Nest Site Habitat and Prey Use of a Breeding Pair of Great Gray Owls in the Upper Peninsula of Michigan

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Abstract

We describe nest site habitat characteristics at two spatial scales and prey use for the first confirmed successful nesting pair of Great Gray Owls (Strix nebulosa) *in Michigan. Habitats around the nest site were considerably heterogeneous out to 2 km, but relatively homogeneous at ≥50 m. Thirty individual prey items were identified in 13 pellets, and mammalian prey comprised 87% of the identified remains. Five mammal species were identified by skeletal elements.* Microtus *voles were most prevalent, with a surprising number of Star-nosed Moles* (Condylura cristata) *also noted.*

The known breeding range of the Great Gray Owl (*Strix nebulosa*) encompasses primarily boreal regions throughout the Northern Hemisphere. In the conterminous United States, this species has been documented to breed regularly among the northern tier states and within several western mountain ranges, including the Rockies, the Sierra Nevadas, and the Cascades (Bull and Duncan 1993). In the Upper Great Lakes region, scattered breeding records exist from Michigan (Jensen et al. 1982; Brewer et al. 1991; Baetsen et al. 2005), Minnesota (Janssen 1987), and Wisconsin (Follen 1979; Merkel 1989; Cutright et

al. 2006). However, the vast majority of published research regarding the breeding biology of this species in the United States (e.g., habitat charactistics, prey use) has occurred from those populations further west (Bull et al. 1988a; Bull et al. 1988b; Franklin 1988; Bull et al. 1989).

In parts of its range, the Great Gray Owl is a year-round resident. Elsewhere, in response to the geographically asynchronous and cyclic nature of prey populations (especially *Microtus* voles), individuals may migrate between higher and lower latitudes at irregular, multi-year intervals (Bull and Duncan 1993). It is during these "winter irruptions" of lower latitudes that most owls have been observed in Michigan, the majority of records being from the state's Upper Peninsula (Wood 1951; Master 1979; Jensen et al. 1982).

Regarding the status and distribution of owls in Michigan during the early 20th century, Barrows (1912: 310) stated: "The Great Gray Owl must be considered one of our rarest birds. It is never seen except in winter, and often several years may pass without one being recorded . . . There is not the slightest reason to suppose that it ever nests within our limits, nor has it ever been recorded except in winter." However, over the remainder of the last century scattered reports (Jensen et al. 1982; Brewer et al. 1991) have suggested that the Great Gray Owl does in fact breed within Michigan, but no active nests had been observed. In 2004, the first active nest site of a Great Gray Owl in Michigan was found at Seney National Wildlife Refuge. From this nest, two owlets eventually fledged (Baetsen et al. 2005). This work is a quantification of the nest site habitat at two spatial scales (within 2 km and 50 m of the nest) and prey use based on pellets opportunistically collected at the nest site.

Study Area and Methods

Seney National Wildlife Refuge (SNWR) is located in Schoolcraft County of Michigan's Upper Peninsula. SNWR encompasses 38,541 ha. Approximately two-thirds of SNWR is wetland and one-third forested. This mosaic of wetland and upland habitat types provides for a diversity of both migratory and non-migratory bird species (Crozier and Niemi 2003). Common non-woody plant species found at SNWR include sedges (*Carex* spp.), bluejoint grass (*Calamagrostis canadensis*), other grasses (Poaceae), cattails (*Typha* spp.), and ferns and allies (Pteridophyta). Common woody plant species include alder (*Alnus* spp.), American beech (*Fagus grandifolia*), balsam fir (*Abies balsamea*), birch (*Betula* spp.), black spruce (*Picea mariana*), eastern hemlock (*Tsuga canadensis*), jack pine (*Pinus banksiana*), large-toothed aspen (*Populus tremuloides*), red maple (*Acer rubrum*), red pine (*Pinus resinosa*), sugar maple (*Acer saccharum*), white pine (*Pinus strobus*), and tamarack (*Larix laricina*).

The successful Great Gray Owl pair nested in a vacated stick nest located in a large-toothed aspen (*Populus grandidentata*). The nest tree was itself located within a Society of American Foresters Red Pine Research Natural Area (RNA). This RNA was established in 1948 for the long-term study of the red pine cover type and represents a relatively undisturbed condition; the last human-induced disturbance was a

backing fire during the 1976 Seney Fire (Anderson 1982). A more thorough description of the nest and nest tree can be found in the chronological breeding account of Baetsen et al. (2005).

We characterized the habitat around the nest tree at two spatial scales. Since prior research suggests that breeding owls may concentrate their foraging within a few kilometers from the nest (Bull and Duncan 1993), we analyzed patch characteristics within a 2-km buffer (1,180 ha) around the nest tree using a geographic information system (GIS) and the existing SNWR cover type data layer. This data layer, created by the United States Geological Survey's (USGS) Upper Midwest Environmental Center in La Crosse, Wisconsin, is the product of ground reconnaissance and subsequent interpretation of color-infrared air photos obtained in September 2004. Minimum mapping units were 2 ha. For more information regarding the classification process see Dieck and Robinson (2004).

