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THE PASSENGER PIGEON Vol. 68 No. 4 Winter 2006

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Send all manuscripts and related correspondence to the Editors. Information for "Seasonal Field Notes" should be sent to the Bird Reports Coordinator (see inside back cover). Art work and questions about the art should be sent to the Associate Editor for art (see left column). Manuscripts that deal with Wisconsin birds, ornithological topics of interest to WSO members, and WSO activities are considered for publication. For detailed submission guidelines, see pages 3–5 of the Spring 2000 issue (Vol. 62, No. 1) or contact the Editors. As a general guide to style, use issues after Vol. 60, No. 1, 1998.

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Front Cover: Breeding pair of Cooper's Hawks. The female is in second-year (SY) plumage with an orange eye color and the male is in adult, after-second-year (ASY) plumage with a dark red eye color that probably indicates an age ≥4 years (Rosenfield and Bielefeldt 1997). The photograph is by W. E. Stout.

Whither Wisconsin's Prairie-Chickens?

Something exciting is happening in the grasslands of central Wisconsin. As we speak, there are 40 Greater Prairie-Chicken (*Tympanuchus cupido*) hens from Minnesota roaming free in the Buena Vista Grasslands. The 7th and final group of birds trapped in northwest Minnesota was driven over to Wisconsin during the last week of September. With the cooperation of the Minnesota Department of Natural Resources, these chickens were first trapped and radio-collared last spring by John Toepfer, research consultant for the Society of Tympanuchus Cupido Pinnatus, Ltd. (STCP), with support from STCP and the Wisconsin DNR. They were re-located and -trapped again in September by Dr. Toepfer for the move across the river to Wisconsin.

Why have these Minnesota birds been translocated to Wisconsin? Blood samples collected from Wisconsin prairie-chickens by Dr. Toepfer as part of a STCP-sponsored research project were analyzed for genetic makeup by researchers in Dr. Peter Dunn's lab at UW-Milwaukee. The analysis showed that the genetic diversity of our Wisconsin prairie-chicken flock is significantly lower than the other remaining large populations in the nation (almost as low as the now-extinct Heath Hen), and 26% lower than the genetic diversity of Wisconsin prairie-chickens in the 1950s. A panel of national conservation genetics experts concurred with the recommendation of STCP that a translocation of birds, preferably from Minnesota, be conducted as soon as possible if we are to restore the genetic health of our Wisconsin birds and help guarantee their long-term presence here.

Thanks to the hard work of Dr. Toepfer and his field assistants, STCP, and Minnesota DNR, we now have Minnesota Greater Prairie-Chickens here in Wisconsin that will mix their genetic material with that of our Wisconsin birds. There are plans to move additional Minnesota hens in the coming several summers to help ensure that this genetic infusion is a success. Researchers from UW-Madison, UW-Milwaukee, the Wisconsin DNR, and STCP are helping evaluate the success of the translocation project.

But fixing the genetic problem is likely not the whole solution. Creating and maintaining additional grassland habitat in central Wisconsin is critical if we are going to reconnect sub-populations of Greater Prairie-Chicken that STCP-sponsored research has shown are now isolated, due to changing land use patterns. The isolation of populations at the Mead and Paul Olson Wildlife Areas from the main chicken population at Buena Vista and Leola has been a significant factor in the loss of genetic diversity of Greater Prairie-Chickens in Wisconsin. There is now a new partnership effort, the Central Wisconsin Grassland Conservation Area project, which aims, among other things, to establish grassland habitat between the areas where sub-populations of Greater Prairie-Chicken are now. This new habitat should aid in the re-connection of prairie-chicken populations, which in turn will increase the chances that we will have prairie-chickens on the Wisconsin landscape for our grandchildren's grandchildren to enjoy. I hope you agree with me that we owe survival of prairie-chickens in Wisconsin not just to our grandchildren, but to the birds themselves.

David W. Sample
President

This photo of a hawk imprint in the snow was taken in December 1992 during a rabbit hunt by Robert Kirsten in Waukesha County, Wisconsin.

Synchronization

The Passenger Pigeon is a quarterly journal and on the cover of each issue is the name of a season, along with a number, to indicate which issue of the year that one is. If you have been reading the Pigeon very long, you will have noticed that the season reported within the issue was never the same as the season named on the cover. When the cover said Spring the seasonal report inside was for Summer, for example. The current editors found that extremely confusing.

In order to have the same season named on the cover and reported inside, we have produced this issue, Vol. 68, No. 4, Winter 2006, without a seasonal report and early in the mailing cycle. This is your fifth issue of *The Passenger Pigeon* in 2006.

You will receive Vol. 69, No. 1 which will contain the spring seasonal report and be labeled Spring 2007, in late February of 2007, about the same time as the spring seasonal report has always appeared (although in an issue called Winter and No. 4 on the cover). From that issue on, the season named on the cover will be the season reported about inside. The four issues of volume 69 for 2007 will all be mailed out within the calendar year 2007, appearing at the beginning of each of our seasons: No. 1 will say Spring on the cover and report on the spring season inside and you will receive it by 1 March, No. 2 will say Summer on the cover and report on the summer season inside and be received by you by 1 June, No. 3 will be Fall and contain the fall seasonal report and be in your mail by 1 August, and No. 4 will say Winter and contain the winter seasonal report and reach you by 1 December.

We hope this makes both producing and enjoying each issue of the Pigeon easier.

Now all the editors need are some interesting articles to go in these issues.

Bettie and Neil Harriman, Editors

A Townsend's Solitaire enjoying a stretch was photographed by Alan Stankevitz at Devil's Lake State Park.

The Status of Breeding Cooper's Hawks in the Metropolitan Milwaukee Area

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Abstract

During 14 years, 1993–2006, in Milwaukee and the surrounding suburbs, Wisconsin's largest city and metropolitan area, urban-nesting Cooper's Hawks (Accipiter cooperii) *averaged 68.7% nesting success, 2.4 young per laying pair, and 3.5 young per successful pair. Urban nesting habitat included a wide variety of residential and park land as well as industrial and commercial land, golf courses, and cemeteries. The percentage of second-year (SY) breeders within this population declined over the 14-year period, in accord with other relatively young raptor populations. Based on relatively high reproductive output, recruitment from within this population, continued reoccupancy of nest sites, and apparent persistence of SY breeders, the breeding population of Cooper's Hawks in the metropolitan Milwaukee area is at least stable and not a sink, and is perhaps increasing in this urban environment.*

Introduction

During the past 25–30 years, urban-nesting Cooper's Hawks (*Accipiter cooperii*) have been reported crosscontinentally in at least ten North American states and provinces including, for example, Arizona (Boal and Mannan 1999) and British Columbia (Beebe 1974; A. C. Stewart and R. N. Rosenfield, unpublished data) in the West, New York (DeCandido 2005) in the East, and North Dakota (T. Driscoll and R. N. Rosenfield, unpublished data) and Wisconsin (Rosenfield et al. 1996, Stout et al. 2007) in the Midwest. For Wisconsin, Rosenfield and Anderson (1983) first reported on the status of Cooper's Hawks across the state, and Murphy et al. (1988) documented a Cooper's Hawk pair nesting in a woodlot in residential (i.e., suburban) Plover, Portage County, in 1981. Stout et al. (2007) studied reproductive success, age structure, nest site reoccupancy, and natal dispersal for an urban Cooper's Hawk population in the metropolitan Milwaukee area in 1993–2004; and Stout et al. (2005) documented the presence and prevalence of West Nile virus (WNV) in this population during 2003–2004. Because nest site availability, prey populations, and other ecological factors that affect habitat quality may vary greatly among the wide variety of urban habitats within individual cities and across a continent-wide breeding range, additional data on the demography and nesting biology of Cooper's Hawks in urban environs are desirable. Here we summarize the results of Stout et al. (2005, 2007), include two additional years of demographic data from 2005–2006, and provide other interpretations regarding the status of the Cooper's Hawk population in metropolitan Milwaukee. Further, we describe habitats used by nesting Cooper's Hawks in this metropolitan area, and expand on the topic of West Nile virus in this species.

Methods

Study Area

The study area encompassed approximately 1,000 km^2 in Milwaukee County and adjoining parts of Waukesha, Washington, Dodge, and Ozaukee Counties. Landscape composition ranged from high intensity urban land-use in Milwaukee, Wisconsin's largest city with an area of 251 km^2 and a human population ca. 600,000, to lower intensity land-use in the surrounding suburban communities.

Nest Surveys

Cooper's Hawk nests found between 10 April and 30 May were visited at least twice, once during early incubation and again when the young reached a bandable age (ca. 18 days), to determine reproductive success. We followed Postupalsky (1974), and Steenhof and Newton (2007) in defining a laying pair as a mated pair of birds that laid eggs, a breeding area or nest site as an area that contains one or more nests within the home range of a pair of mated birds, and a successful pair as birds that raised at least one young to a nestling age ca. 16–19 days old or 70% of fledging age (Stout et al. 2007, Rosenfield et al. 2007). Fieldwork on Cooper's Hawks was performed in tandem with annual nest surveys for Red-tailed Hawks (*Buteo jamaicensis*) and Great Horned Owls (*Bubo virginianus*). All Cooper's Hawk nests located during 1993–1995 were found incidentally during intensive searches for hawk and owl nests; none were found during earlier hawk and owl nest searches in 1987 through 1992. Beginning in 1996, we annually targeted Cooper's Hawk nests as a survey objective. We did not fully cover the entire study area yet did find nest sites objectively without foreknowledge or preconception of the presence of nesting Cooper's Hawks. Search efforts were annually comparable during 1996–2006. We suggest that these nest sites are an unbiased sample of breeding Cooper's Hawks within the study area. When an initial nesting attempt failed, we re-surveyed the area for a second nesting attempt (i.e., a re-nest). Our calculations of nesting success and productivity are based on the number of young that reached a bandable age (Stout et al. 2007). Nesting success is reported here as the percentage of nest sites or laying pairs that produced young on first or second nesting attempts at the same site, and productivity is the number of young produced per laying pair or successful pair in first or second nesting attempts. For a comparison of first and second nesting attempts, see Stout et al. (2007). We also documented the habitat type and nest tree species for each nesting attempt.

Composition of Breeders: Population Age Structure

We used brown yearling (second year: SY) and gray after-second-year (ASY) plumages to index the relative age of the nesting population. We trapped breeding Cooper's Hawks in mist nets using a live Great Horned Owl as a decoy (Rosenfield and Bielefeldt 1993a) during the nestling and fledgling stages from 1996 through 2006. Captured hawks were banded with USGS aluminum leg bands, as well as colored, alpha-numerically coded leg bands. Nestlings were marked with aluminum bands only (Fig. 1), in an attempt to detect natal dispersals, the movement of birds from hatch sites to subsequent breeding sites (Greenwood 1980).

Statistical Analyses

We used one-way Analysis of Variance (ANOVA) to compare Cooper's Hawk productivity across years for nesting attempts. We used linear regression to determine if the proportion of SY breeders varied over time. We pooled age structure (i.e., composition of SY breeders) data into two-year categories (e.g., 1993 and 1994, 1995 and 1996, etc.), and applied a one-way ANOVA and subsequent post hoc test (Sidak Multiple Comparisons test) to determine how the composition of SY breeders varied across the 14-year period. Data from 1993 and 1994 were included in the analyses of age structure despite the smaller sample sizes in those years because we speculate that this may have been the approximate time at which nesting Cooper's Hawks in this urban location were first becoming more common and more detectable. We used SYSTAT (SPSS 2000) for statistical analyses. Significance was accepted at $P \leq 0.05$.

RESULTS

Reproductive Success

During extensive fieldwork on other raptors within the metropolitan Milwaukee area, we made no incidental discoveries of nesting Cooper's Hawks in 1987–1992. However, we have since

Figure 1. Three Cooper's Hawk nestlings approximately 22 days old. These three birds are sporting U.S. Geologic Survey (USGS) aluminum lock-on leg bands. Photo by W. E. Stout.

detected 316 nesting attempts (i.e., laying pairs) on the study area in the 14 subsequent years through 2006. Although nests were few (annually ≤ 8) before 1996 and our search of the study area was not exhaustive, it is perhaps worth remarking that the mean number of nesting attempts was 22.6 per year (range 4–32) in those 14 years in an urban landscape. Nesting success (n = 316) was 68.7% with means of 2.41 and 3.54 young per laying pair (n = 312) and successful pair (n = 217), respectively (Figs. 1–3). Productivity (the number of young per laying pair and the number of young per successful pair) did not vary significantly over the 14-year period (P = 0.377 and 0.704, respectively). We note here that we found evidence implicating Great Horned Owl predation on a brooding female Cooper's Hawk at a nest in 2005.

Urban Nesting Habitat

Cooper's Hawks nested in a wide variety of urban habitats in the metropolitan Milwaukee area (Table 1). These habitats included residential properties within subdivisions as well as in city blocks, and residential lot sizes for these nest sites varied from small, although probably not tiny (i.e., <0.05 ha; no room for suitable nest trees), to large. Occasionally nests were located on road margins, grassy areas between the road and sidewalk, typically bordering city blocks. Nesting habitats included every conceivable type of city or county park including greenway corridors along rivers and creeks of all sizes such as the Milwau-

Figure 2. Five Cooper's Hawk nestlings approximately 16–18 days old in a white pine (*Pinus strobus*). The number of young produced per laying pair ranged from 0–6 for each nesting attempt. Photo by W. E. Stout.

kee and Menomonee Rivers, Kinnickinnic River, and Honey Creek. For a detailed description of habitat types see Stout (2004). Individual park sizes varied from small to large, and park habitats for nest sites ranged from wooded areas with wood-chipped or paved hiking trails to mowed grassy areas with a tree or cluster of trees suitable for a nest (generally designed for human uses such as picnics or soccer). Other urban nesting habitats included golf courses, cemeteries, and small wooded patches located in industrial or commercial areas. Cooper's Hawks built nests in 28 different deciduous tree species (n = 246), five different evergreen species (n = 23), and one dead tree still, although barely, distinguishable as a white oak (*Quercus alba*). To date, we have found no Cooper's Hawk nests on human-made structures in the metropolitan Milwaukee area.

Age Structure of the Breeding Population

In the field or in hand, we examined plumage for 372 breeding Cooper's Hawks (156 males, 216 females) over the 14-year period. Of the 372 nesting birds, 14.8% (n = 55, annual average = 24.1%) were in SY plumage, with 22.7% (n = 49, annual average = 30.4%) of females and 3.8% (n = 6, annual average = 3.4%) of males as SY breeders. We banded 736 nestling Cooper's Hawks and, while trapping and colormarking 136 breeders, obtained natal dispersal data for six subsequently breeding Cooper's

Figure 3. Six Cooper's Hawk nestlings. Broods of six nestlings are rare; laying pairs of Cooper's Hawks raised broods of six young in only five of 312 nesting attempts that we found over the 14-year period, 1993–2006, in the metropolitan Milwaukee area (one brood of six young in each of 2001–2004, and 2006). Photo by W. E. Stout.

Hawks banded as nestlings. Natal dispersal distance averaged 19.9 km for three females (range 18.8–20.4) and 3.5 km for three males (range 1.3–5.7).

The annual proportion of SY breeders decreased significantly over the 14-year period, 1993–2006 ($P = 0.019$). SY females were present as breeders in all study years while SY males were present in only three years out of 12 years of data for males. Although the annual proportion of SY females decreased significantly across years, the much lower annual proportion of SY males did not vary significantly during 1995–2006 ($P = 0.037$ and 0.690, respectively). Additionally, SY composition within two-year time periods varied significantly across the 14-year study for all breeders ($P = 0.023$) with SY composition for 1993–1994 being greater than the 5 most recent two-year time periods, but not 1995–1996. Breeding Cooper's Hawks in 1997–2006 totaled 13.4% SY birds (annual average = 13.2%).

Discussion

Reproductive Success and Nest Site Predation

The overall nesting success of 69% for our 14-year study was in the mid-range of the 53% to 85% reported in other North American work (Rosenfield and Bielefeldt 1993b). The mean of 2.4 young per laying pair is similar to that reported in other studies (range 1.6–2.8 in Rosenfield and Bielefeldt 1993b, 3.0 in Rosenfield et al. 1996), but the average of 3.5 young per successful pair in the metropolitan Milwaukee area is among the highest values reported for Cooper's Hawks

Table 1. Urban nesting habitat for Cooper's Hawks in the metropolitan Milwaukee area. Density in this table refers to humans.

