

Winter Roost Habitat and Diet of Short-eared Owls (*Asio flammeus*) in Door County, Wisconsin

*During November through March of 1994–95, Short-eared Owls (*Asio flammeus*) were observed at and near a Christmas tree plantation in southern Door County, Wisconsin. Within the Christmas tree plantation, observation of owls, their pellets, and their tracks indicated its use as a communal roosting site.*

*Analysis of 25 studies containing information on 30 Short-eared Owl winter roosting sites using mean January temperatures from atlases revealed a tendency for them to roost in “cover” at colder temperatures (mean January temperature $< -1.1^{\circ}\text{C}$) and in areas of “no cover” at warmer temperatures (mean January temperature $> -1.1^{\circ}\text{C}$). The percent occurrence of diet items in 136 pellets was 99.3% meadow vole (*Microtus pennsylvanicus*), 1.47% house mouse (*Mus musculus*), 0.47% woodland deer mouse (*Peromyscus maniculatus*), and 0.47% Norway rat (*Rattus norvegicus*). Mean estimated mass (\pm SE) of meadow vole prey was 33.19g (\pm 0.37g).*

by Andrew Kinziger

The Short-eared Owl (*Asio flammeus*) is distributed throughout most of North America, South America, Europe, and Asia (Holt and Leasure 1993). In North America it makes irregular migrations, often stopping in areas with abundant rodent populations (Clark 1975, Holt and Leasure 1993). At its wintering locations, it

communally roosts in a variety of habitats. Some variation in roosting behavior has been partially explained by Bosakowski (1986), who demonstrated that snow prompted Short-eared Owls to roost in conifers. In addition to snow cover, I hypothesize that temperature may affect Short-eared Owl winter roosting habitat.

Short-eared Owls feed primarily on microtine prey in North America (Clark 1975, Holt and Leasure 1993). However Korpimäki (1986) demonstrated that owl feeding behavior may change according to geographical location. A recent occurrence of wintering Short-eared Owls in Door County, Wisconsin provided the opportunity to collect data on diet and roosting habitat for comparison with other geographical locations.

METHODS

The study site, located in southern Door County, Wisconsin (T26N,R24E,S23), contained a Christmas tree plantation of approximately 0.8 km². The plantation is composed of spruce and pine trees ranging from 0.5m-5m in height. It is surrounded by cultivated fields and fields set aside for the Conservation Reserve Program. Short-eared Owls occupied this area from approximately November to March of 1994-95. Before January 1995, the area was estimated to contain approximately 100 Short-eared Owls (Lange 1995), as well as Northern Harriers (*Circus cyaneus*), Rough Legged Hawks (*Buteo lagopus*), and American Kestrels (*Falco sparverius*).

Short-eared Owl roosting locations were assessed using two methods. The first included searches for regurgitated pellets within the Christmas tree plantation. The other consisted of a visit to the plantation the morning after a March snowstorm. During this trip an attempt was made to flush and estimate the number of owls in the Christmas tree plantation, and record notes on the position of the "tracks" made by the ground roosting owls.

To assess geographical variation in winter roosting habitat, I examined 25 studies containing information on 30 Short-eared Owls winter roost sites throughout North America. For the purpose of this study, winter included the months of November, December, January, February, and March, and literature containing information about roosting during any or all of these months is included in the analysis. I assigned the reported roosting sites to categories of "cover" and "no cover." Sites considered to contain "cover" were those in or near trees or woody or other debris (e.g., conifers, piles of lumber). "No cover" roosting areas contained light-colored vegetation or substrate (e.g., prairies, dunes). Each roosting site was also assigned to a temperature category of $< -1.1^{\circ}\text{C}$ ($< 30^{\circ}\text{F}$) or $> -1.1^{\circ}\text{C}$ ($> 30^{\circ}\text{F}$) using isotherms of mean January temperatures (Gerlach 1970, Garrett 1985, Mattson and Mattson 1990). The data were entered into a 2×2 contingency table and examined with Fisher's Exact Test (Sokal and Rohlf 1981). One-tailed test was used because I expected colder temperatures to be associated with "cover."