We characterized habitat within 50 m of the nest by adapting methods from previous studies of Great Gray Owls (e.g., Whitfield and Gaffney 1997; Stepnisky 1997). To avoid disturbing the breeding pair and their young, fieldwork was conducted after both young had fledged (11 June 2004, Baetsen et al. 2005). Because the nest site was located in the RNA, no destructive vegetation sampling techniques were used. Understory data were collected at the four cardinal directions along five concentric rings, with the actual nest tree representing the central point. The concentric rings were located 2.5, 5.0, 10.0, 25.0, and 50.0 m from the nest tree. At these 20 points we measured basal area, percent cover of tree canopy, and percent cover of the shrub and ground flora layer within a 1-m^2 plot. Ground cover data were collected using the Braun-Blanquet cover class codes as discussed by Elzinga et al. (1998). To characterize the overstory we measured tree diameter and height wherever a tree intersected the perimeter of the five concentric rings emanting 2.5, 5.0, 10.0, 25.0, and 50.0 m from the nest tree.

Thirteen pellets were collected opportunistically from the forest floor within 75 m of the nest: four on 11 June, three on 30 July, two on 5 August, and four on 11 August 2004. Based on the condition of the pellets and other observations (Baetsen et al. 2005), it was assumed all pellets collected came from Great Gray Owls and not other owls species. For each sample from each of the four sampling dates, we combined the pellets and matched up the skull, teeth, and other skeletal elements. When necessary, skeletal remains were compared with museum specimens for identification purposes. Methods used provided a minimum count for the number of individuals of each taxon present.

RESULTS

Twenty-nine cover types (in 369 discrete habitat patches) were found within the 2-km buffer around the nest, representing 62% of all cover types found at SNWR. Forested cover types comprised 115 (31%) of all patches and 703.36 ha (60%) of the study area (Table 1). Overall mean (± 1SD) patch size was 3.20 ha (± 5.33 ha). The four more dominant cover

Table 1. Habitat characteristics within the 2-km nest site buffer. Only cover types represented by two or more discrete patches within the buffer are shown. Cover types are listed in ranked order based on total area.

	Habitat Characteristics		
Cover Type	No. patches	Mean patch size (ha) (±1SD)	Total area (ha) (% of buffer)
Open water	11	11.33(21.39)	124.62 (10.56)
Tamarack-spruce	40	2.63 (2.94)	105.16 (8.91)
Sedge-bluejoint grass	28	3.44 (4.37)	96.42 (8.17)
Red pine-jack pine	42	2.28 (1.73)	95.79 (8.12)
Marsh	13	7.35 (9.76)	95.48 (8.09)
Upland mixed conifers	32	2.80 (2.38)	89.44 (7.58)
Lowland scrub-shrub	18	4.07 (6.50)	81.34 (6.89)
Upland mixed forest	23	3.32 (2.67)	76.43 (6.48)
Aspen-pine	26	2.87 (3.35)	74.77 (6.34)
No. hardwoods-white pine-hemlock	15	4.85 (3.93)	72.75 (6.16)
Jack pine	17	2.72 (2.23)	46.23 (3.92)
Grass-ferns	9	3.86 (6.58)	34.76 (2.95)
Submergents	2	12.42 (8.14)	24.83 (2.10)
Black spruce	15	1.42 (0.80)	21.22 (1.80)
Spruce-fir	11	1.81 (1.13)	19.97 (1.70)
Aspen-birch-fir-spruce	12	1.54 (0.77)	18.48 (1.56)
Northern hardwoods	5	3.66 (3.86)	18.31 (1.55)
Aspen	7	2.43 (2.85)	17.00 (1.44)
Lowland mixed conifers	11	1.45 (1.29)	15.92 (1.35)

types (in terms of number of patches) were red pine-jack pine, tamarack-spruce, upland mixed conifers, and sedge-bluejoint grass. The four more dominant cover types in terms of area were open water, tamarack-spruce, sedge-bluejoint grass, and red pine-jack pine and the four more dominant cover types in terms of mean patch size were submergents, open water, marsh, and northern hardwoods-white pine-hemlock (Table 1).

Within 50 m of the nest we found little variation in most habitat features measured (Table 2). The mean (± 1SD) diameter breast height (dbh) of all 24 trees measured (i.e., 14 red pine, six white pine, three large-toothed aspen, and one red maple) was 44.04 cm (2.15 cm), and the mean height (±1SD) of these same trees was 26.66 m (2.76 m). Overall, the stand was well stocked, but with enough canopy open to create a multi-storied forest condition. The understory was relatively open and consisted primarily of *Vaccinium* spp.

Information from pellets collected on the same day was combined because it quickly became clear that elements from a single specimen were often distributed among multiple pellets (e.g., part of a skeleton in one pellet and the rest in another). Skeletal remains from 30 individual prey items were identified (Fig. 1). Mammalian prey of five species comprised 87% of the identified remains, namely Meadow Vole (*Microtus pennsylvanicus*, nine individuals), Star-nosed Mole (*Condylura cristata*, seven individuals), unknown *Microtus* spp. (four individuals), Southern Bog Lemming (*Synaptomys cooperi*, three individuals), and

Table 2. Mean (±1SD) of Great Gray Owl nest site characteristics 0–50 m from nest tree.