Urban Habitat Description	No. of Nests
Residential—high-density city block, lot size ca. 0.05–0.1 ha	28
Residential—suburban-density subdivision, lot size ca. 0.1–0.25 ha	47
Residential—large wooded lot or estate, lot size >0.25 ha	13
Street margin of city block, grassy area between the road and sidewalk	6
Industrial—small woodlot or tree cluster in industrial area	9
Commercial—small woodlot or tree cluster in commercial area	2
Cemetery	6
Golf course—small woodlot or tree cluster	8
Park—wooded with wood chipped or paved trails for birding, hiking, etc.	103
Park—tree cluster or individual tree surrounded by mowed grass	22
Park—wooded river corridor with trails for birding, hiking, etc.	27
Park—wooded river corridor, tree surrounded by mowed grass	2
Park—wooded, woodlot surrounded by mowed grass	5
Urban woodlot—small woodlot in high-density city block, <0.1 ha	1
Suburban woodlot—wooded area not larger than a suburban lot, 0.1–0.25 ha	11
Exurban woodlot—wooded area larger than a suburban lot, >0.25 ha	26

(range 2.7–3.5 in Rosenfield and Bielefeldt 1993b; 4.0 in Rosenfield et al. 1996).

Several factors including nest site predation may affect Cooper's Hawk reproductive success. Stout et al. (2007) and the present study gave evidence of nest site predation on eggs, nestlings, or adult Cooper's Hawks by raccoons (*Procyon lotor*), Red-tailed Hawks, and Great Horned Owls. Great Horned Owls may have an impact on Cooper's Hawks as predators in some locations as also suggested in Rosenfield and Bielefeldt (1993b). Stout et al. (2007) speculated that raccoons, in particular, may affect nesting success of Cooper's Hawks in many urban and suburban environments where they are common, tree-climbing, and tree-roosting predators.

The Cooper's Hawk Population: Dynamics and Stability

Even though occupied Cooper's Hawk nest sites (n = 2) and a successful nesting attempt (n = 1) were documented near or in our study area in the early 1980s (R. N. Rosenfield and J. Bielefeldt, unpublished data), Stout et al. (2007) noted that the breeding population of Cooper's Hawks in the metropolitan Milwaukee area apparently became more readily detectable about 1993–1995. Despite intensive annual surveys for other nesting raptors throughout the same areas of metropolitan Milwaukee beginning in 1987, no incidental detections of nesting Cooper's Hawks were recorded until 1993. Incidental detections then increased during 1993–1995. Stout et al. (2007) suggested that an increase in the nesting population of Cooper's Hawks within this study area had led to a corresponding increase in the detectability of breeding birds in or about 1993.

The relatively high, total percentage (15%) of SY birds of both sexes among breeding Cooper's Hawks in the metropolitan Milwaukee area in 1993–2006 is in accord with other relatively young breeding populations of raptors (Stout et al. 2007). Other studies have found a relatively low total percentage (3%) of breeding SY Cooper's Hawks (27 of 414 females, 0 of 414 males) in populations with relatively high nesting densities elsewhere in Wisconsin, both urban and rural, during the same time period, 1993–2006 (Rosenfield et al. 1995; Bielefeldt et al. 1998; R. N. Rosenfield, unpublished data). For some raptor species, growing and/or newly re-established breeding populations have a higher percentage of younger breeders of both sexes (though females typically predominate) compared to stable, well-established populations (Newton 1979, Wyllie and Newton 1991, Tordoff and Redig 1997). We emphasize that breeding SY males appear to be rare in "established" Cooper's Hawk nesting populations (Rosenfield and Bielefelt 1993b, but see Boal 2001). Of note, DeCandido (2005) documented the first two Cooper's Hawk nesting attempts in New York City since 1955; in the years of initial discovery (1999 and 2001), both breeding males and one breeding female were SY birds. The percentage of SY breeding Cooper's Hawks in metropolitan Milwaukee declined over a 12-year period (Stout et al. 2007). With two additional years of data in the present study of 14 years, the decreasing trend persists.

Parker (1996) studied several Mississippi Kite (*Ictinia mississippiensis*) populations, reviewed the status (e.g., rural to urban expansion) of this species across the U.S., and presented an alternate hypothesis for the presence and, perhaps, varying percentages of SY breeders within [urban] populations. Two urban studies of Mississippi Kites documented relatively high productivity and high proportions of SY breeders (24% and 17–20%; Shaw 1985, Gennaro 1988; respectively). Parker (1996) then suggested that the high percent composition of SY or yearling breeders in urban locations was a function of high productivity, thus, resulting in a high recruitment of SY breeding birds. This hypothesis is consistent with the relatively high reproductive output and persistence of SY breeders in recent years (13% for 1997–2006) for our study. Elsewhere in other urban North American studies, the proportion of SY breeders has ranged from an annual average of 0% for recent work since 1999 in eastern North Dakota (T. Driscoll and R. N. Rosenfield, unpublished data) to a persistently high annual average of 26% for another study in British Columbia, 1995–2005 (A. C. Stewart and R. N. Rosenfield, unpublished data). The variations of SY breeders that we detected within this Cooper's Hawk population over a 14-year period may have initially been due to a relatively young population (the decreasing trend of SY breeders); however, the consistent presence of SY breeders within this population in the later years of this study may be the result of relatively high reproductive output (Newton 1979, Parker 1996). Such regional and temporal variations in the percentage of SY breeders would seem to warrant further monitoring of the age structure of nesting Cooper's Hawk populations in both urban and exurban habitats.

Source populations have a reproductive surplus that produce more offspring than are required to replace adults lost to mortality, whereas sink populations have low reproductive output and are therefore unable to compensate for breeders lost to mortality (Pulliam 1988). During annually consistent search efforts in 1996–2006, breeding Cooper's Hawks showed similar numbers of laying pairs (20–32 per year) on our metropolitan study area, where most nest sites were consistently reoccupied in most years after initial discovery over a span of at least two generations (Stout et al. 2007), estimated as six years per generation in Wisconsin (Rosenfield et al. 1995). Nesting hawks in the metropolitan Milwaukee area also showed indices of reproductive success within the mid to upper ranges of these measures for studies in Wisconsin and elsewhere, an initially high but now apparently consistent proportion of SY breeders, demonstrable local recruitment of nestlings to the metropolitan breeding population, and a wide distribution in diverse urban habitats within the study area. On these multiple bases, Stout et al. (2007) and the continued work of the present study suggest that the breeding population of Cooper's Hawks in the metropolitan Milwaukee area is at least stable and not a sink, and is perhaps increasing in this urban environment. Whether the metropolitan population may serve as a source of breeding birds in other nearby areas is unknown, although a small sample of natal dispersal distances—for females at least (mean = 19.9 km, n = 3)—may support that possibility.

Relatively young populations of urban nesting Cooper's Hawks across North America perhaps exhibit varying demographic responses to what are disparate habitats and/or ecological conditions; and thus, conservation assessments for one location may have limited potential management applications to populations in other geographic areas or temporally within the same site. For this reason, continued monitoring of Cooper's Hawks in the metropolitan Milwaukee area is warranted and may provide additional insight into the demographics of these urban populations.

West Nile Virus

Stout et al. (2005) tested this Cooper's Hawk population for the presence and prevalence of West Nile virus (WNV) antibodies during 2003–2004. They found that 88% (37 of 42) of adult and 2.1% (2 of 96) of nestling Cooper's Hawks tested positive for WNV antibodies, and WNV titers for adults (i.e., breeders) were significantly greater than for nestlings (Table 2). They also indicated that in every case where maternal parentage was known or inferred, each nestling with detectable WNV antibody titers came from an adult female that tested positive for WNV. Consequently, in conjunction with significantly higher WNV antibody titers and the increased prevalence in adults compared to nestlings, they suggested that nestlings with detectable antibody levels acquired these antibodies through passive transmission from the mother during egg production.

Stout et al. (2005) suggested that WNV infection exhibited no apparent adverse effects on the Cooper's Hawk population in the metropolitan Milwaukee area. Caffrey et al. (2005) used disappearance data of American Crows (*Corvus brachyrhynchos*) as evidence of possible mortality due to WNV. From our long-term, mark-recapture studies on breeding Cooper's Hawks in Wisconsin, we have no disappearance data that could serve as potential evidence of mortality due to

Table 2. West Nile virus (WNV) antibody presence in Cooper's Hawks in southeastn Wisconsin for 2003 and 2004. Results for second-year (SY) birds that were tested are given in parentheses for each SDNt titer. The percent of the total population that tested positive is given in parentheses after the total number of individuals that tested positive. Results are taken from Stout et al. (2005) with permission from *Avian Diseases.*

		Negative Results			Positive Results						
		SDNt Titer			SDNt Titer						
	n	None	1:5	Total	1:10	1:20	1:40	1:80	1:160	≥ 1:320	Total (%)
Adults[a]											
Males	21	1 (1)[c]	1	2	2	5	3	3	5	1	19 (91%)
Females	21	2 (1)	1	3	3 (1)	3 (1)[d]	4	0	6 (2)	2	18 (86%)
Total	42	3 (2)	2	5	5 (1)	8 (1)	7	3	11 (2)	3	37 (88%)
Nestlings[b]	96	87	7	94	2	0	0	0	0	0	2 (2.1%)

[a]Results include second-year (SY) breeders and a potential helper.
[b]One additional nestling sample was cytotoxic, yielding no results.
[c]One male may have been a "helper." An SY male and an ASY male were both trapped defending the same site.
[d]One additional SY female from 2003 (also trapped in 2004) is not included in these data (SDNt Titer: 1:20) to maintain independence of samples. The 2004 data (SDNt Titer: 1:40) is included in the table.

WNV (R. N. Rosenfield and W. E. Stout, unpublished data). Hull et al. (2006) documented WNV in 13% of migrating Cooper's Hawks (3 of 28 juveniles and 1 of 2 adults) in California, found no visible signs of WNV illness, and no apparent adverse effects on relative health (based on weight to wing chord ratios). However, their study did not indicate the relative concentration levels of WNV antibodies in these Cooper's Hawks and, therefore, their results may not be directly comparable to results from Stout et al. (2005); it is unclear whether the WNV antibodies in the juveniles tested may possibly be residual from maternal antibody transmission. Continued monitoring of WNV infection in Cooper's Hawks and additional studies of WNV and Cooper's Hawk habitat associations are warranted to determine the associated risks for WNV exposure.

Human Interactions with Cooper's Hawks

Cooper's Hawks nesting in urban settings such as residential neighborhoods, although perhaps beneficial to the species' population status in various locales, are seen by some of the general public as positive and by others as negative elements of the metropolitan environment. Many homeowners take pride in Cooper's Hawks nesting on their property or in their neighborhood, but other disgruntled homeowners in several midwestern cities have complained to us about the perceived or real loss of songbirds at feeders because of Cooper's Hawk presence and predation, the fouling of landscapes and vehicles by hawk feces, and in rare instances, stoops by adult Cooper's Hawks on people who apparently walked too close to nests. On several occasions residents indicated that they would consider taking action in response to these perceived problems.

Some landowners also needed explanations and/or reassurances that our techniques of capturing, handling, and marking Cooper's Hawks were safe, humane, and legal. We believe that this type of educational component garners public support for, and thus contributes to the success of, our urban research. We suggest that researchers will probably need to educate the urban public about the role of avian predators including Cooper's Hawks in city environs, and about the methods, purposes, and values of wildlife research in these settings. We agree with Boal and Mannan (1999) that resource management personnel in urban areas should also be cognizant of potential human-hawk conflicts, and be prepared to address and alleviate public concerns.

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Literature Cited

Beebe, F. L. 1974. Field studies of the Falconiformes of British Columbia: vultures, hawks, falcons, and eagles. British Columbia Provisional Museum Occasional Paper No. 17. Victoria, BC, Canada.

Bielefeldt, J., R. N. Rosenfield, W. E. Stout, and S. M. Vos. 1998. The Cooper's Hawk in Wisconsin: A review of its breeding biology and status. Passenger Pigeon 60: 111–121.

Boal, C. W. 2001. Nonrandom mating and productivity of adult and subadult Cooper's Hawks. Condor 103: 381–385.

Boal, C. W. and R. W. Mannan. 1999. Comparative breeding ecology of Cooper's Hawks in urban and exurban areas of southeastern Arizona. Journal of Wildlife Management 63: 77–84.

Caffrey, C., S. C. R. Smith, and T. J. Weston. 2005. West Nile virus devastates an American Crow population. Condor 107: 128–132.

DeCandido, R. 2005. First nesting of Cooper's Hawks (*Accipiter cooperii*) in New York City since 1955. Journal of Raptor Research 39: 109.

Gennaro, A. L. 1988. Breeding biology of an urban population of Mississippi Kites in New Mexico. Pages 88–98 *in* R. L. Glinski, B. Pendleton, M. B. Moss, M. N. LeFranc, Jr., B. A. Millsap, and S. W. Hoffman, eds. Proceedings of the southwest raptor management symposium and workshop. National Wildlife Federation, Washington D.C.

Greenwood, P. J. 1980. Mating systems, philopatry, and dispersal in birds and mammals. Animal Behavior 28: 1140–1162.

Murphy, R. K., M. W. Gratson, and R. N. Rosenfield. 1988. Activity and habitat use by a breeding male Cooper's Hawk in a suburban area. Journal of Raptor Research 22: 97–100.

Newton, I. 1979. Population ecology of raptors. Buteo Books, Vermillion, SD.

Parker, J. W. 1996. Urban ecology of the Mississippi Kite. Pages 45–52 *in* D. M. Bird, D. E. Varland, and J. J. Negro, eds. Raptors in human landscapes. Academic Press, London, England.

Postupalsky, S. 1974. Raptor reproductive success: some problems with methods, criteria, and terminology. Pages 21–31 *in* F. N. Hamerstrom, B. E. Harrell, and R. R. Olendorff, eds. Management of raptors. Raptor Research Report No. 2. Proceedings of the Conference on Raptor Conservation Techniques. Fort Collins, CO.

Pulliam, H. R. 1988. Sources, sinks, and population regulation. American Naturalist 132: 652–661.

Rosenfield, R. N. and R. K. Anderson. 1983. Status of the Cooper's Hawk. Unpublished Report, Wisconsin Department of Natural Resources, Madison, WI.

Rosenfield, R. N. and J. Bielefeldt. 1993a. Trapping techniques for breeding Cooper's Hawks: two modifications. Journal of Raptor Research 27: 170–171.

Rosenfield, R. N. and J. Bielefeldt. 1993b. Cooper's Hawk *(Accipiter cooperii)*. *In* The Birds of North America, No. 75. (A. Poole, and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Rosenfield, R. N. and J. Bielefeldt. 1997. Reanalysis of relationships among eye color, age and sex in the Cooper's Hawk. Journal of Raptor Research 31: 313–316. (Citation for cover photo.)

Rosenfield, R. N., J. Bielefeldt, J. L. Affeldt, and D. J. Beckmann. 1995. Nesting density, nest area reoccupancy, and monitoring implications for Cooper's Hawks in Wisconsin. Journal of Raptor Research 29: 1–4.

Rosenfield, R. N., J. Bielefeldt, J. L. Affeldt, and D. J. Beckmann. 1996. Urban nesting biology of Cooper's Hawks in Wisconsin. Pages 41–44 *in* D. M. Bird, D. E. Varland, and J. J. Negro, eds. Raptors in human landscapes. Academic Press, London, England.

Rosenfield, R. N., J. W. Grier, and R. F. Fyfe. 2007. Reducing research and management disturbance of nesting raptors. *In* D. M. Bird and K. L. Bildstein, eds. Raptor research and management techniques. Hancock House Publishers, Blaine, WA. In press.

Shaw, D. M. 1985. The breeding biology of urban-nesting Mississippi Kites (*Ictinia mississippiensis*) in west central Texas. M.Sc. Thesis, Angelo State University, San Angelo, TX.

SPSS. 2000. SYSTAT 10 for Windows. SPSS, Chicago, IL.

Steenhof, K. and I. Newton. 2007. Assessing raptor nest success and productivity. *In* D. M. Bird and K. L. Bildstein, eds. Raptor research and management techniques. Hancock House Publishers, Blaine, WA. In press.

Stout, W. E. 2004. Landscape ecology of the Red-tailed Hawk: with applications for land-use planning and education. Ph.D. Dissertation, University of Wisconsin, Madison.

Stout, W. E., A. G. Cassini, J. K. Meece, J. M. Papp, R. N. Rosenfield, and K. D. Reed. 2005. Serologic evidence of West Nile virus infection in three wild raptor populations. Avian Diseases 49: 371–375.

Stout, W. E., R. N. Rosenfield, W. G. Holton, and J. Bielefeldt. 2007. Nesting biology of urban Cooper's Hawks in Milwaukee, Wisconsin. Journal of Wildlife Management 71: in press.

Tordoff, H. B. and P. T. Redig. 1997. Midwest Peregrine Falcon demography, 1982–1995. Journal of Raptor Research 31: 339–346.

Wyllie, I. and I. Newton. 1991. Demography of an increasing population of Sparrowhawks. Journal of Animal Ecology 60: 749–766.