Pellets regurgitated by the Short-eared Owls were used as indicators of diet. Collections from the roosting site on 4 March and 14 April 1995 were brought to the lab for analysis. Fragmented pellets from both collections were eliminated from the analysis, and pellets in the second collection were differentiated from those of Northern Harrier by estimating bone percentage and discarding questionable pellets (Holt et al. 1987). The pellets were dried and teased apart with forceps, and prey remains were identified to species using Jones and Manning

(1992) and Burt (1957). Undamaged crania of meadow voles (*Microtus pennsylvanicus*), the dominant prey in this study, were used to estimate body mass. Measurements of upper diastema (UD), palatine foramen (PF) and rostral breadth (RB) were completed to the nearest 0.01mm with a digital caliper. These measurements were performed according to Blem et al. (1993) and entered into their equation for estimation of body mass in grams (N): $N = 17.52RB + 0.72PF + 6.18UD - 100.89$.

RESULTS

The Christmas tree plantation served as winter roost habitat for Short-eared Owls. This was indicated by the regular presence of owls and their pellets in the plantation. Other evidence included flushing approximately 30–35 Short-eared Owl and observation of owl “tracks” in the planation the morning after a March snowstorm.

Winter roost habitat as reported in the literature is summarized in Table 1. The Fisher Exact Test suggested a tendency for Short-eared Owls to roost relatively more often in “cover” at sites with mean January temperatures $< -1.1^{\circ}\text{C}$ ($< 30^{\circ}\text{F}$) and in areas of “no cover” where mean January temperatures are $> 1.1^{\circ}\text{C}$ ($> 30^{\circ}\text{F}$) (one tailed test, $p = 0.0152$) (Table 2).

Comparison of the two pellet collections revealed no obvious differences in prey size, and therefore the data were pooled (e.g., paired t-test of PF measurements $p = 0.87$). The 136 pellets had a mean length (\pm SE) of 43.54mm (± 1.07 mm) and contained 191 prey items (mean number of prey items per pellet 1.43), with a maximum

of 3 prey items in a single pellet. Meadow voles comprised 97.9% of the prey items, while house mouse (*Mus musculus*), woodland deer mouse (*Peromyscus maniculatus*), and Norway rat (*Rattus norvegicus*) constituted the remaining portion (Table 3). The mean estimated weight (\pm SE) of 185 meadow voles recovered from the pellets was 33.19g (± 0.37 g) (Figure 1).

DISCUSSION

Short-eared owls in their winter roosts are thought to prefer light-colored vegetation (“no cover”) over dark-colored vegetation (Craighead and Craighead 1956), and this roosting behavior has been observed by several researchers (Table 1). Light-colored vegetation is believed to conceal the owls by matching their light tawny colors (Craighead and Craighead 1956). However, it has been noted in other instances that owls roost in dark-colored vegetation such as conifers (Table 1). A third, intermediate condition has been established, in which Short-eared Owls move from ground roosts in light-colored vegetation to conifer roosts when snow is present (Bosakowski 1986). It has been hypothesized that this transition is due to the change in color of the roosting habitat to the white color of the snow, which does not adequately conceal the owls (Banfield 1947).

Although camouflage may be important in winter roost site selection, thermal characteristics of the roosting habitat may also be important. For instance, Bald Eagles (*Haliaeetus leucocephalus*) occupy winter roosts with the lowest mean and maximum wind speeds (Buehler et al. 1991). Further-

Table 1. Short-eared Owl studies roost locations, winter roost habitats, and assigned habitat and temperature categories.

