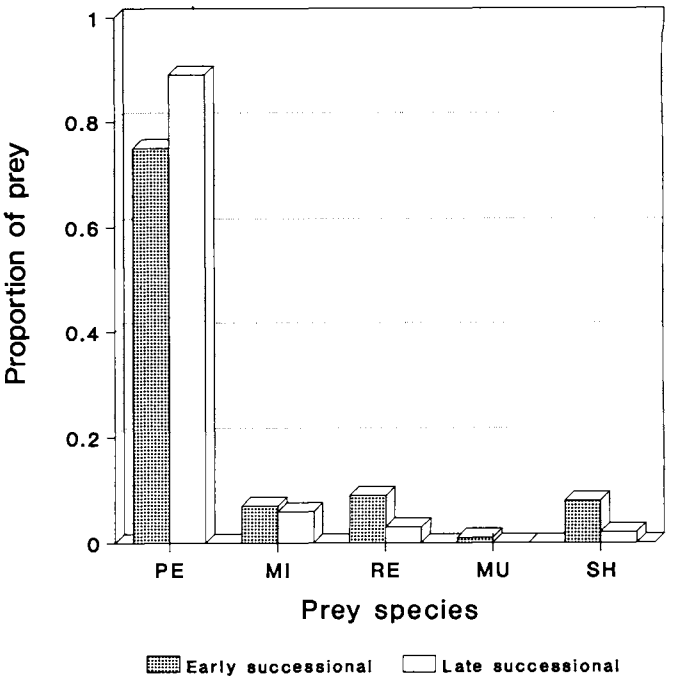

Fig. 2. Apportionment among various genera of identifiable prey in pellets of northern saw-whet owls collected in two habitat types in central Iowa, 1979-89. Symbols are: PE = *Peromyscus*, MI = *Microtus*, RE = *Reithrodontomys*, MU = *Mus*, and SH = Shrews.

DISCUSSION

Most studies of the food habits of northern saw-whet owls have noted that *Peromyscus* is the most frequent prey item consumed, and our findings are similar. Most *Peromyscus* we found were probably *P. leucopus* based on the wooded habitat (Schwartz and Schwartz 1981), but *P. maniculatus* was probably also represented in our samples. The large proportion of *Peromyscus* in each sample probably reflects the abundance of this genus in central Iowa. Differences in the number of *Microtus* and shrews consumed could be explained by the variable nature of their populations. The cyclic nature of vole populations is well-known (Schwartz and Schwartz 1981). Shrews, particularly *Blarina*, also tend to be periodically more abundant (Schwartz and Schwartz 1981). Such fluctuations in abundance could have influenced the year-to-year variation in the number consumed by northern saw-whet owls. The low representation of *Microtus* in our samples may also be due to the larger size of members of this genus, possibly making it harder for northern saw-whet owls to capture and ingest them.

Other food habits analyses of northern saw-whet owls (Scott 1938; Weller et al. 1963; Boula 1982; Grove 1985) have noted significant amounts of avian remains. Only one bird remain was found in this central Iowa sample.

McCabe (1972) noted that northern saw-whet owl pellets contained an average of two prey items. Weller et al. (1963) found an average of 1.6 prey items per pellet. The 1.1 prey items per pellet in our study is much lower than these studies, probably because only skulls were used to identify prey items. However, Collins (1963) noted that northern saw-whet owls in captivity never consumed a whole prey item at once; a single prey item was usually regurgitated in two pellets.

Peromyscus are probably abundant in both early and late successional habitats, although we did not have data on population levels. *Reithrodontomys* and shrews probably frequent early successional habitats because of their preference for grassy areas and a thick understory layer (Schwartz and Schwartz 1981). Smaller proportions of *Reithrodontomys* may be the result of its restricted habitat requirements and consequent scarcity near many roost locations. Both *Reithrodontomys* and shrews prefer habitats near water (Schwartz and Schwartz 1981). *Microtus* should also be more frequently abundant in early successional habitats, but differences in consumption were not evident in our results.

Tests using roost location as a variable should be interpreted cautiously since sample sizes often were small. Also, variability in the specific habitat at each roost location, such as understory or proximity to water, probably influenced our results. Both *Peromyscus* and *Reithrodontomys* varied significantly by roost locations within successional stages. These results are not surprising since vegetation characteristics within each successional stage varied among roost locations. Only *Microtus* showed significant differences among years within roost locations and successional stages, possibly due to population fluctuations or small sample sizes for some years.

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