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Behavior of a Brood of Post-fledging Cooper's Hawks: Non-independence of Sibling Movements

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Abstract

We describe hitherto undocumented post-fledging behaviors of two male and three female sibling Cooper's Hawks (Accipiter cooperii) *that were opportunistically observed over 26 days in a residential lot in central Wisconsin during 1997. The hawks were observed primarily in groups (≥ 2 individuals within 4 m of each other) from 19 to 44 days after fledging during 11.8 hr over 21 separate observation episodes. We provide a detailed narrative of the fledged hawks successfully and unsuccessfully attacking prey, joining in group foraging, engaging in physical confrontations and dominance-submission displays during competition for killed prey, sharing prey after a group hunt, stealing food, taking a nestling songbird from its nest, mimicking hunting behavior of an adult, and showing apparent non-hunting interactions with heterospecifics. These post-fledging hawks acting either in groups of 2–4 siblings or as single individuals successfully captured prey, primarily eastern chipmunks* (Tamias striatus), *in 10 (56%) of 18 total hunting attacks. Three of the five total group attacks involved 4 siblings (always 3 females and 1 male) simultaneously attacking prey. These juvenile hawks often followed and interacted with each other in various social contexts. Results from our study along with observations from other researchers suggest that post-fledging Cooper's Hawks may typically occur in groups in which movement and other behaviors of some individuals are not independent of the behavior of their siblings.*

Descriptions of the behaviors of nestling and breeding adult Cooper's Hawks (*Accipiter cooperii*) are rather well-documented (e.g., Meng and Rosenfield 1988, Rosenfield and

Bielefeldt 1993). However, the post-fledging period, that time after young have first left the nest (i.e., fledged) and become independent of adult care prior to dispersal from the nesting area, may be the stage of breeding about which we know the least for Cooper's Hawks and other woodland raptor species (Newton 1986, Bustamante 1994, Rosenfield and Bielefeldt 1993). The significance of the post-fledging period is implicit in the suggestion that during this time survivability of young is perhaps lower than at any subsequent time (Newton 1986). The primary reason for the paucity of behavioral data from the post-fledging period may be the difficulty in observing young birds once they depart the nest, particularly for species that breed in forested environments where visibility is limited (Varland et al. 1991). Moreover, because young birds are found at increasing distances from the nest as they develop their flying skills, it is likely that biologists overlook fledged young when visiting a nest site (Reynolds and Wight 1978). Researchers must often rely on radio-telemetry to track movements of post-fledging woodland raptors (e.g., Kennedy et al. 1994, Kenward et al. 1993a), but such investigations primarily document spatial information on individuals and provide limited or no detailed information on the specific behaviors we present here.

Newton (1979) submitted that immature hawks do not remain together once they leave the nest, which further diminishes the chances of observing them. However, we were afforded a convenient opportunity to directly observe post-fledging behavior of five (two males, three females) Cooper's Hawks near a nest on the senior author's suburban property in June 1997. This brood of five hawks remained in the neighborhood for about 6 wk after fledging and, contra to Newton's (1979, 1986) aforestated contention and findings for the congeneric Eurasion Sparrowhawk (*Accipiter nisus*), these Cooper's Hawks typically were observed in groups of 2–4 young that often followed each other and interacted socially.

The opportunistic nature of our sightings precluded a comprehensive chronology of any one bird's behavior over this entire observation period. Here we emphasize hunting, feeding, roosting, and social behaviors (e.g., following among siblings) not quantified or described in detail in the few previous anecdotes on post-fledging behavior in Cooper's Hawks (Plunkett 1986, Dancey 1993). We also report to our knowledge the first quantitative information on hunting success of post-fledging Cooper's Hawks, a phenomenon generally undocumented for most raptor species. Our study is contemporarily significant because it occurred in a suburban environment that appears to be increasingly used by nesting Cooper's Hawks (Rosenfield and Bielefeldt 1993, Boal and Mannan 1999).

Study Area

The study area was an 0.8 ha residential lot within a 16.2 ha residential subdivision in the Village of Plover, Wisconsin (44°46N 89°49W), Portage County. This location was approximately 1 km south and 1.6 km east of the urban study area reported by Rosenfield et al. (1995) in their investigation of the nesting density of

Cooper's Hawks. The neighborhood was densely wooded with mature white pine (*Pinus strobus*) and red oak (*Quercus rubra*), as well as younger red maple (*Acer rubrum*) in the understory. The nest in which the Cooper's Hawks hatched was in a mature white pine on the east end of the lot. This subdivision was bordered on three sides by open agricultural and business uses, with a 16.2-ha undeveloped wooded conservancy area on the remaining side. Residential lots were typically about 0.4 ha, with relatively small lawns and many mature trees as typical of fragmented woodlots in suburban tracts of central Wisconsin where numerous Cooper's Hawk nests have been found (e.g., Rosenfield et al. 1996).

Perhaps a significant feature of the study area was its long rows of loosely stacked piles of branches and other tree debris along lot lines. These accumulations were generally 1–2 m wide and 0.5–1 m high, extending through the underbrush for approximately 90 m along each property line. This debris may have been responsible in part for the seemingly abundant supply of small mammal prey within the study area, particularly eastern chipmunks (*Tamias striatus*), the most common prey we saw taken by the fledged hawks.

Methods

We opportunistically recorded the behavior of two male and three female sibling Cooper's Hawks during 11.8 hr in 21 separate observational episodes. These episodes collectively spanned most hours of the day (0710–2000 h) and they varied in length (3 min–101 min; $\bar{x}$ = 33.7 min) in accord with duration of presence of birds clearly within our view and our availability to conduct observations. The data reported here, which primarily emphasize undocumented hunting and social behaviors, extend and complement studies during 43 additional observation episodes of the same 5 post-fledging hawks. We do not report findings from these 43 periods because they do not, except for one instance, contain any hunting attacks, nor do these additional episodes contain new details of behavior. We emphasize, however, that the tendency of these post-fledging hawks to occur in groups (≥ 2 individuals within about 4 m of each other) and to follow one another during these other episodes accords with the results from the 21 observational periods which are presented here in their entirety. We do occasionally refer to some data from these 43 additional episodes.

We used observation logs to plot, record, and time the birds' locations, movements, actions, and interactions. We determined nestling hatch dates by back-dating from estimated ages of young based on plumage development of known-age birds (Fig. 1) at the time of banding (Rosenfield and Bielefeldt 1999). We thus calculated hatch dates of 1 June for two females and one male, 3 June for the other male, and 4 June for the remaining female. A common hatch date of June 2 was used on the daily logs because the birds were not always individually distinguishable once they had left the nest. Cooper's Hawks first leave the nest using combinations of climbing, jumping, and flapping approximately 25 d after hatching (Rosenfield and Bielefeldt 1993, Rosenfield and Bielefeldt 2006),

Figure 1. Two of the young Cooper's Hawks at banding time.

and in this study we thus estimate a common fledging date of 27 June.

It was usually easy to detect the presence of the fledgling hawks on the study site because they were relatively easily seen together in groups and especially because their loud and frequent calling could be heard from an estimated 200–250 m, even farther than the 150 m documented by Stewart et al. (1996). Although we did not record all vocalizations of these post-fledglings, the immature hawks' frequent calls of "eeeeee . . . eeeeee" were very distinctive and consistent with the descriptions documented as typical of when fledged young are hungry and/or flying through the woods (Meng 1951, Rosenfield and Bielefeldt 1993).

Observations were made while the observer was wearing camouflage and from a position that afforded good visibility of the study area. The largest trees were mapped and coded alphabetically to facilitate descriptions of the locations of hawks. When a hawk landed in a coded tree, or in a smaller tree or brush within 2–3 m of the designated one, the code was noted in the observation log. Those notes thus tracked the movements of the birds.

Our methods allowed us to differentiate between individual hawks when two or more were interacting in a given period. However, there was no practical way of identifying a given bird with certainty from one observation period to the next. We assume that all detections of young Cooper's Hawks in our study area were of the resident hawks that fledged there because we did not know of any other Cooper's Hawk nests within 1.6 km of our study site, and because our observations occurred at one of the earliest nests that fledged young that year and temporally before dispersal begins in Wisconsin Cooper's Hawks (RNR, unpubl. data). This assumption was regularly supported by the sighting of aluminum leg bands on the brown-plumaged young; both adults were in gray, ≥ 2-year-old plumage and were marked with unique colored leg bands. We could frequently determine the gender of fledged young because of the noticeable difference in size between large females and smaller males (Meng 1951, Rosenfield and Bielefeldt 1993). When a gender is not reported here, the sex was unknown.

Hunting attacks were behaviorally self-evident as we frequently could see prey being pursued by hawks on the ground or when prey was pursued by non-vocalizing hawks while in "direct" flights or swoops to the ground. We defined a group attack as occurring when ≥ 2 fledglings simultaneously attacked prey or when a juvenile hawk attacked prey immediately (≤ 30 sec) after its sibling had done so.

In addition to noting the hawks' interactions and movements within the study area, we haphazardly logged the frequency of the birds' vocalizations. We used the following descriptions to classify the timing of their calls: intense calling = 1 second or less between calls of a given bird; rapid calling = 2–5 sec betweens calls; frequent = 5–15 sec; occasional = 15–60 sec; and isolated = more than 1 min between calls. The timing of the birds' calling was usually estimated and seldom determined with a timepiece. When calling frequencies are not given, they were not recorded in the logs.

Results and Discussion

The young Cooper's Hawks were observed from 19 to 44 days after fledging during 26 d of observation. Although not episodically presented below, the last observation of a group of juveniles was on 7 August (41 d post-fledging; 66 days post-hatching) and our last detection of any fledgling was a single juvenile whose behavior is described below on 10 August (44 d post-fledging; 69 days post-hatching). Observations and discussions are presented in the following five categories of behaviors: hunting/feeding, roosting, juvenile contacts with adults, hawk contacts with other animals, and other interactions. The first observation presented below is described in considerable detail to illustrate the specificity of the information in the observational logs. Subsequent observational descriptions are condensed.

Hunting/feeding behaviors

17 July (20 d fledged) 1002–1143 h—Four Juvenile Hawks Attack Squirrel, Adult Bird Appears and Captures Different Prey in Presence of Juveniles

Four immature hawks, three female and one male, enter the observation area over a 7 min period and fly back and forth among the trees for 20 min. The male juvenile swoops down and strikes at a gray squirrel (*Sciurus caroliniensis*) on the ground. The squirrel escapes into a brush pile, and within 9 min, all birds have left the area. Twenty-four minutes later, two hawks appear, followed by a third and then a fourth bird within 3 minutes. Hawk 1 swoops from a tree to the ground next to the brush pile, flushing out a gray

Figure 2. Maternal adult Cooper's Hawk.

squirrel about 20 m from where it (or a different one) had taken refuge earlier. The squirrel runs south toward the edge of the woods, and Hawk 2 swoops to the ground in front of the squirrel. While on foot, Hawk 2 lunges at the squirrel, and the squirrel responds by biting and clawing at the bird. Hawk 3 lands on the ground 2 m west of Hawk 2 and the squirrel; the squirrel runs back toward the brush pile to escape, but its path appears to be blocked by Hawk 1. The squirrel turns and runs toward the east and away from the three hawks, but Hawk 4 (male) swoops to the ground east of the squirrel, blocking it in that direction. The squirrel turns and runs west, where Hawk 3 lunges at it. The squirrel jumps up kicking, scratching, and biting, thus driving off Hawk 3, which retreats to the fence. The squirrel then heads away from Hawk 3, toward the brush pile again. Hawk 4 lands in front of the squirrel at the edge of the brush. Hawk 2 attacks from the south from the back of the squirrel. The squirrel spins around and jumps repeatedly with legs, claws, and teeth flailing at the hawk. Hawk 2 and the squirrel grapple on the ground, and Hawk 1 joins the struggle.

The adult female hawk (Fig. 2) then enters silently from the west, flying

½–1 m off the ground and just above the hawks and squirrel, eventually gaining a tree perch. We note that nothing in her behavior suggested interest in the squirrel as prey. The attention of all four juveniles then seems to shift immediately to the adult, diverting them from the squirrel, which escapes into the brush. The adult calls out ("kak-kak-kak") upon perching, and while the male juvenile stays on the ground, the other three fly to separate trees surrounding the adult. Within 2 min, the adult female approaches the brush pile, flushing a chipmunk, which she immediately seizes on the ground at the edge of the brush pile. She then immediately flies west out of view with the chipmunk. Within 1 min, the three female juveniles follow the adult.

The juvenile male, Hawk 4, which has remained on the ground, flies to within 2 m of where the adult had captured the chipmunk. With its beak, it begins picking in the brush, pulling out sticks and twigs. Within 1 min, this activity apparently flushes out another chipmunk, which the hawk captures and begins eating. Within 12 min, two other juveniles return from the west, landing in trees above Hawk 4. The two call and he glances up at them. He continues eating the chipmunk, occasionally looking at his siblings, who are perched together about 8 m above him. Within 2 min, a gray squirrel climbs a bush about 5 m behind Hawk 4, causing one of the branches to bow to the ground. The hawk immediately mantles over its prey, with hackles extended, but then resumes feeding. The other two juvenile hawks continue calling but do not move closer to Hawk 4 and his prey. Within 3 min, Hawk 4 finishes eating the chipmunk and jumps to a large branch on top of the brush pile. He then flies west and out of view and is followed immediately by one of the other two immature hawks. The remaining juvenile flies down to where Hawk 4 had consumed the chipmunk. Using her beak and talons, she pushes into and around the twigs and leaves, but does not appear to strike at prey per se. Within 1 min, she also flies west out of view.

Chronologically, this incident was the second one in observing the fledged hawks. It was relatively early in their departure from the nest (they were only 46 days of age, 20 days fledged), so their inexperience at hunting, discussed below, seemed evident. Meng (1951) opined that Cooper's Hawks learn through experience what hunting methods and prey require the least amount of effort and are the most rewarding. He further commented that adult hawks "are not nearly as foolhardy as the young birds." Whatever the possible motivations of the adult female, her presence and/or behavior seemed to have had the effect of ending (beneficially, we believe) the attacks of the fledgling hawks on the squirrel. We think it likely that the encounter could have ended with serious injury to or the death of one or more juveniles from the conflict with the squirrel. Gray squirrels are rarely taken by breeding adult Cooper's Hawks in Wisconsin (Bielefeldt et al. 1992; RNR unpubl. data). Indeed, adult Cooper's Hawks, even large females, appear to respond indifferently to gray squirrels or regard them as potential nest predators, rather than perceive them as prey (Rosenfield and Bielefeldt 1991; RNR unpubl. data). This adult female's mass was 700 g at the nestling stage, the second largest female among 341 adult females caught in Wisconsin over 26 years; her mass exceeded that of several adult male breeding Northern Goshawks (*Accipiter gentilis*) caught in Wisconsin (Rosenfield and Bielefeldt 1999, RNR unpubl. data).

Meng (1951) also suggested that sometimes two Cooper's Hawks will "work together," particularly "young hawks" (no ages given) that have just learned to hunt, as observed here. The hawks' behavior in this incident was indicative of "social hunting," defined as a bird's hunting activity within 3 m of one or more other birds that are also hunting (Varland et al. 1991). More specifically, it seemed to qualify as imitative social hunting, in which individuals observe others and learn hunting behavior by copying what they see (Varland and Loughlin 1992). Although Meng (1951) stated that Cooper's Hawks begin hunting for themselves at eight weeks of age, these fledglings were hunting independently of an adult considerably sooner, at 6 wk 3 d of age, 20 d fledged. Lastly, this incident seems consistent with Newton's suggestion regarding development in young Peregrine Falcons (*Falco peregrinus*), that "adults behave in a way that encourages the young to perform action associated with hunting" (Newton 1979).

18 July (21 d fledged) 1048–1104 h—Four Juvenile Hawks Simultaneously Attack Prey

Four juveniles land in four adjacent trees. Much calling occurs, and all four simultaneously leave their perches and attack the same chipmunk on the ground. Positioned within 1–2 m of each other, the four hawks each attack the prey repeatedly, rising off the ground less than 1 m and then pouncing at the chipmunk, but not always striking it. It is not caught immediately but is kept within the confines of the group of juvenile hawks. After about 2 min, one juvenile catches and flies away with the prey, and two of the other juveniles follow immediately.

This incident agrees with Brown and Amadon's (1968) observation that when young hawks are learning to hunt, a group may pursue the same prey animal, which is then caught by one as the prey seeks to evade the others. They note that this is not actually cooperation, though the results may be the same. The hunting observed here can appropriately be categorized as social hunting. The hawks attacked the same prey simultaneously, and the attacks may have appeared superficially to be cooperative. However, in cooperative foraging, defendable food is shared among participants (Hector 1986), which we did not observe in this incident.