Study	Location	Original description of winter roost habitat	Habitat category	Temperature category (°C)
Tomkins 1936	entrance to the Savannah River, Savannah, Georgia	"All along the dunes the roof rats and mice had their dens . . . This was in the same places used as day resting stations by the owls"	no cover	> -1.1
Baumgartner and Baumgartner 1944	Stillwater, Oklahoma	"several roosts were found on the grassy slopes"	no cover	> -1.1
Kirkpatrick and Conway 1947	Tippecanoe County, Indiana	"Their [short-eared owls] use of the wheat stubble for roosting was indicated by numerous pellets deposited there"	no cover	< -1.1
Weller et al. 1955	Columbia, Central Missouri	"Marsh Hawks were observed hunting over a field in the upland prairie region . . . Later observations revealed . . . Short-eared Owls feeding and roosting there."	no cover	> -1.1
Craighead and Craighead 1956	Ann Arbor, Michigan	"almost without exception, Short-eared Owls roost in timothy, fox-tail grass, brome-grass, or other light colored vegetation"	no cover	< -1.1
Reed 1959	Shiawassee County, Michigan	"resting on snow-covered ground, or roosting in the trees and on fenceposts . . . apple orchard where owls were said to roost frequently and along fence rows"	no cover	< -1.1
Long and Wiley 1961	Jasper County, Missouri	"pellets in grass and on the ground in a treeless, prairie habitat . . . owls were congregated on a semi-circular mud-bank in a flat area that is grassy and marshy" (pellets found in grassy area)	no cover	> 1.1
Graber 1962	Two sites in Champaign County, Central Illinois	"roosting sites of Short-eareds were grassy-weedy fields or grass grown slopes of drainage ditches"	no cover	< -1.1
Weller and Fredrickson 1963	Johnston County, Iowa	"short-eareds roosted in fields of tall grass and forbs"	no cover	< -1.1
Fitzner and Fitzner 1975	Whitman County, Southeastern Washington	"Short-eared Owl roosting site . . . Palouse Prairie vegetation . . . Idaho fescue, bluebunch wheatgrass"	no cover	< -1.1
Page and Whitacre 1975	Bolinas Lagoon, Point Reyes Peninsula, California	"Short-eared Owls roosted in the dunes"	no cover	> -1.1
Machniak and Feldhamer 1993	Saline County, Illinois	"roost on the ground in fields of foxtail, broomsedge little blue stem, switchgrass and fescue"	no cover	> -1.1
Hendrickson and Swan 1938	Ames, Iowa	"owls roosted in . . . the thicket" (logs and brushpiles)	cover	< -1.1
Snyder and Hope 1938, Banfield 1947	Toronto region, Canada	"roosting in ornamental evergreen planting about the York Downs Golf Course"	cover	< -1.1
Terres and Jameson 1943	Schuyler County, Central New York	"Short-eared Owls roosted in a white pine grove	cover	< -1.1
Johnston 1956	San Francisco Bay region, California	"composed mainly of leaf-out <i>Grindelia</i> , but there is a varying admixture of <i>Distichlis</i> and <i>Salicornia</i> . . . Short-eared Owls find roosting cover in daylight hours in these tangles"	cover	> -1.1

(continued)

Table 1. Continued

Study	Location	Original description of winter roost habitat	Habitat category	Temperature category (°C)
Short and Drew 1962	Ingham County, Southern Michigan	"communal roost consisting of a pile of discarded lumber and branches"	cover	< -1.1
Hoyt 1962	Ludlowville, near Ithaca, New York	"apparently were roosting in the cedars"	cover	< -1.1
Munyer 1966	Central Illinois	"All roosts were conifers"		
	Coles County		cover	< -1.1
	McLean County		cover	< -1.1
	Woodford County		cover	< -1.1
Clark 1975	Central New York			
	Cayuga County	"Abandoned limestone quarry with occasional stumps	cover	< -1.1
	Niagara County	"Scotch pine grove, swale, auto junkyard, storage for heavy machinery"	cover	< -1.1
	Seneca County (1)	"Stubble fields, stump piles"	cover	< -1.1
	Seneca County (2)	"Abandoned gravel pit"	cover	< -1.1
Ponshair 1976	Ottawa County, Michigan	"a scotch pine, <i>Pinus sylvestris</i> , plantation consisting 20 acres which has been a roosting ground for short-eared owls"	cover	< -1.1
Colvin and Spaulding 1983	Ohio, coast of Lake Erie	"roost locations at the base of ditch banks, logs and signposts in or boarding the field"	cover	< -1.1
Bosakowski 1986	Lyndhurst, New Jersey	"4-meter Austrian pines or 1m common junipers-roosted 1-2m above ground, or in <i>phragmite communis</i> marsh (reeds 2-3m)"	cover	< -1.1
This Study	Door County, Northeast Wisconsin	Christmas tree plantation (spruce and pine 1-2.5m in height)	cover	< -1.1

more, Walsberg (1986) determined that protection from wind or forced convection is of great importance in nocturnal roosting locations of Phainopepla (*Phainopepla nitens*). Descrip-

tions of Short-eared Owl winter roost site selection suggest a similar behavior, i.e., roosting in areas that would shelter them from harsh weather con-