Habitat characteristic	Distance from nest (m)						Grand mean
	0	2.5	5	10	25	50	
DBH[a] (cm)	43.05 (-)	—	43.43 (-)	47.50 (-)	43.10 (7.65)	43.41 (6.49)	44.04 (2.15)
Height (m)	27.43 (-)	—	25.0 (-)	30.48 (-)	25.97 (4.80)	24.40 (2.85)	26.66 (2.76)
Basal area (m2)	39.62 (-)	41.91 (6.76)	49.53 (6.76)	57.15 (5.21)	48.01 (15.81)	45.72 (16.13)	46.99 (4.95)
% canopy	—	57.5 (6.45)	51.25 (14.36)	65.00 (29.72)	51.25 (10.31)	35.00 (29.72)	43.33 (12.27)
% shrub[b]	—	2.75 (0.96)	3.00 (1.41)	2.75 (0.5)	3.00 (1.0)	2.75 (2.06)	2.85 (0.14)
% ground flora[b]	—	2.75 (0.96)	2.25 (0.5)	2.25 (1.26)	2.50 (1.29)	3.00 (1.15)	2.13 (0.35)

[a]DBH = Diameter breast height (approximately 1.5 m from ground).
[b]Braun-Blanquet cover class code: 0 = 0%, 1 = 1–5%, 2 = 6–25%, 3 = 26–50%, 4 = 51–75%, 5 = >75%.

Figure 1. Skeletal elements of Star-nosed Mole.

Northern Flying Squirrel (*Glaucomys sabrinus,* two individuals). Other remains included unidentified *Glaucomys* sp., unidentified voles, an unidentified beetle, and unidentified birds.

Discussion

Although many aspects of the breeding biology (including nest site habitat and prey use) of Great Gray Owls have been relatively well studied where the owl is a regular breeder (Bull et al. 1988a; Bull et al. 1988b; Bull et al. 1989), there is a paucity of information on this species from elsewhere in its breeding range (Bull and Duncan 1993). Moreover, in areas such as the Upper Great Lakes region no study that we know of has quantified nest site habitat characteristics. Therefore, following the breeding chronology work of Baetsen et al. (2005), we documented nest site habitat at two spatial scales and prey use based on pellets collected at the nest site of the first confirmed successful pair of Great Gray Owls in Michigan.

When observed at the 2-km scale, habitat around the nest site was exceptionally heterogeneous and illustrated the wetland-forest mosaic that characterizes SNWR overall (Crozier and Niemi 2003). Although forest cover types comprised 60% of the total area around the nest and large-diameter red and white pines were prevalent within 50 m of the nest tree, only 31% of all cover type patches identified were forested. Numerous wetland cover types were found to be dispersed throughout the area, and a large (>10 ha) upland opening was also nearby. The fact that habitat characteristics within the 2-km buffer were exceptionally heterogeneous compared to within 50 m of the nest tree suggests that land managers trying to conserve or enhance Great Gray Owl breeding habitat must consider more than one spatial scale in their management decisions.

Prey use as illustrated by skeletal elements in this study was similar to the findings of Merkel (1989) from northern Wisconsin. Although a few Northern Flying Squirrels were identified in the pellets we analyzed, the natural history of identified prey suggests that the owls hunted primarily over the nearby non-forested (or openland) habitats. In our work—and again in that of Merkel (1989)—we found a predominance of *Microtus* voles, and a nearly total lack of shrews (e.g., *Blarina brevicauda*). The later finding seems surprising as shrews are abundant within the nest site vicinity at SNWR (pers. obs.). The predominance of Star-nosed Moles (23% of all identified prey) seems especially noteworthy as the only published literature we found that mentioned this species as prey was again the work of Merkel (1989).

Based upon our findings (albeit from a very limited sample size) and a review of the literature, we suggest that Great Gray Owls in the Upper Peninsula may select breeding habitat similar to birds in Canada (Harris 1984), Scandinavia (Mikkola 1981 in Bull et al. 1988b), Minnesota (Janssen 1987), and, in particular, Wisconsin (Merkel 1989). As suggested by others working in the Upper Great Lakes region (Follen 1979, Merkel 1989), the availability of existing stick nests and a mosaic of openland and forestland seem to be important nest site selection cri-

teria for Great Gray Owls. Based upon our knowledge of the surrounding area and other anecdotal evidence, we suggest that more breeding birds may be in the area. In northeastern Oregon (Bull et al. 1988a) and northern Wisconsin (Follen 1987; Gostomski 1997), increased surveying effort yielded higher Great Gray Owl breeding densities than expected. The same may hold true in the Upper Peninsula of Michigan and Seney National Wildlife Refuge in particular.

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Blue Jay by Dennis Malueg.