22 July (25 d fledged) 1710–1805 h—Social hunting and possible competition over killed prey

Hawk 1 (male) is perched when two other juveniles join him in adjacent trees. For 8 min, the birds call while moving among the same three trees. Hawk 1 then swoops to the ground, apparently to capture prey, and is immediately joined by two siblings with frequent calling from all three. After a short flurry of activity from all three birds, with rapid calling, Hawk 1 flies to a tree, grasping a chipmunk in its talons. Within 1 min, Hawk 4 flies into view and lands in the same tree where

Hawk 1 is perched. Hawks 2 and 3 also fly to that tree (hawks 2, 3, and 4 are females).

Hawk 1 carries the prey to various locations on the same branch during the next 5 min, and finds a spot to eat the chipmunk. Meanwhile, Hawk 4 has moved lower in the tree, to about 3 m from Hawk 1; Hawks 2 and 3 are 5–6 m above Hawk 1. These three female hawks have been calling repeatedly as Hawk 1 moved on his branch, before he begins eating the chipmunk. When he begins eating, the other birds stop calling, and Hawk 4 moves to within 2 m of the male, who continues eating. Hawk 4 then moves to within 1 m of her brother and begins calling frequently. Hawk 1 mantles over its prey and calls rapidly (2–5 sec) for about 1 min. Hawk 4 stops calling and remains within 1 m of the male. Hawk 1 then stops calling and resumes eating the chipmunk.

Within 3 min, Hawks 2 and 3 fly to an adjacent tree and then out of view. Over the next 16 min, Hawk 1 continues feeding until he has consumed the chipmunk. Hawk 4 watches him continuously, moving between two limbs, but staying within 1–2 m of her brother. But when he finishes eating the chipmunk, his sister flies from view.

It appeared to us that the male had caught the prey himself in conjunction with the efforts of two of his sisters, but then defended his catch from them. This observation thus represents another example of social hunting (Varland et al. 1991).

24 July (27 d fledged)1828–1840 h—Two hawks share prey animal

Two females enter the observation area. Hawk 1 flies to a brush pile, flaps momentarily along the edge, and moves to a low branch in a nearby tree. Hawk 2 immediately flies to the same spot in the brush, captures a chipmunk, and hops onto the top of the brush pile. Hawk 1 flies toward and lands within 1 m of Hawk 2.

Hawk 2 begins eating the chipmunk as Hawk 1 steps closer to Hawk 2, and Hawk 2 mantles over the prey. Hawk 1 advances, as Hawk 2 retracts her wings but still holds onto the chipmunk. Hawk 1 reaches in with her beak and tears a piece off the prey and swallows it quickly without standing fully erect, then reaches down and takes another piece, this time standing more erect before swallowing. Hawk 2 takes 2–3 more bites, Hawk 1 takes two bites, and Hawk 2 finishes the chipmunk with 3–4 final bites. At no time during this episode is there any calling by the hawks. The two hawks fly off but stay in view for another 16 min within 3 m of one another.

This incident was the reverse of the previous encounter of 22 July, in which the male hawk guarded and defended his food. These two females did not engage in what appeared to be cooperative hunting, but their post-catch behavior of sharing prey would have qualified that part of the incident for such a designation using Hector's (1986) criteria.

25 July (28 d fledged) 1729–1751 h—Hawk catches prey in company of siblings and no apparent interaction regarding the food item.

Four juvenile hawks are perched together in one tree during a light rain. Hawk 1 moves to another tree, and

Figure 3. Female Cooper's Hawk at about 8 weeks of age.

Hawk 2 swoops to the ground, catches a chipmunk and flies back to the original tree with its prey (Hawk 2 is a male, Hawks 1/3/4 are females). Hawk 1 returns, and all four birds are again in the same tree. As Hawk 2 eats the chipmunk, the other three are calling frequently while all are perched within about 4 m of him. Hawk 2 occasionally stops eating to mantle over his prey, while the other birds continue calling. When Hawk 2 finishes eating, the others stop calling, and Hawk 5 flies past the group and lands in a nearby tree. All five birds then begin flying about the study site as a "divided group," with two hawks moving off first and followed by the other three, one flying off followed by four, three followed by two, two then one then two, and so forth. All the while there is much calling among the birds, but the group stays intact, with each bird never more than about 4 m apart from another for more than a few seconds.

This observation was one of only two times among 64 (3%) observational episodes when all five juvenile hawks were observed together. Because the birds spent considerable time in areas other than the immediate study site, we do not know if they were typically together or separated when they were out of the observation area. Assuming that our observations on the study site were indicative of the juvenile hawks' behavior elsewhere in the surrounding area, it was rare for all five fledglings to be in close proximity to one another.

27 July (30 d fledged) 1407–1416 h—Unyielding retention of killed prey.

Three juvenile hawks perched in adjacent trees. Hawk 1 (male) calls frequently. Hawk 2 (female) flies to a brush pile, apparently hunting, but does not catch prey. She (Fig. 3) then flies back to her tree. After about a minute, Hawk 1 swoops to within 1 m of where the first hawk had landed, but he too fails to capture prey and returns to his perch. After another minute, Hawk 2 returns to the brush pile at the same spot where Hawk 1 had landed, catches a chipmunk, and carries it to a branch 3 m above Hawk 1.

Hawk 2 has difficulty eating the chipmunk and staying balanced at the same time. While moving the prey in her grasp in order to tear pieces from it, Hawk 2 drops the chipmunk, which falls to the base of the tree, below Hawk 1. Hawk 1 spreads its wings to fly when Hawk 2 dives past him to the chipmunk. She lands very roughly on the dead animal in what appeared to be a "crash landing." She immediately mantles over it, and Hawk 1 retracts his wings and resumes sitting and watching Hawk 2. Within 1 min, Hawk 2 flies out of the study area with the chipmunk, followed by Hawks 1 and 3. In this incident, the male appeared to be dissuaded from attempting to obtain the prey when the female landed on it and immediately mantled. This behavior corresponds to Palmer's (1988) observation that it does not always take much assertiveness for one youngster to intimidate others among fledgling Cooper's Hawks.

28 July (31 d fledged) 1835–1926 h—Vigorous physical altercation over food

Hawk 1 (male) is first seen perched in a tree (Fig. 4), and Hawk 2 is heard calling from a nearby tree. Hawk 1 swoops to the ground, catches a chipmunk, and returns to his perch with its prey. Within 4 min, two of his sisters land in the same tree with him. Hawk 1 begins eating the chipmunk, as the two siblings call frequently and move among the branches about 3 m from the feeding hawk. When they are within 2 m of Hawk 1, he mantles over his prey. Hawk 2 (female) moves toward Hawk 1 and pushes into him with much flapping of wings, physical contact, and intense calling between the two birds. Hawk 1 continues to mantle and then calls, and a piece of his prey falls onto a branch 3 m below. Hawk 2 backs off, drops to the lower branch, and eats the fallen morsel. Hawk 2 moves closer, seemingly in an attempt to get the chipmunk; considerable wing flapping, physical contact, and intense calling from both birds again ensue. Hawk 1 prevails and continues to mantle his catch, but he does not resume eating until Hawk 2 moves off about 2 m and turns her back to and does not look at him. Another piece of chipmunk falls off and lands on a lower branch; Hawk 3 (female) flies down and eats that piece. There is occasional calling from Hawk 2, but she keeps her back to Hawk 1. He finishes eating the chipmunk, and he cleans his talons and beak. Within 4 min, all three birds are at rest in the same tree.

Unlike the 22 and 27 July incident,

Figure 4. Male Cooper's Hawk at about 8 weeks of age.

mere mantling of one hawk over a prey animal was not sufficient to deter another from trying to steal the food in this case. Physical resistance on the part of Hawk 1 was apparently necessary to keep Hawk 2 from getting at the prey. Of particular note in this incident, in addition to documenting the fledgling male's propensity to not share food with his siblings, is that of one female moving off and assuming a "submissive" posture when she was unable to force more food from the male. RNR (unpubl. data) has observed this posture in nestling Cooper's Hawks that unsuccessfully competed with siblings for food, but this was the first he had seen this posture in post-fledglings.

30 July (33 d fledged) 0710–0801 h—Unsuccessful social hunting.

One hawk enters the observation area and lands on a fence at the edge of the woods. It jumps from the fence and attacks a gray squirrel, which escapes into a brush pile. Three other juveniles then enter the area and land on the fence within 1 m of one another. In the next 12 min, there are repeated attacks from fence to brush pile after the squirrel. The group activity is interrupted when one bird is distracted by a moth fluttering nearby, and flies down to investigate the insect. Two hawks then leave the area, and the squirrel has escaped.

This incident provides evidence of the juveniles' inability, even when acting as a group, to successfully capture a relatively large, potentially dangerous prey species at a stage of their maturation after they have attained repeated success (sometimes in groups) in capturing chipmunks. The hawks' tenacity in the attack also runs contrary to suggestions that adult Cooper's Hawks, if prey is not taken in the first attempt, will break off pursuit, surprise being the ally of an accipiter, not endurance (Dunne et al. 1988, Johnsgard 1990). This incident is also another example of the hawks engaging in social foraging behavior, consistent with reports that some raptors may hunt in groups with little or no coordination among the members (Hector 1986).

30 July (33 d fledged) 1833–1918 h—Protracted consumption of prey, defending it from two other juveniles.

Hawk 1 (male) flies into the study area carrying a dead nestling or fledgling bird. He is followed by Hawk 2. Hawk 1 drops the prey, goes to the ground to retrieve it, and carries it to a tree perch. The crop of Hawk 1 appears full, and he does not appear to be in a hurry to consume the prey. Hawk 3 enters the area and lands in the same tree as Hawk 1. Hawks 2 and 3, both females, are calling, but Hawk 1 does not appear to react to them. The male hawk mantles over his prey when a squirrel approaches him. Hawk 1 eventually finishes eating the prey. This episode is further evidence of the male defending food from his sisters. However, we have no observations of the two brothers together in a similar situation that involved food. We do not know if the male's failure to share food with his female siblings was gender-based.

31 July (34 d fledged) 1641–1710 h—One fledgling hawk stealing prey from a sibling.

Three juveniles are perched in one tree, and one of them is eating prey. Hawk 4 flies into the group, grabs the prey, and flies to another tree. One fledgling follows Hawk 4, but it protects (mantles over) the food and finishes eating it. Another juvenile flies to the same tree and hops around nearby branches for a short time before flying off. None of the birds' genders was determined. Cooper's Hawk nestlings have been observed to snatch pieces of prey from siblings, as well as aggressively taking food from the adult female's beak when she delivers prey to the nest (Meng 1951, RNR unpubl. data), but we are unaware of other reports of post-fledging Cooper's Hawks stealing food from each other.

2 August (36 d fledged) 1940–1943 h—Inexperienced killing of prey.

A juvenile female hawk flies to the ground and catches a chipmunk. The bird holds its wings outstretched, apparently to keep its balance as it is grasps the animal in its talons. The hawk lifts one foot up two times quickly in succession, releasing its hold *completely*, and then regrabs the chipmunk each time. She then flies

Figure 5. Female Cooper's Hawk at 9 weeks of age.

out of the observation area with her dead prey. This kill was consistent with other reports of killing behaviors in adult Cooper's Hawks, in which the birds used repeated clenches to dispatch prey, responding to movement of the prey with grasping, relaxing, and reclamping grips until the animal is dead (Palmer 1988). This immature hawk used a form of that technique, however, that demonstrated the hawk had apparently not yet learned that it is unnecessary to *completely* let go of the prey and restrike it in order to kill it.

10 August (44 d fledged) 1557–1606 h—Capture of a nestling songbird.

Rapid calling of several nestling songbirds of unknown species comes from 8–10 m high in a tree. No parent songbird is observed or heard. A juvenile female hawk (Fig. 5) is in an adjacent tree, moving from branch to branch, looking in the direction of the calling chicks. The hawk flies without calling into the foliage of the tree, the chicks' chirping intensifies, and the hawk quickly flies out of the tree with an unfeathered passerine chick in its talons. The hawk returns to its original tree momentarily before flying out of view with the prey.

Much literature asserts that birds typically make up most of a Cooper's Hawk diet (e.g., Hornaday 1927, Hausman 1948, Craighead and Craighead 1956, Heintzelman 1979), but that was not the case with these juvenile Cooper's Hawks. In our study this was the only incident in which we knew a bird was the targeted prey among this brood of post-fledging Cooper's Hawks. The hunting behavior of these hawks seems to corroborate suggestions that the Cooper's Hawk diet may stem from prey availability instead of a proclivity toward avian items (Errington 1933, Craighead and Craighead 1969, Bielefeldt et al. 1992). Moreover, ground-based prey such as chipmunks have fewer avenues of predator detection and escape compared to arboreal species and individuals, and thus ground prey may be easier to catch (Bielefeldt et al. 1992). In our study, all mammals except for one gray squirrel hunted in a tree, were attacked while they were on the ground.

Roosting behavior

19 July (22 d fledged) 1831–2000 h—Three hawks roost together.

Three hawks enter the observation area, and within 6 min all are on two branches in the same tree. All three birds are calling frequently, and Hawk 1 (male) moves to an adjacent tree, where a red squirrel (*Tamiasciurus hudsonicus*) moves within 4 m of him and begins scolding. Meanwhile, a chipmunk approaches the observer, who is seated about 30 m from the birds, and the chipmunk starts chattering. All three hawks stop calling, and hawks 2 and 3 turn their heads toward the observer and the chipmunk. Hawk 1 has been continuously staring at the red squirrel, but the squirrel leaves, and the hawk looks over toward the chipmunk. All three birds watch the chipmunk, but none are calling. The chipmunk stops scolding and leaves, and the hawks begin visually surveying the area around them again. They resume calling among themselves, but individually, "taking turns," with calls from one and then another but not always in the same order. The most distant hawks are within 10 m of each other, in two adjacent trees. Within 3 min, their calling has stopped, and all three fluff up their feathers in a roosting posture. They remain in that position until darkness.

21 July (24 d fledged) 1834–1847 h—Interrupted roosting.

Three juvenile hawks fly into the observation area simultaneously. Hawk 1 (male) lands in one tree, and Hawks 2 and 3 (females) land about 3 m apart in an adjacent tree. Hawk 3 gradually moves closer to Hawk 2 until they are less than 1 m apart. There is no calling among the birds.

Over the next 6 min, all three birds ruffle their feathers, and perch on one leg. Hawk 1 is distracted by something near his tree. He begins calling loudly and rapidly, and continues vocalizing until flying off in that direction. Hawks 2 and 3 immediately follow him in the same direction, and all three birds are calling as they leave the observation area. We suspect that the birds may have been responding to a food delivery by an adult as post-fledging Cooper's Hawks typically call frequently while flying toward a parent when it is delivering prey (RNR, unpubl. data), whereas, and as noted above (see Methods), these five fledglings were silent while in flying pursuit of prey, as is also true of older Cooper's Hawks (RNR unpubl. data).

23 July (26 d fledged) 1732–1828 h—Red squirrel and hawks.

Three juveniles are first noticed perched on a fence near the observation post. Hawk 1 is a male, and the other two are females. The birds fly from the fence and move from tree to tree, staying within about 4 m of one another. Hawk 4, another female, flies into the observation area and lands in a separate tree. During the first 15 min, there is very little calling among the birds. Hawks 2 and 3 are within 2 m of each other and assume roosting posture (i.e., fluffing feathers and perching on one leg). After 3 min, a red squirrel in the tree next to Hawks 2 and 3 begins scolding about 5–6 m away from them, then moves into the same tree as the hawks, stopping on the trunk about 2 m short of Hawk 3. Both hawks stare at the squirrel but do nothing detectable in response to it. After 3 min, Hawk 3 takes one step toward the squirrel, and the squirrel scurries part way down the trunk. It stops and scolds for an additional 30–40 sec and then proceeds to the ground. Hawk 1 has been in a different tree during the squirrel incident but now joins Hawks 2 and 3 briefly before returning to his tree. Within 3 min, all four hawks are roosting.

In both this and the above 19 July episodes, it seemed that the hawks were committed to roosting rather than attacking potential prey. Red squirrels are preyed upon by breeding adult Cooper's Hawks (Rosenfield and Bielefeldt 1993), and it seems reasonable that they could have been killed by the juveniles. These incidents were three of only five observations of the fledgling hawks roosting in the study area at day's end. However, it cannot be concluded that the birds were outside study area on other nights, because their pre-roosting behavior sometimes involved little or no calling, so that roosting on the study area may have been undetected.