Table 2. A 2 x 2 contingency table showing the number of Short-eared Owl roosts in "cover" and in "no cover" at colder (< -1.1°C) and warmer (> -1.1°C) temperatures.

Roost	< -1.1°C	> -1.1°C	Total
"Cover"			
Observed	16	1	17
Expected	13.03	3.97	
"No Cover"			
Observed	7	6	13
Expected	9.97	3.03	
Total	23	7	30

Table 3. Number and percent occurrence (number pellets with item/total number of pellets x 100) of prey items occurring in the diet of Short-eared Owls.

Species	Number	Percent occurrence
Meadow Vole (<i>Microtus pennsylvanicus</i>)	187	99.3
House Mouse (<i>Mus musculus</i>)	2	1.47
Deer Mouse (<i>Peromyscus maniculatus</i>)	1	0.47
Norway Rat (<i>Rattus norvegicus</i>)	1	0.47

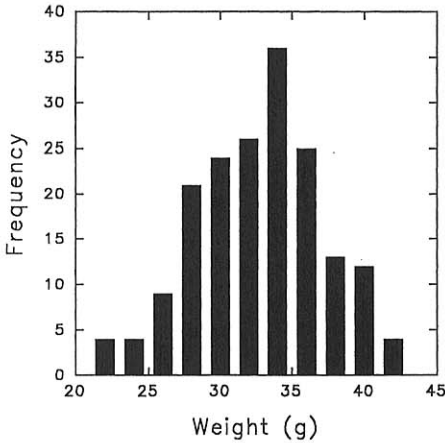


Figure 1. Frequency distribution of estimated meadow vole weights.

ditions (Hendrickson and Swan 1938, Short and Drew 1962, Munyer 1966, Clark 1975, Ponshair 1976). My analysis suggests that roosting behavior varies with geographic location and that temperature in addition to snow cover is an important factor affecting roost sites of Short-eared Owls.

According to a local resident, Short-eared Owls used the Christmas tree plantation roost site in the winter of 1987–88 in addition to the winter of 1994–95. During both years, local residents also noted large numbers of meadow voles. A nomadic specialist, the Short-eared Owl seems to have increased numerically in response to large meadow vole populations. This type of response has been documented for Short-eared Owls by Korpimäki and Norrdahl (1991) in western Finland. Many studies throughout North America also show a correlation between Short-eared Owls and the presence of large populations of small mammals illustrating that the Short-eared Owls' response to small rodents is widespread (Tomkins 1930, Syde

and Hope 1938, Terres and Jameson 1943, Baumgartner and Baumgartner 1944, Kirkpatrick and Conway 1947, Weller et al. 1955, Stegeman 1957, Reed 1959, Long and Wiley 1961, Clark 1975, Fitzner and Fitzner 1975, Baker and Brooks 1981). Nevertheless, other studies indicate that Short-eared Owls also prey occasionally upon birds and bats (Munro 1918, Huey 1926, Page and Whitacre 1975, Johnston 1956, Fisler 1960).

Adult meadow voles in Wisconsin weigh 36–56g (Jackson 1961). Based on my meadow vole mass estimates (mean = 33.19g), the prey eaten by the Short-eared Owl in this study can be categorized as subadults. Using the same methods, Blem et al. (1939) in northwestern Montana estimated mean weights (\pm SE) of meadow vole prey to be 30.3g (\pm 0.6g). My results suggest a geographic consistency in prey size of Short-eared Owls in North America, although these results may be confounded by the time of year, geographic size differences in voles, or other factors (Blem et al. 1993). In addition, some error may have resulted from estimating body mass with equations developed for other studies (Blem et al. 1993).

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