Juvenile contacts with adult bird

16 July (19 d fledged) 1030–1040 h—Adult hawk examines potential prey site, followed by juveniles.

Juveniles are present when the adult female hawk flies onto a large oak, calls, and then moves to the side of the large fieldstone planter known by the observer to be an active habitat for chipmunks. The adult walks for 1–2 min around the perimeter of the planter, apparently examining it, and then flies back to the oak. In less than 1 min, an immature hawk lands next to the planter where the adult had been and is immediately joined by another juvenile. A third and then a fourth juvenile fly out of the trees, over the two hawks on the ground, and then out of view. The two birds on the ground walk around the fieldstone planter and its bushes, as the adult female had done.

It appeared to us that these two young hawks were mimicking the adult female's hunting behavior at the same specific spot, as also seemed to have occurred in another hunting episode on the next day (see Hunting/Feeding behaviors, 17 July). It might be concluded that the adult behaved in a way (intended or not) that encouraged the young to perform behaviors associated with hunting (Newton 1979).

18 July (21 d fledged) 0915–1014 h—Adult hawk appears during conflict between two immature hawks.

Three juveniles arrive individually, within 3 minutes of each other. A gray squirrel runs up a nearby tree, and two hawks make separate unsuccessful strikes at it during the next 6 minutes. The two hawks then fly to the same branch on the nest tree, with loud, rapid calling between them as they jostle one another, flapping their wings and pushing into each other on a branch immediately below the nest. The adult female flies into the area, straight and level at the nest tree. She lands on a branch 1 m above the scrapping juveniles. The vocalizations of the young birds are so loud that it cannot be determined if the adult is calling. Immediately after the adult lands, the two juveniles stop battling and fly to another tree. The adult flies out of the study area, and the young hawks resume their agonistic behavior. One of the fledglings flies off, low over the ground and around trees, with the other mirroring those flight motions and staying within 1–2 m of the first bird. They both fly from view.

In this incident, the adult female was not seen until she was within 30 m of the nest tree. We think that her presence may have caused the young to cease aggressive behavior as they ended their engagement immediately upon her arrival and resumed such immediately upon her departure.

Our non-detection of adults during most of the post-fledging period was noticeable. However, even the apparently limited presence of the maternal adult indicated some continued involvement with her brood as they matured. Our extended waits (often >2 hr) while attempting to trap Cooper's Hawks near theirs nests at the post-fledgling stage at >100 other Cooper's Hawks nests in Wisconsin over 15 years has shown that adults appear at or visit the immediate nest site infrequently (ca 2–4 times daily), either with or without prey, and are present for about <15–30 min per visit (RNR and W.E. Stout, unpubl. data; see also Murphy et al. 1988).

Hawk contacts with other animals

31 July (34 d fledged) 15:30–15:36 h—Mantling by an immature hawk apparently drives away two gray squirrels.

A gray squirrel is on its back, "playing" with a piece of tree bark on the ground. A female juvenile hawk lands within 1 m of it and the squirrel runs up a nearby sapling. The hawk then hops away from the squirrel, stands still, and scans its surroundings. The squirrel comes down from the tree and resumes playing with the piece of bark about 1 m from the hawk. A second gray squirrel approaches, moving slowly toward the first squirrel until the two of them form a triangle with the hawk, each about 1 m from the others. The hawk briefly watches the animals and takes a step toward one of them. Neither squirrel retreats. The hawk mantles, and the squirrels immediately run away with no pursuit by the hawk.

Cooper's Hawks have been observed to follow prey into underbrush and run them down. They can appear clumsy and unorthodox, but they can be proficient at ground pursuit (Meng 1951).

In this incident, the juvenile had either not learned ground hunting skills or was uncertain whether she should try to catch a squirrel. Faced with two such relatively large prey animals, which were so close but apparently unfrightened of her, this immature Cooper's Hawk appeared to react ambiguously. Perhaps she exhibited the mantling behavior as a response. Her behavior may have been intended to intimidate the squirrels, to protect herself, or to serve some other purpose. Whatever her intent was, the effect of her mantling was to elicit a fleeing response in both squirrels.

Other hawk interactions

19 July (22 d fledged) 0610–0642 h—Three juveniles swoop together, one awkwardly performing a possible hunting maneuver.

Three immature hawks are flying together. They land on trees at 5–10 m heights, staying on branches for only a few seconds, then flying back and forth with each sibling staying within about 4 m of each other. The flight patterns are deep swoops taking the birds at times to within 1–2 m above brush piles.

After several minutes, Hawk 1 lands on a tree branch 5 m above the ground, but 2 m below where a gray squirrel is watching from the trunk of the same tree. The squirrel descends the tree to the same branch, putting hawk and squirrel within 2 m of each other. The squirrel chatters as the hawk watches the squirrel without interruption. The squirrel stops chattering, goes to the ground, and disappears into the brush pile. The hawk flies down and attempts to land in a dense part of the brush pile. It struggles to maintain balance among protruding branches. The hawk gets one wing stuck in an outstretched position and begins to fall off the branch. It attempts to retain its grip on the branch for a few seconds before falling off the brush, tumbling into flight, and leaving the area.

Young raptors must learn to perform flying and hunting maneuvers (Newton 1979). This hawk did not strike at prey per se, but was apparently not yet adept at successfully gaining a perch from which to scan for the potential prey that had just entered the brush pile.

20 July (23 d fledged) 0741–0753 h—Non-food-related sparring between two juveniles.

Hawk 1 arrives at the observation area. Within 3 minutes, Hawks 2 and 3 (females) arrive and perch within 1 m of each other in an adjacent tree. Together, Hawks 2 and 3 hop from branch to branch, changing branches five times in the next 2–3 minutes. During these changes of position there is physical contact between them, such as a flapping wing of one pushing at the other, with this same behavior coming from both birds. No prey item is present. After 4 minutes of this activity, Hawks 2 and 3 fly out of the observation area.

We could not discern a pattern in the order of departures, landings, or other movements of the birds in this incident or in a similar observation on

19 July. Nothing that suggested a leader-follower type of relationship was observed. The physical interaction appeared to be of a sparring nature, with neither bird "winning" the engagement. Such behavior is consistent with Ficken's (1977) observation that fighting in young birds often does not have a definitive outcome.

31 July (34 d fledged) 1713–1729 h—One juvenile "playing."

Hawk 1 (male) flies into the observation area, lands in a sapling, and begins flying from tree to tree. It alights on a fence at the edge of the woods, where it joins Hawk 2 on the fence. Hawk 1 is on a higher rail, but both birds are in the same 2.5 m section of the fence. Hawk 1 jumps to the ground and back to the fence repeatedly, Hawk 2 watching its maneuvers. On the ground, Hawk 1 picks up a piece of bark. He takes it in his foot, returns with it to the fence rail, and carries it along the fence, stopping occasionally to peck at it. The hawk continues "playing" with the object, carrying it back and forth between the ground and the fence rail. Hawk 2 does not join the activity but merely watches until both birds fly off.

There are reports that young raptors "play" with objects by manipulating twigs, pieces of wood, or other objects. The birds often carry them into the air, catch them with their feet, and repeat the activity many times (Ficken 1977). The behavior observed here probably provided the hawk with practice in manipulating and maneuvering skills that perhaps are relevant to successful hunting. Additionally, Hawk 2's observing Hawk 1 during this activity is consistent with the suggestion that young raptors develop some behavior by observing other family members (Bustamante 1993).

Hunting success and groupings of the fledgling hawks.

These inexperienced fledgling Cooper's Hawks were more often successful than not in hunting attacks, capturing prey in 10 (56%)—9 chipmunks and 1 nestling songbird—of 18 hunting episodes. Among these total 18 incidents, single hawk attacks were successful in 7 (54%) of 13 attempts to capture prey, while 3 (60%) of 5 group attacks were successful. Three of these 5 group attacks involved 4 siblings (always 3 females and 1 male) simultaneously attacking prey. The other two group attacks involved 3 siblings (2 females and one male) in a simultaneous attack and in the other hunt a female immediately followed the attack of her sister. Thus group attacks by this brood of post-fledging Cooper's Hawks mostly involved females.

Although not directly comparable to accounts of hunting success by larger numbers of different individual Cooper's Hawks across larger landscapes and longer time periods, the success rates for fledglings at this urban site were nonetheless higher than the 33% and 24% hunting success rates reported for more experienced adult and juvenile Cooper's Hawks, respectively, in Missouri by Toland (1986) or the 20% hunting success rate for overwintering, mostly adult female Cooper's Hawks in Indiana (Roth and Lima 2003).

Because the five juveniles were not individually identifiable, it was not possible to determine which hawks, if any, tended to be with other specific individuals when a group of them gathered. Across 64 separate observational episodes (21 observation episodes detailed above plus the 43 additional episodes [see Methods]), we detected the following highest total number of post-fledging Cooper's Hawks observed during each episode: single individuals 14 times (22%), two siblings together 17 times (27%), three hawks together 18 times (28%), four siblings in a group 13 times (20%), and all five juveniles together only twice (3%) on consecutive days at the age of 54 d and 55 d (28 d and 29 d fledged).

It is also unknown if the observed groupings of four hawks (always three females and one male), involved the same juvenile male. Likewise, when there were two females together, either as a pair or in a trio with one male, we do not know which females were involved. Such information would be helpful in exploring ideas about the variation in post-fledging and subsequent dispersal behavior in individual birds and perhaps in relating those phenomena to hatching order, gender, or other variables. In the congeneric Northern Goshawk, females tended to maintain closer groupings than males, and males were as likely to associate with other males as with females (Kenward et al. 1993b).

Mated pairs aside, Cooper's Hawks are not known to move about, hunt, or otherwise function in groups as adults, typically do not share food as nestlings or, so far as previously known, as fledglings (Rosenfield and Bielefeldt 1993). Yet for 6 weeks post-fledging in our study, these juveniles often followed one another (at least one instance of such behavior in 14 [67%] of 21 observational episodes), and remained close (within 4 m) to each other in 17 (81%) of 21 episodes in various behavioral contexts, as also suggested by briefer observations of fledged Cooper's Hawks in rural New York (Meng 1951), urban Colorado (Stahlecker and Beach 1979), rural Minnesota (Plunkett 1986), and in urban Indiana where Dancey (1993) indicated that two young appeared "inseparable" for "weeks" after fledging. Extensive observations of post-fledging Cooper's Hawks in Victoria, British Columbia also suggest that movements of individuals are not independent of those of their siblings (A. C. Stewart, unpubl. data).

Our observations along with those of others suggest that post-fledging Cooper's Hawks may typically occur in groups and that movement and other behaviors of some individuals are not independent of their siblings. In related research Kennedy et al. (1994) assumed independence of movements among siblings in analyses of radio-telemetry data for post-fledging Northern Goshawks, but admitted that this assumption may have been unrealistic. Kenward et al. (1993a) reported that post-fledgling goshawks in another population did occur in groups, although they did not indicate if the juveniles followed each other. In several non-accipiter raptors it is apparently not uncommon for post-fledglings to occur in groups and to follow one another (Southern et al. 1954, Johnson 1973, Parker 1975, Sherrod 1983). Lett and Bird (1987) suggested that family groups in young-of-the-year American Kestrels (*Falco sparverius*) may remain intact for months after leaving their territory, possibly even migrating together. If true for Cooper's Hawks as well, such behavior could provide insight on why some immature birds may at times move in small groups of 2–3 birds during autumnal migration (Rosenfield and Bielefeldt 1993, D. L. Evans and RNR unpubl. data).

Perhaps broods of recently fledged Cooper's Hawks occur in groups and follow each other simply because, at least in the short term, they associate their siblings with food delivered by parents (as learned passively from the nestling period). We speculate that a benefit of post-fledging groups may involve some survival skills, as we suggested above, passed among fledglings through their observation and mimicking of sibling behavior. It also seems possible that predator detection by and thus survivorship of juvenile Cooper's Hawks could be enhanced when they occur in groups (Alcock 1989), although we have no evidence to support this idea. In contrast, Newton (1986) speculated that a predator that locates one fledgling Eurasion Sparrowhawk is less likely to be led to its sibling because they, unlike Cooper's Hawks and some other raptor species, do remain spatially separated during the post-fledging stage. We urge further research on group behavior during the post-fledging period in Cooper's Hawks and other birds of prey at this largely unexplored stage of breeding.

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LITERATURE CITED

Alcock, J. Animal behavior: an evolutionary approach. Sinauer Associates, Sutherland, MA.

Bent, A. C. 1937. Life histories of North American birds of prey. Part 1. Bulletin No. 167. Smithsonian Institution. Washington, D.C.

Bielefeldt, J., R. N. Rosenfield, and J. M. Papp. 1992. Unfounded assumptions about diet of the Cooper's Hawk. Condor 94: 427–36.

Boal, C. W. and R. W. Mannan. 1999. Comparative breeding ecology of Cooper's Hawks in an urban environment. Journal of Wildlife Management 63: 77–84.

Brown, L. and D. Amadon. 1968. Eagles, hawks, and falcons of the world. Vol. 2. McGraw-Hill Book Company, New York, NY.

Bustamante, J. 1993. The post-fledging dependence period of the Black-shouldered Kite. Journal of Raptor Research 27: 185–190.

Bustamante. J. 1994. Behavior of colonial Common Kestrels *(Falco tinnunculus)* during the post-fledging dependence period in southwestern Spain. Journal of Raptor Research 28: 79–83.

Craighead, J. J. and F. C. Craighead. 1956. Hawks, Owls, and Wildlife. Dover Publications, Inc., New York, NY.

Dancey, H. 1993. A pair of subadult Cooper's Hawks nest in Indiana. Indiana Audubon Quarterly 71: 26–34.

Dunne, P., D. Sibley, and C. Sutton. 1988. Hawks in flight. Houghton Mifflin, Boston, MA.

Errington, P. L. 1933. Food habits of southern Wisconsin raptors, Part II—Hawks. Condor 35: 19–29.

Ficken, M. S. 1977. Avian play. Auk 94: 573–582.

Hausman, L. A. 1948. Birds of prey of northeastern North America. Rutgers University Press, New Brunswick, NJ.

Hector, D. P. 1986. Cooperative hunting and its relationship to foraging success and prey size in an avian predator. Ethology 73: 247–257.

Heintzelman, D. S. 1979. Hawks and owls of North America. Universe Books. New York, NY.

Hornaday, W. T. 1927. Hornaday's American

Natural History. Charles Scribner's Sons. New York, NY.

Johnsgard, P. A. 1990. Hawks, eagles, and falcons of North America. Smithsonian Institution Press. Washington, D.C.

Johnson, S. T. 1973. Reproductive success and post-fledging behavior of Red-tailed Hawks (*Buteo jamaicensis*) in the Gallatin Valley, Montana. Ph.D. dissertation. Montana State University, Bozeman, MT.

Kennedy, P. L., J. M. Ward, G. A. Brinker, and J. A. Gessaman. 1994. Post-fledging areas in Northern Goshawk home ranges. Studies in Avian Biology 16: 75–82.

Kenward, R. E., V. Marcstrom, and M. Karlbom. 1993a. Post-nesting behavior in goshawks, (*Accipiter gentilis*): I. The causes of dispersal. Animal Behavior 46: 365–370.

Kenward, R. E., V. Marcstrom, and M. Karlbom. 1993b. Post-nestling behavior in goshawks, (*Accipiter gentilis*) II. Sex differences in sociality and nest-switching. Animal Behavior 46: 371–378.

Lett, D. W. and D. M. Bird. 1987. Postfledging behavior of American Kestrels in southwestern Quebec. Wilson Bulletin 99: 77–82.

Meng, H. K. 1951. The Cooper's Hawk, *Accipiter cooperii* (Bonaparte). Ph.D. dissertation, Cornell University, Ithaca, NY.

Meng, H. K. and R. N. Rosenfield. 1988. Cooper's Hawk: reproduction. Pages 331–349 *in* R. S. Palmer, editor, Handbook of North American Birds, Vol. 4, part 1: diurnal raptors. Yale University Press, New Haven, CT.

Murphy, R. K., M. W. Gratson and R. N. Rosenfield. 1988. Activity and habitat use by a breeding male Cooper's Hawk in a suburban area. Journal of Raptor Research 22: 97–100.

Newton, I. 1979. Population ecology of raptors. Buteo Books, Vermillion, SD.

Newton, I. 1986. The sparrowhawk. T. and A. D. Poyser, Calton, U.K.

Palmer, R. S. (editor). 1988. Handbook of North American Birds. Vol. 4: Diurnal raptors (Part 1). Yale University Press, New Haven, CT.

Parker, A. 1975. Young male peregrines passing vegetation to each other. British Birds 68: 242–243.

Plunkett, A. M. 1986. An experience with Cooper's Hawks. Loon 58: 55–60.

Reynolds, R. T. and H. M. Wight. 1978. Distribution, density, and productivity of accipiter hawks breeding in Oregon. Wilson Bulletin 90: 182–196.

Rosenfield, R. N. and J. Bielefeldt. 1991. Reproductive investment and anti-predator behavior in Cooper's Hawks during the pre-laying period. Journal of Raptor Research 25: 113–115.

Rosenfield, R. N. and J. Bielefeldt. 1993. Cooper's Hawk (*Accipiter cooperii*) *in* The Birds of North America, No. 75 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C.

Rosenfield, R. N. and J. Bielefeldt. 1999. Mass, reproductive biology, and non-random pairing in Cooper's Hawks. Auk 116: 830–835.

Rosenfield, R. N. and J. Bielefeldt. 2006. Cooper's Hawk (*Accipiter cooperii*). Pages 162–163 *in* Atlas of the Breeding Birds of Wisconsin (N. J. Cutright, B. R. Harriman, and R. W. Howe, eds)., Wisconsin Society for Ornithology, Inc. Waukesha, WI.

Rosenfield, R. N., J. Bielefeldt, J. L. Affeldt, and D. J. Beckmann. 1995. Nesting density, nest area reoccupancy, and monitoring implications for Cooper's Hawks in Wisconsin. Journal of Raptor Research 29: 1–4.

Rosenfield, R. N., J. Bielefeldt, J. L. Affeldt, and D. J. Beckmann. 1996. Urban nesting biology of Cooper's Hawks. Pages 41–44 *in* D. M. Bird, D. E. Varland, and J. J. Negro, editors. Raptors in Human Landscapes. Academic Press, San Diego, CA.

Roth, T. C. and S. L. Lima. 2003. Hunting behavior and diet of Cooper's Hawks: an urban view of the small-bird-in-winter paradigm. Condor 105: 474–483.

Sherrod, S. 1983. Behavior of fledgling peregrines. Pioneer Impressions, Fort Collins, CO.

Southern, H. N., R. Vaughan, and R. C. Muir. 1954. The behavior of young tawny owls after fledging. Bird Study 1: 101–110.

Stahlecker, D. W. and A. Beach. 1979. Successful nesting by Cooper's Hawks in an urban environment. Inland Bird Banding 51:56–57.

Stewart, A. C., R. W. Campbell, and S. Dickin. 1996. Use of dawn vocalizations for detecting breeding Cooper's Hawks in urban environment. Wildlife Society Bulletin. 24: 291–293.

Toland, B. 1986. Hunting success of some Missouri raptors. Wilson Bulletin. 98: 116–125.

Varland, D. E., E. E. Klass, and T. M. Loughin. 1991. Development of foraging behavior in the American Kestrel. Journal of Raptor Research 25: 9–17.

Varland, D. E. and T. M. Loughin. 1992. Social hunting in broods of two and five American kestrels after fledging. Journal of Raptor Research 26: 74–80.

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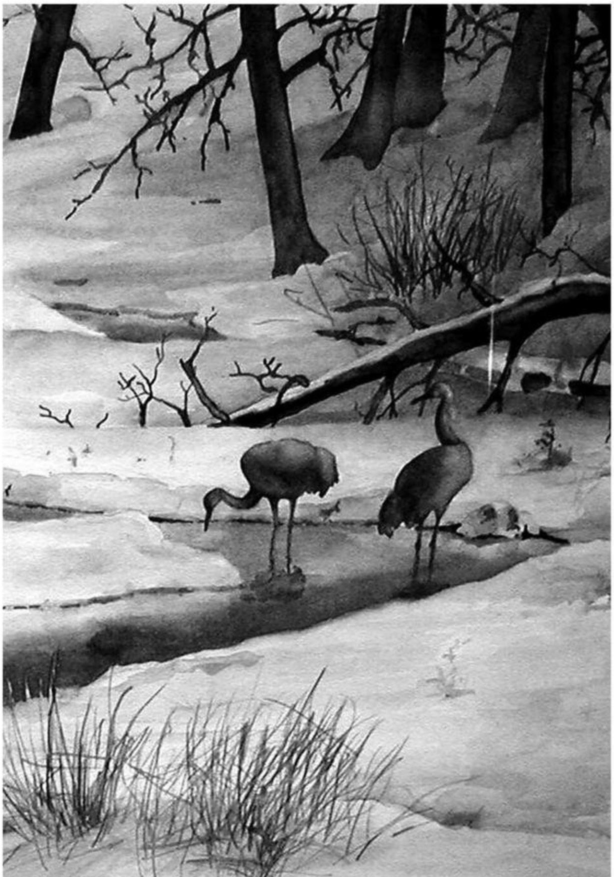

"March Migrants" by Janet Flynn.

Townsend's Solitaire by Alan Stankevitz.

Dynamics of Breeding and Non-breeding Sandhill Cranes in South-central Wisconsin

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Abstract

Color-banded greater Sandhill Cranes (Grus canadensis tabida) *were monitored to understand dynamics occurring between the breeding and non-breeding portions of a dense population in south-central Wisconsin. Of 151 cranes banded as chicks between 1991–2005, 21–28% likely did not reach sexual maturity, 23% were observed as paired and on a breeding territory, and 34% were observed alive in the past three years, most being paired and potentially holding territories outside of our study area. Cranes of known age (i.e., banded as hatch-year chicks; n=18) stayed on territory an average of 3.3 years. This estimate of territory retention differs from cranes banded as breeding adults (n=111), which stayed on territory for an average of 6.5 years following banding. Nine adult cranes lost their breeding territory following a mate switch and returned to the non-breeding portion of the population. Only two of these nine cranes were confirmed on a new breeding territory and successfully bred again. One of these birds was a female that was followed from chick to subadult (3 years), to breeding adult (1 year), to non-breeding adult (2 years), then back to breeding adult again (3+ years). Another four adults were observed alive after their status changed, suggesting they dispersed out of our study area and may or may not have occupied another territory. Crane members of a non-breeding flock consist, therefore, of 1) immature birds physiologically incapable of breeding, 2) sexually mature birds that have not yet acquired a breeding territory, 3) sexually mature birds temporarily removed from a breeding territory, and 4) post-breeding birds who are no longer able to hold a territory. Movement of birds between breeding and non-breeding flocks is highly dynamic, more extensively than previously recorded. To fully understand crane survival, as well as territory acquisition and retention for this population, the ecol-*

ogy of dispersing birds needs to be examined in greater detail.

Introduction

Greater Sandhill Cranes (*Grus canadensis tabida*) are easily observed during spring, summer, and fall in Wisconsin, as well as in surrounding Great Lakes states. During spring and fall, large flocks of sandhills are seen in agricultural fields, along the Wisconsin River and other staging areas (United States Fish and Wildlife Service, unpubl. data), or in migratory flight. Migrants and local birds are mixed at this time and difficult to distinguish. During the summer, however, resident birds are more sedentary and do not mingle with migrants. In this season, two distinct social classes can be differentiated. Breeding pairs return annually to a specific breeding territory and defend it against encroachment from neighboring pairs or displacement by another pair (Walkinshaw 1989). In addition to territorial defense, each member of a pair participates in incubation and raising the chicks (Walkinshaw 1973). Pairs also remain united until fall migration even if chick rearing is unsuccessful (Hayes 2005).

Within general breeding areas, loosely aggregated flocks of non-territorial individuals also occur. These flocks are less tied to a specific area and move from location to location throughout the breeding season (Bennett 1989, Nesbitt and Williams 1990) but within a relatively small home range (International Crane Foundation, unpubl. data). It has long been recognized that a majority of individuals in these flocks are young birds because the minimum age of sexual maturity in Sandhill Cranes appears to be three (Tacha et al. 1989, Nesbitt 1992, Mirande et al. 1996). It has also been speculated that these flocks contain adults that were formerly breeding, but lost their territory following a mate switch (Tacha 1988) but this situation has not been documented. Nesbitt and Wenner (1987) and Nesbitt (1989) referred to the preponderance of female Florida Sandhill Cranes moving to the non-breeding flock after a mate switch, while males remained on territory. In contrast to this, virtually all Whooping Cranes (*Grus americana*) were able to find a new mate quickly after mate loss without losing a breeding opportunity (Stehn 1992).

The International Crane Foundation (ICF) has been color-banding Sandhill Cranes in south-central Wisconsin for the past 15 years (Hayes et al. 2003). In that period, observations of banded cranes suggest that the dynamics between non-breeding and breeding portions of the population are more complex than once thought. Do Sandhill Cranes move from the non-breeding flock to a breeding territory as soon as they reach sexual maturity? Is there evidence that although a crane achieves breeding status, it might be forced to return to the non-breeding flock? Finally, are there other types of cranes that occur in non-breeding flocks? Answers to these questions will help understand the population ecology of cranes.

Study Area

Sandhill Cranes were monitored near Briggsville, Wisconsin (N 43° 36′, W 89° 36′), an area dominated by agriculture intermixed with wetlands and limited residential development aside from small farmsteads (Su 2003). Sandhill Cranes remained in this area during the extreme reduction in population size which occurred throughout the Midwest during the early 1900s (Henika 1936, Walkinshaw 1949). This population has since rebounded (Su et al. 2004) and the Briggsville area now has a dense population of Sandhill Cranes. The average nesting density of this population was 3.3 nests/km^2 of wetland between 2001 and 2003 (ICF unpublished data). Most viable breeding territories are occupied, leaving little room for new territory establishment (Hayes 2005). In addition to breeding cranes, approximately 50% of the total population occurs as non-breeding birds (Su 2003).

Methods

Two different methods were used to capture Sandhill Cranes from 1991–2005. Territorial adult pairs and family groups with fledged chicks (older than 90 days) were captured using alpha-chloralose, an oral tranquilizer (Hayes et al. 2003). Flightless chicks (age 36 to 70 days) were chased on foot until they hid and could be captured (Boise 1979). Each crane received a three-inch plastic band engraved with a unique three-digit number that was placed above the tarsal joint of one leg. One-inch colored plastic leg bands were added, in a unique color combination for each bird, above the same joint on the opposite leg. U. S. Fish and Wildlife Service (USFWS) aluminum rivet bands were also added in the color combination or below the tarsal joint. Each bird was identifiable in three different ways: color-band combination (quickly discernible at long distances by trained observers); 3-inch band number (simple recognition for untrained observers); and USFWS band (bird in hand). Having each crane redundantly marked allowed the opportunity for more observations from a diversity of observers with varied training.

Age (adult or chick) was determined through presence/absence of red skin on the bird's head (Lewis 1979). Blood samples were collected on most birds captured between 1996 and 2005. For chicks where blood samples were collected, gender was determined through genetic analysis (Griffiths et al. 1998, Duan and Fuerst 2001). For other adults and chicks, gender was determined by size (males are typically larger than females; Nesbitt et al. 1992) or behavior (unison call; Archibald 1976).

We defined a non-breeding crane as one that was present during the breeding season but did not defend a territory or attempt breeding during that season. To determine this, the area was observed for non-breeding flocks of cranes from the time Sandhill Cranes arrived on the breeding grounds (late February through early March) until they departed for the wintering grounds (mid to late November) each year (Su 2003). Breeding cranes were differentiated from non-breeding cranes by behavior: defending a territory; nesting; or hatching and raising chicks with another crane (Walkinshaw 1973). Mean values in the Results section are ± 1 SD.

Results

A total of 262 Sandhill Cranes have been individually banded in the Briggsville area over the past 15 years. Of these cranes, 151 (58%) were banded as hatch-year chicks (known-age cranes) and 111 (42%) were banded as breeding adults already defending a territory.

Subadult Cranes

Of the 151 known-age cranes banded during this study, 31 (21%) did not get the opportunity to defend a territory and attempt breeding. Twenty-two died or disappeared prior to fledging while four were not seen with their parents after capture. The five remaining known-age cranes all reached independence and were seen in the study area, but died between 1–3 years old (i.e., prior to obtaining a breeding territory). Additionally, 10 chicks (7%, n=151) were observed alive with their parents up to their first fall migration, but were not observed alive at any time afterwards. So it is unknown whether or not these chicks dispersed from the study area or died following their fall departure.

Of the 110 remaining known-age cranes, 25 (23%; 13 males and 12 females) were confirmed defending and maintaining a breeding territory of which 18 territories were found inside the study area. Seven territories were confirmed by observing pairs on fall staging areas with chicks, confirming breeding without knowing the location of their territory. Only three subadult cranes moved into a breeding territory following the confirmed or suspected death of a banded breeding adult (Hayes 2005). The remaining individuals paired with unbanded birds, so we do not know if the mates were previously territorial and lost a mate, or if they were not yet territorial.

Average time spent on territory for the 18 known-age cranes now breeding in our study area was 3.3 ± 1.6 years (range 1–7 years), including nine individuals whose time on territory was ongoing at the end of this study period. When the sample was narrowed to cranes on territory for a confirmed length of time (n=9), the average dropped to 3.0 ± 1.9 years, but the range remained the same. Mortality or disappearance from a breeding territory signaled the end of territoriality for all cranes except two; these individuals left their territory following a mate switch (see below).

The number of mates each of these 18 known-age birds in our study had is difficult to determine, since many banded cranes paired with unbanded individuals. One female had only one mate during her four years on territory, while another female had two mates during her seven years on territory, switching only after her first mate died. A third female paired with an unbanded mate after her first mate disappeared, while a male divorced his banded mate and paired with a new unbanded individual on a new territory.

Of the remaining 85 known-age birds, 34 (40%) were seen alive in the study area at some point during 2005 (Table 1). Eighteen of 34 cranes (53%) were at least 4 years old (range 4–15 years), suggesting they were sexually mature but were not on territory. Twelve of these 18 cranes were strongly paired, whereas six birds were paired with at least two different individuals. Interestingly, an eight-year-old

Table 1. Number of Sandhill Cranes of different age and social groups and the last year they were observed.

Year Last Seen	Paired Age (years) 1–3	Paired Age (years) 4+	Non-paired Age (years) 1–3	Non-paired Age (years) 4+
2005	5	12	11	6
2004	2	1	1	1
2003	1	2	4	6
2002	0	0	4	1
2001	1	3	8	2
2000	0	0	0	4
1999	0	0	2	2
1998	0	0	4	0
1994	0	0	2	0

male, a five-year-old female, and a four-year-old female have been consistently observed each summer since independence and, although each is paired, they have not acquired a territory. Eighteen other known-age birds were observed in 2004 and 2003 (Table 1) and are likely still alive as well, but because these birds summer outside our study area, their territorial/breeding status is unknown. The remaining 33 birds have not been observed recently, so their status cannot be determined.

Cranes That "Lost" Breeding Status

Cranes banded as breeding adults (n=111) remained on a breeding territory for an average of 6.5 ± 4.1 years (range 1–15 years), with individuals remaining on the same territory for an average of 6.2 ± 4.1 years (range 1–15 years). Causes for territoriality to end came from mate-switching (occurring at a high rate; Hayes 2005) and from territory switching (rarely occurring). Nine breeding adults (two males and seven females) moved to nearby territories after a mate switch without missing a breeding season. Nine other breeding adults (three males and six females) lost their breeding territory and status following a mate switch. None of the three males were observed with a new mate or breeding territory. The carcass of one male was found approximately three weeks after displacement from his territory. While the other two males were observed alive after being displaced from their territory, they disappeared within two months. These males may be alive outside of our study area or they may have died after they disappeared.

All of the six females that lost their breeding status re-paired with a new male. Actual time to re-pairing following the death of a mate occurred in less than three months because five of the six females lost their mates during winter. Only two of the six females could be relocated on a breeding territory following re-pairing. One of these females went through the complete cycle of non-breeding subadult (3 years), to breeding adult (1 year), to non-breeding adult (2 years), then back to breeding adult again (3+ years). While both females took approximately 18 months to gain a new breeding territory following the death of their mate, they took three to four years to fledge chicks after becoming breeding birds again. Of the four females that could not be relocated on a breeding territory, three were observed alive after territory displacement and likely dispersed from the study area.

The sixth female is the most interesting. Her mate of at least three years disappeared during the winter of 1998–1999. In 1999, this female was observed in a non-breeding flock of four birds consisting of two banded un-paired males and an unbanded bird of unknown gender or age. These four individuals were observed regularly throughout that breeding season. In 2000, the female was paired with one of banded males intermittently throughout the breeding season, but did not defend a territory. In 2001, the female copulated with a banded territorial male while his mate was absent (Hayes in press). The next day, the territorial male was back with his original mate, while the female paired with an unbanded male nearby. The female was observed alone intermittently, suggesting that she and her unbanded mate may be nesting, but this could not be confirmed from later observations. The female disappeared after July 2002. It is possible that she moved outside of our study area and was not seen, but she also could have died.

Discussion

The breeding and non-breeding portions of this population are highly dynamic. Not only do immature cranes populate a resident, non-breeding flock, but so do cranes who are sexually mature but unable to obtain breeding status by becoming territorial. Further, breeding adults do not retain their territory, once established, for as long as they live. Sexually mature birds that are temporarily removed from a breeding territory can regain a territory, but this opportunity is not assured. Post-breeding birds no long able to hold a territory remain in the non-breeding flock until they die or find another territory. Movement between breeding and non-breeding components of the resident population is more frequent than previously suspected. These tendencies have been speculated for other Sandhill Crane populations (Nesbitt and Wenner 1987, Tacha 1988, Nesbitt 1989), but not to the extent we cover here.

The time that known-age cranes (banded as chicks) spent on territory was about half that of those banded as breeding adults who were captured on their territory. One explanation could be the large difference in sample size, as many known-age cranes are just now beginning to attain territories even though this study has been underway for 15 years. Over half of the known-age cranes have not lived out their entire span on territory. As more known-age cranes obtain breeding status, a more realistic comparison can be attained.

Breeding cranes that lost a mate and territory, due to death or divorce, did not necessarily gain instant access to a new territory, and had to return to the non-breeding portion of the population, as suggested, but not measured, in other studies (Nesbitt and Wenner 1987, Nesbitt 1989). Some of these individuals did successfully re-pair and gain a new territory, but they lost two to three breeding opportunities (years) before doing so. This delay can be costly, as reproductive success for a breeding pair in this population averages 0.5 chicks per year (Hayes 2005).

Not all cranes attained breeding status once sexually mature. Failure to obtain breeding territories suggests that all suitable breeding territories in our study area are filled with breeding cranes and breeding adult mortality in this population is relatively low (Hayes 2005). Even though young birds may pair, they may delay reproduction while waiting for an opening on a territory to occur. This wait can be significant as each year a sexually mature crane does not breed lowers its reproductive fitness and potential. Young birds must decide whether to remain in the study area (safe because they know the area) and wait for an opening (costly because delay lowers fitness), or leave the area (costly because they move to an unfamiliar area) and potentially obtain a territory at an earlier age. Regardless, a pair of cranes that remain on territory for three years cannot replace themselves with an average fledging rate of 0.5 chicks per year, and only narrowly replace themselves over six years with the same fledging rate.

More intense observation is needed on non-breeding Sandhill Cranes, especially those that disperse from our study area. Many chicks that dispersed from their natal area were observed alive, but only seen in our study area during migration. Following these chicks as they mature and defend their own territory would help us understand the costs and benefits of being philopatric versus dispersing (in terms of finding mates and defending territories at younger ages, as well as overall reproductive success). Such studies would further provide a better understanding of the sustainability of the breeding population in our study area and of how these cranes interact with surrounding breeding populations in Wisconsin.

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LITERATURE CITED

Archibald, G. W. 1976. The unison call of cranes as a useful taxonomic tool. Ph.D dissertation, Cornell University, Ithaca, NY.

Bennett, A. J. 1989. Movements and home ranges of Florida Sandhill Cranes. Journal of Wildlife Management 53: 830–836.

Boise, C. M. 1979. Lesser Sandhill Crane banding program on the Yukon-Kuskokwim Delta, Alaska. Pages 229–236 *in* J. C. Lewis, ed., Proceedings 1978 Crane Workshop. Colorado State University and National Audubon Society, Fort Morgan, CO.

Duan, W. and P. A. Fuerst. 2001. Isolation of a sex-linked DNA sequence in cranes. Journal of Heredity 92: 392–397.

Griffiths, R., M. C. Double, K. Orr, R. J. G. Dawson. 1998. A DNA test to sex most birds. Molecular Ecology 7: 1071–1075.

Hayes, M. A. In press. Observation of an extra-pair copulation by Sandhill Cranes. Wilson Journal of Ornithology.

Hayes, M. A., B. K. Hartup, J. M. Pittman, and J. A. Barzen. 2003. Capture of Sandhill Cranes using alpha-chloralose. Journal of Wildlife Diseases 39: 859–868.

Hayes, M. A. 2005. Divorce and extra-pair paternity as alternative mating strategies in monogamous Sandhill Cranes. M.S. Thesis. University of South Dakota, Vermillion, SD.

Henika, F. S. 1936. Sandhill Cranes in Wisconsin and Other Lake States. Proceedings North American Wildlife Conference 1: 644–646.

Lewis, J. C. 1979. Field identification of juvenile Sandhill Cranes. Journal of Wildlife Management 43: 211–214.

Mirande, C. M., G. F. Gee, A. Burke, and P. Whitlock. 1996. Egg and semen production. Pages 45–57 *in* D. H. Ellis, G. F. Gee, and C. M. Mirande, editors, Cranes: Their Biology, Husbandry, and Conservation. Department of the Interior, National Biological Service, Washington D.C., and International Crane Foundation, Baraboo, WI.

Nesbitt, S. A. 1989. The significance of mate loss in Florida Sandhill Cranes. The Wilson Bulletin 101: 648–651.

Nesbitt, S. A. 1992. First reproductive success and individual productivity in Sandhill Cranes. Journal of Wildlife Management 56: 573–577.

Nesbitt, S. A., and A. S. Wenner. 1987. Pair formation and mate fidelity in Sandhill Cranes. Pages 117–122 *in* J. C. Lewis, editor, Proceedings 1985 Crane Workshop, Platte River Whooping Crane Habitat Maintenance Trust and U.S. Fish & Wildlife Service, Grand Island, NE.

Nesbitt, S. A, and K. S. Williams. 1990. Home range and habitat use of Florida Sandhill Cranes. Journal of Wildlife Management 54: 92–96.

Stehn, T. V. 1992. Re-pairing of Whooping Cranes at Aransas National Wildlife Refuge. Pages 185–187 *in* D. A. Wood, editor. Proceedings of the 1988 North American Crane Workshop. Florida Fish and Wildlife Conservation Commission, Gainesville, FL, USA.

Su, L. 2003. Habitat selection by Sandhill Cranes, *Grus canadensis tabida*, at multiple geographic scales in Wisconsin. Ph.D Dissertation, University of Wisconsin-Madison, Madison, WI.

Su, L, J. Harris, and J. Barzen. 2004. Changes in population and distribution for greater Sandhill Cranes in Wisconsin. Passenger Pigeon 66: 317–326.

Tacha, T. C. 1988. Social organization of Sandhill Cranes from mid-continent North America. Wildlife Monographs 99: 1–37.

Tacha, T. C., D. E. Haley, and P. A. Vohs. 1989. Age of sexual maturity of Sandhill Cranes from mid-continental North America. Journal of Wildlife Management 53: 43–46.

Walkinshaw, L. N. 1949. The Sandhill Cranes. Cranbrook Institute of Science, Bloomfield Hills, MI.

Walkinshaw, L. N. 1973. Cranes of the world. Winchester Press, New York, NY.

Walkinshaw, L. N. 1989. The greater Sandhill Crane in Michigan: An update of nest data with observations on site fidelity. The Jack-Pine Warbler 67: 3–17.

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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) 0	2.5	5	10	25	50	Grand mean
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 criteria 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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LITERATURE CITED

Anderson, S. H. 1982. Effects of the 1976 Seney National Wildlife Refuge wildfire on wildlife and wildlife habitat. Resource Publication 146, U. S. Fish and Wildlife Service, U. S. Department of Interior, Washington, D. C.

Baetsen, R., B. Heuvelhorst, and T. Casselman. 2005. Nesting of the Great Gray Owl, Seney National Wildlife Refuge, Schoolcraft County, Michigan. Michigan Birds and Natural History 12: 2–5.

Barrows, W. B. 1912. Michigan bird life. Michigan Agricultural College, East Lansing, MI.

Brewer, R. A., G. A. McPeek, and R. A. Adams, Jr. 1991. The atlas of breeding birds of Michigan. Michigan State University Press, East Lansing, MI.

Bull, E. L., M. G. Henjum, and R. S. Rohweder. 1988a. Home range and dispersal of Great Gray Owls in northeastern Oregon. Journal of Raptor Research 22: 101–115.

Bull, E. L., M. G. Henjum, and R. S. Rohweder. 1988b. Nesting and foraging habitat of Great Gray Owls in northeastern Oregon. Journal of Raptor Research 22: 101–115.

Bull, E. L., M. G. Henjum, and R. S. Rohweder. 1989. Diet and optimal foraging of Great Gray Owls. Journal of Wildlife Management 53: 47–50.

Bull, E. L., and J. R. Duncan. 1993. Great Gray Owl (*Strix nebulosa*). *In* The Birds of North America, No. 41 (A. Poole and F. Gill, Eds.). The Academy of Natural Sciences, Philadelphia and The American Ornithologists' Union, Washington, D. C.

Crozier, G. E., and G. J. Niemi. 2003. Using local patch and landscape variables to model bird abundance in a naturally heterogeneous landscape. Canadian Journal of Zoology 81: 441–452.

Cutright, N. J., B. R. Harriman, and R. W. Howe. 2006. Atlas of the Breeding Birds of Wisconsin. Wisconsin Society for Ornithology. Waukesha, WI.

Dieck, J. J., and L. R. Robinson. 2004. General classification handbook for floodplain vegetation in large river systems. United States Geological Survey, Upper Midwest Environmental Science Center, La Crosse, WI.

Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and monitoring plant populations. U. S. Department of the Interior, Bureau of Land Management, BLM/RS/ST-98/005+1730, Denver, CO.

Follen, D. G., Sr. 1979. A probable breeding record of Great Gray Owls in Wisconsin. The Passenger Pigeon 41: 53–57.

Follen, D. G., Sr. 1987. Wisconsin Great Gray Owl update. Passenger Pigeon 49: 96–98.

Franklin, A. B. 1988. Breeding biology of the Great Gray Owl in southeastern Idaho and northwestern Wyoming. Condor 90: 689–696.

Gostomski, T. J. 1997. Observations of Great Gray Owls (*Strix nebulosa*) within the Apostle Islands National Lakeshore and surrounding area, Bayfield and Ashland Counties. Passenger Pigeon 59: 275–277.

Harris, W. C. 1984. Great Gray Owls in Saskatchewan (1974–1983). Blue Jay 42: 152–160.

Hoglund, N. H., and E. Lansgren. 1968. The Great Gray Owl and its prey in Sweden. Viltrevy 5: 360–421.

Janssen, R. B. 1987. Birds in Minnesota. University of Minnesota Press, Minneapolis, MN.

Jensen, W. F., W. L. Robinson, and N. L. Heitman. 1982. Breeding of the Great Gray Owl on Neebish Island, Michigan. The Jack-Pine Warbler 60: 27–28.

Law, C. 1960. The Great Gray Owl of the woodlands. Blue Jay 18: 14–16.
Master, L. L. 1979. Some observations on Great Gray Owls and their prey in Michigan. The Jack-Pine Warbler 57: 215–217.
Merkel, K. J. 1989. Wisconsin's first documented nesting of Great Gray Owls. Passenger Pigeon 51: 133–143.
Mikkola, H. 1976. Konneveden lapinpollot. Savon Luonto 8: 13–22.
Stepnisky, D. P. 1997. Landscape features and characteristics of Great Gray Owl (*Strix nebulosa*) nests in fragmented landscapes of central Alberta. Pages 601–607 *in* J. R. Duncan, D. H. Johnson, and T. H. Nicholls, eds. Biology and Conservation of Owls of the Northern Hemisphere. General Technical Report NC-190. U. S. Forest Service, St. Paul, MN.
Whitfield, M. B., and M. Gaffney. 1997. Great Gray Owl (*Strix nebulosa*) breeding habitat use within altered forest landscapes. Pages 498–505 *in* J. R. Duncan, D. H. Johnson, and T. H. Nicholls, eds. Biology and Conservation of Owls of the Northern Hemisphere. General Technical Report NC-190. U. S. Forest Service, St. Paul, MN.
Wood, N. A. 1951. The birds of Michigan. University of Michigan Press, Ann Arbor, MI.

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Blue Jay by Dennis Malueg.

Monitoring Population Trends of Owls and Woodpeckers with Volunteers in Western Superior National Forest, Minnesota

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Abstract

Monitoring of trends in populations of owl and woodpecker species along fixed road transects was initiated with the use of volunteers. Owls were relatively uncommon. Five species of woodpeckers were detected more frequently than owl species. Results were affected by volunteer skill (observer difference), weather, noise from cars and dogs, differential results with response to playback calls, noise from walking, wide annual fluctuations in peak of calling by owl species, and difficulty in identifying woodpecker species by just drumming.

Introduction

Volunteer-based surveys have been used to determine the status and trend of populations of owl and woodpecker species; e.g., surveys conducted in Montana and several Canadian provinces including Ontario and Manitoba (Duncan and Duncan 2001, Takats et al. 2001, Badzinski 2002). Broadcast surveys are used widely to locate and survey owls (e.g., Smith and Carpenter 1987, Takats et al. 2001). Techniques for monitoring Pileated Woodpecker were developed in the western United States (Bull et al. 1990; see Tables 1 and 2 for scientific names of birds). The staff of the Chippewa National Forest in north central Minnesota have been monitoring population trends of Barred Owl and Pileated Woodpecker since 1988 as part of the program to monitor populations of their management indicator species. Population trends of larger-sized cavity nesters are of interest because these trends may be affected in part by trends in forest management. Our objective was to establish a baseline and monitor population trends of owls and woodpeckers population on the Laurentian Ranger District of the Superior National Forest. We also wanted to see if standard Ruffed Grouse monitoring transects could be used to monitor woodpeckers. These same species, with the exception of Boreal Owl, are also found in the North Woods of Wisconsin. This paper describes the results of volunteer-based surveys to accomplish that objective and comments on their effectiveness.

Methods

Populations of owls and woodpeckers were sampled in 1992 and 1993. Owls only were sampled again in 1994, 1998, 2000, 2001, and 2002. The 1992 and 1998 and later surveys were conducted by students at Vermillion College in Ely (coordinated 1992 by Bill Tefft and later by Lori Schmidt). The 1993 surveys were done under contract by professional biologist Don Goodermate. The 1994 surveys were completed by students of Hibbing Community College (coordinator Dave Ungaro).

Surveys were conducted on nine 7- to 16.5-mile transects on forest roads driveable in the winter located between Side Lake north of Chisholm and Greenwood Lake-Highway 2 north of Two Harbors (total of 112 miles of road). Observers stopped every 0.5 mile along fixed routes. They listened for 3 minutes, noting any detections. Then they broadcast a Barred Owl or Pileated Woodpecker territorial call for 15 seconds, noting additional detections during the remainder of the observation period which lasted a total of 6 minutes at each stop. Surveys for owls were conducted between February and April, and for woodpeckers in late April. Woodpeckers were identified to species from sightings, calls, and sometimes their drumming. Surveys for owls were conducted at night, usually before 1 a.m., and those for woodpeckers were done in the morning before 11 a.m.

In 1993, owls were sampled twice, once in March and the second time in April. Early March was too early for most species with the exception of Great Gray Owl and Great Horned Owl. Poor weather (winds > 12 mph or precipitation) between 5 and 20 April 1993 made surveying impossible except for four nights, yet more owls were detected in the April survey that year.

Results

Owls were relatively uncommon (Table 1). These species were not confined to any one part of the project area. While Boreal Owls were most

Table 1. Acoustic detections and visual observations of owls per mile of road surveyed by year*.

Species	1992	1993	1994	1998	2000	2001	2002
Long-eared Owl (*Asio otus*)	0.009	0	0	0.036	0	0	0.012
Great Horned Owl (*Bubo virginianus*)	0	0.090	0.035	0.018	0.017	0.010	0.023
Barred Owl (*Strix varia*)	0.009	0.081	0.079	0.080	0.034	0.010	0.022
Great Gray Owl (*Strix nebulosa*)	0.045	0.063	0	0.018	0	0.020	0.047
N. Saw-whet Owl (*Aegolius acadicus*)	0.089	0.053	0.097	0.018	0.102	0.051	0.082
Boreal Owl (*Aegolius funereus*)	0.098	0.018	0.009	0.009	0	0	0

*In 1992, 1993, 1994, and 1998 based on nine 7- to 16.5-mile transects totalling 112 miles and located across the Laurentian Ranger District, Superior National Forest. In 2000 monitoring was limited to six road segments totalling 59 miles. In 2001, eight road segments totalling 98 miles were monitored. In 2002, road construction or closure restricted monitoring to seven road segments totalling 85.5 miles.

Table 2. Acoustic detections and visual observations of woodpeckers and Ruffed Grouse per mile of road surveyed by year*.

Species	1992	1993
Yellow-bellied Sapsucker (*Sphyrapicus varius*)	0.089	0.29
Downy Woodpecker (*Picoides pubescens*)	0.178	0.28
Hairy Woodpecker (*Picoides villosus*)	0.170	0.15
Black-backed Woodpecker (*Picoides arcticus*)	0.009	0.04
Am. Three-toed Woodpecker (*Picoides dorsalis*)	0	<0.01
Northern Flicker (*Colaptes auratus*)	0.241	0.68
Pileated Woodpecker (*Dryocopus pileatus*)	0.563	0.39
Unidentified woodpecker	n.a.	0.53
Ruffed Grouse (*Bonasa umbellus*)	0.509	0.33

*Based on nine 7- to 16.5-mile transects totalling 112 miles and located across the Laurentian Ranger District, Superior National Forest.

likely to be detected in the eastern portion (Hwy 2 north of Two Harbors), calls were also recorded in other areas including the western portion north of Virginia.

Woodpeckers were detected more frequently than owls. Common woodpecker species included Yellow-bellied Sapsucker, Downy Woodpecker, Hairy Woodpecker, Northern Flicker, and Pileated Woodpecker (Table 2).

Discussion

We received mixed reports on the effectiveness of using playback calls to detect owls and, therefore, used a 3-minute silent observation period before playing the tape. Don Goodermote, when initially experimenting with also using a Boreal Owl playback, reported that owls within about 0.5 mile seemed to cease calling following the Boreal Owl playback. Other observers reported occasional responses to the tape.

In 1992, portions of each transect were also walked without stopping (total 35 miles). The noise from walking in snow made it difficult to hear and observers concluded that driving and stopping to listen every 0.5 miles was a better technique. However, more woodpeckers and Ruffed Grouse per linear mile were sampled by walking.

Some of the routes, especially near populated areas north of Virginia, had considerable noise from vehicles and dogs. These routes need to be sampled after about 10 p.m. to reduce interference from road noise. Frank Nicoletti, working as a volunteer for the Minnesota Department of Natural Resources (DNR), found that vocalizing frogs in late April made owl detection difficult.

Local owl biologist Steve Wilson (personal communication) observed how difficult it is to monitor Boreal Owl population trends in northeastern Minnesota because the periods of peak calling fluctuated widely from year to year. Missing a peak period could radically affect numbers of detections.

Identifying woodpeckers required considerable practice and experience to be used correctly. Don Goodermote (personal communication) reported that broadcasting the Pileated Woodpecker call and drumming tapes evoked responses from Pileated Woodpeckers and other woodpeckers. Goodermote also experimented with playback of Black-backed Woodpecker drumming, and on one occasion a Black-backed Woodpecker began drumming following the playing of that recording. Woodpecker activity decreased significantly after early morning, and especially after about 11 a.m., so similar surveys should probably be limited to the distance that can be surveyed in early morning (about 10 miles) per morning.

Ten miles (20 stops, not observing at start of route) is the same length used for the Minnesota DNR's standard Ruffed Grouse survey and, therefore, there is the possibility to expand Ruffed Grouse surveys to include woodpeckers. Observers found it easy to record Ruffed Grouse drumming counts while noting woodpeckers, except that most observers had trouble distinguishing woodpecker tapping by species. Conducting surveys prior to Northern Flicker migration might be easier because one would then have only to distinguish among the three all-year resident woodleckers. However, such a survey would have to be done prior to when Ruffed Grouse surveys are usually conducted.

Woodpeckers are more easily detected than owls, are probably more common, and may therefore be the more reliable indicator of cavity nesting habitat. Observers need to spend more time learning species-specific calls and drummings. Northern Flicker and Yellow-bellied Sapsucker are probably not good indicators because large numbers may be migrating through the area when surveys are conducted in late April–early May.

Owl species are more difficult to monitor given low population numbers. Many more survey routes or a combination of techniques may be needed to achieve statistical precision in detecting significant changes in populations except perhaps over very long periods of time. Owls may have considerable annual changes in populations in relation to prey densities in the local area as well as far to the north. Northern Saw-whet Owl, Boreal Owl, and Great Gray Owl may also call while migrating in spring in Manitoba (Jim Duncan, owl biologist, Manitoba, personal communication 27 April 2002).

In the spring of 2000, the Minnesota Department of Natural Resources and the University of Minnesota Natural Resources Research Institute (NRRI) initiated a volunteer-based nocturnal and diurnal raptor survey in three locations in northern Minnesota outside the Superior National Forest (unpublished NRRI technical report NRRI/TR-2000/37). They observed the same owl species that we detected (Table 1), except for Boreal Owl. They concluded that individual differences among observers might be as influential as playback calls, especially during hawk surveys that are more visually based. They also had difficulty determining the optimal time to survey. Two, and perhaps at least three, surveys are needed between February and April for owls. Subsequent Minnesota DNR surveys in 2001 found nesting Boreal Owl extending northwest into northern Koochiching County (Maya Hamady, personal communication 2003).

After evaluation of these pilot surveys, along with similar on-going efforts in Ontario, Manitoba, and elsewhere (Takats et al. 2001), a coordi-

Table 3. Key elements of a set of standards for owl monitoring (Takats et al. 2001).

Routes should be selected using appropriate randomizations (if possible) to ensure that they are representative of the area being surveyed, within the constraints of a roadside survey.
Routes should consist of at least 10 stations spaced at least 1.6 km apart, that can be surveyed in a single night.
Routes should be surveyed once per year at the time when the majority of species in the region are most active vocally.
The starting position, and preferably all stations along a route should be georeferenced to allow linking of owl records to locations for habitat analysis.
The protocol at each station should start with a 2-minute silent listening period.
Optionally, playback may be used at a station if particular species of owls are being targeted that may respond well to playback.
The field data form should be designed so that the intervals in which each owl is detected (i.e., before or after playback of various species) are recorded.
Record the approximate direction and distance to the first location where each owl was detected.

nated survey procedure and effort for raptors and woodpeckers in northern Minnesota should be developed. Takats et al. (2001) suggest a set of standards for owl monitoring, the key elements of which are listed in Table 3. This publication was not available when we initiated our surveys. While our silent observation period and distance between stops differ, the basic protocol concept is similar. We were not able to randomly locate routes because of limited availability of plowed roads that could be driven by 2-wheel drive vehicles in the winter. So, we located routes systematically across the project area to provide wide geographic coverage tempered by practical considerations given use of volunteers. Our experience suggests that sampling just once a year as suggested by Takats et al. (2001) may lead to considerable variation and probably not give a good indication of populations in any particular year. It would be useful to determine if it would be better to sample several times a year or sample more transects just once a year. In our case we did not have many more available (driveable) winter routes within our project area.

Volunteers are a valuable resource for conducting wildlife surveys when funds are limited. Survey objectives and methods should be developed by professionals and be field tested at least one season by a professional. Analysis methods should also be developed and tested by the first year's data. New volunteers should probably pass a field training exercise before collecting information or be paired up with more experienced surveyors, especially at night during owl surveys. Drumming woodpeckers are probably too difficult to identify to species for most volunteers and should probably not be used to assess population distribution and trends. Given low population numbers (owls), differences in observers as mentioned earlier, and large week-to-week variation in results, monitoring should be done several times in a season if possible, and over many years. These surveys have served as good projects for college wildlife clubs. They provide valuable training in field census techniques and the group support often needed to accomplish larger projects. As with the National Geological Survey's Breeding Bird Survey (Sauer 2001), many repeated surveys over a long time are needed to compensate for considerable observer variation.

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LITERATURE CITED

Badzinski, D. 2002. Ontario nocturnal owl survey, 2001 final report. Ontario Ministry of Natural Resources, Wildlife Assessment Program, Bird Studies Canada, 18pp. (http://www.bsc-eoc.org/ontowlrpt2000.html).

Bull, E. L., R. S. Holthausen, and M. G. Henjum. 1990. Techniques for monitoring pileated woodpeckers. USDA Forest Service General Technical Report PNW-GTR-269. 13pp.

Duncan, J. and P. Duncan. 2001. Manitoba's nocturnal owl survey, 2001 progress report. Balmoral, Manitoba. 11pp. Unpublished report.

Sauer, J. R., J. E. Hines, and J. Fallon. 2001. The North American Breeding Bird Survey, results and analysis 1966–2000. Version 2001.2, USGS Patuxent Wildlife Research Center, Laurel, MD. (http://www.mbr.pwrc.usgs.gov/bbs/).

Smith, D. G. and T. Carpenter. 1987. Owl census techniques. Pages 304–307 *in* R. W. Nero, R. J. Clark, R. J. Knapton, and R. H. Hamre, editors. Biology and conservation of northern forest owls: symposium proceedings, 3–7 February 1987, Winnipeg, Manitoba. USDA Forest Service General Technical Report RM-142, 309 pp.

Takats, D. L., C. M. Francis, G. L. Holyroyd, J. R. Duncan, K. M. Mazur, R. J. Cannings, W. Harris, and D. Holt. 2001. Guidelines for nocturnal owl monitoring in North America. Beaverhill Bird Observatory and Bird Studies Canada, Edmonton, Alberta. 32pp. (http://www.bsc-eoc.org/regional/owlguide.html).

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Wisconsin Falconwatch Peregrine Falcon Nesting Season Reports 2006

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Introduction

Over the past twenty years, while working to help restore peregrines in Wisconsin, I've collected and compiled a fair amount of data pertaining to the identification, origins and turnover of nesting falcons, nesting chronology, dispersal, and overall trends in the recovery of the species.

Early on in the beginning years of the recovery effort, keeping tabs on these data and monitoring and managing urban nest sites was a relatively simple matter. For the most part, the nests were located in proximity to each other and they were few in number. Visiting the nest sites frequently, I was able to identify the nesting falcons by reading their band numbers as well as document the egg laying sequences. I was also able to make sure the nest boxes and trays were kept up and cleaned each fall.

That was then. This year, 2006, there were 21 known successful peregrine nests in Wisconsin, most of which are urban in nature. And although some of the nests are clustered, most (11) are spread out over many miles along the western shore of Lake Michigan. Another nest site is located along the lower Fox River (Green Bay, Brown County), one was on a power plant along the Wisconsin River in Rothschild (Marathon County), one was in Jefferson (Jefferson County), and seven were located on both man-made and natural sites along the Mississippi River. The seven Mississippi River sites are not covered here.

Table 1 provides a breakdown of nest site types and production for 2006. Although a promising number of historical cliff eyries have been reoccupied along the Mississippi River, as one can see, man-made sites remain the significant source of annual production.

Maintaining and managing the nests at these man-made sites requires a certain degree of hands-on attention, and working together with the owners and employees at each site has become increasingly significant. Although peregrines will probably always have some specific appeal to a segment of the general public, the days of high-profile media attention which served to encourage the initial installation of nest boxes at man-made sites have waned. The point having been made, it be-

Table 1. Wisconsin Nest Site Types and Production 2006

Site Type	Nests	%Total	Site Type	Young Produced	% Total
Power Plants	10	48%	Power Plants	33	51%
Buildings	5	24%	Buildings	15	23%
Elevators/Silos	3	14%	Elevators/Silos	10	15%
Natural Cliffs	3	14%	Natural Cliffs	7	11%
Bridges	0	0%	Bridges	0	0%

comes evident that those corporations and building owners who continue to host nesting peregrines are doing so out of goodwill and a sense of stewardship and not for the publicity that once came their way, which is both commendable and encouraging.

As peregrine recovery efforts grew in Wisconsin, I was fortunate to be able to develop and maintain working relationships with building owners and individuals from several corporations. Many of these relationships have grown and evolved and we continue to work together today to ensure peregrines are provided with nest boxes and given consideration and protection during the nesting season.

Through the years as I went about my nest monitoring each spring and as a courtesy to the owners and all interested parties at each nest site, I would compile information and condense and distill this into a report that came to be called Wisconsin Falconwatch. At first the reports were short, maybe a page or two and covered at most 2–3 sites but after 20 years, things have changed.

This year the final edition of Wisconsin Falconwatch was 11 pages and covered 18 sites, 14 of which were successful. What began as checking a few closely located nest sites has now grown into an expanded labor of love that starts in February as adults begin courtship activities and continues into July when I band the last young of the year. The miles driven each year have increased as well. This year I made over 80 site visits and banded 45 peregrines covering close to 7,000 miles. Visiting the nest sites allows me to identify nesting falcons and document turnover as well as determine egg laying dates. With egg laying dates in hand, I can then estimate hatch dates and schedule banding at each site when the young are at the proper age.

Earlier this year, Bettie Harriman, co-editor for *The Passenger Pigeon*, asked if I might share this year's final edition of Wisconsin Falconwatch with its readers. To that end, what follows is a condensed and updated account of this year's observations as well as information on Wisconsin-produced peregrines nesting in other states.

2006 Final Nesting Season Report

This year in Wisconsin there were 21 successful peregrine nests that produced a total of 65 young (3.09 young/nest). Eleven nests were located along the Lake Michigan shoreline. There were also 7 nests along the Mississippi River (3 on cliffs), 2 inland nests, and 1 nest in the Fox Valley (Green Bay). The Mississippi River sites are not included here, but more information on them may be obtained at www.raptorresource.org.

Once again power plants comprised nearly half (48%) of the successful nests and produced over half (51%) of the young.

Abbreviations used in the accounts:
b/r = black over red
b/g = black over green
** before a band number or letter means the character is tipped on its side*
wpr = wild-produced.

Lakefront Nest Sites

Pleasant Prairie: We Energies Pleasant Prairie Power Plant

The adult female here is **"Breezer" (b/r) *R/*2** produced in 1998 at the U.S. Steel site in Gary, Indiana. This is Breezer's 8th year at Pleasant Prairie. I've also finally identified the adult male as **"Duke" (b/r) 1/*P** produced in 1998 at Milwaukee's Landmark on the Lake apartment building.

Eggs: 5 laid between 22–30 March
Projected Hatch Dates: 28 April–2 May
Eggs Hatched: 5 between 3–7 May
Banded: 5 Males on 25 May

Kenosha: United Hospital System, Kenosha Medical Center

The adult male (Fig. 1) here is once again **"Aaron" (b/g) 80/H**, a 2002 falcon produced at the Froedtert Malt Complex in West Allis, Wisconsin. The adult female was not banded and is believed to be the same female present last season. On banding day, I captured the adult female and banded her as **"Maggie" (b/g) M/14**.

Eggs: 4 Laid between 1–9 April
Projected Hatch Dates: 10–12 May
Eggs Hatched: 4 between 11–13 May
Banded: 1 female and 3 males on 2 June

Racine: Racine County Courthouse

The adult female (Fig. 2) here is once again **"Lily" (b/g) 56/A** hatched in 2001 at the Firstar Bank in Cedar Rapids, IA. "Scott" (b/g) M/Y who was at this site since 2002 has been replaced by a new unidentified adult male. Scott is now paired with Atlanta at the Oak Creek Power Plant in Oak Creek, Wisconsin.

Eggs: 4 between 11–17 April
Projected Hatch Dates: 18–20 May
Eggs Hatched: 4 between 18–21 May
Banded: 4 males on 7 June

Oak Creek: We Energies Oak Creek Power Plant

"Atlanta" (b/r) L/*C is here for her 8th year. "Griffin" (b/r) 5/*D her former mate has been replaced by a new adult male whom I identified as **"Scott (b/g) M/Y**. Scott was produced at the Froedtert Malt Complex site West Allis in 2000. Scott had nested at the Racine County Courthouse since 2002 but as indicated above has now been replaced.

Eggs: 4 between 9–15 April
Note: Only 3 eggs present on 26 April
Projected Hatch Dates: 16–18 May
Eggs Hatched: 2 between 16–18 May
Note: 1 chick died within a day after hatching
Banded: 1 male on 7 June

Milwaukee: We Energies Valley Power Plant

The adult female here is once again **"Liberty" (b/g) 0/*T**. Liberty was hatched in 2002 at the Busch Agricultural Resources site in Manitowoc, Wisconsin. This is Liberty's 3rd year here. No identification was made on the adult male.

Figure 1. "Aaron" (b/g) 80/H was wild-produced in 2002 at the Froedtert Malt complex in West Allis, Wisconsin. He was present and paired with an unbanded adult female at the Kenosha Hospital site last spring and four eggs were laid but none hatched. This year he and his now banded mate produced four young.

Figure 2. "Lily" (b/g) 56/A with her four chicks at the Racine County Courthouse nest site. Lily was wild-produced at the Firstar Bank nest site in Cedar Rapids, Iowa, in 2001 and has nested at the Courthouse since 2002, producing a total of eleven young.

Figure 3. Four youngsters are shown here shortly after banding at Milwaukee's Miller Brewery nest site. Since this site became active in 2002, a total of thirteen young have been produced here.

Eggs: 4 laid between 27 March–3 April
Projected Hatch Dates: 4–6 May
Eggs Hatched: 4 between 4–6 May
Banded: 2 females and 2 males on 30 May

Milwaukee: Miller Brewery

An unbanded adult female is present here once again with a new adult male. The new male is **"Herbert" (b/g) 80/N** produced at We Energies Valley Power Plant in Milwaukee in 2004.

Eggs: 4 laid between 13–19 April
Projected Hatch Dates: 20–22 May
Eggs Hatched: 4 between 20–22 May
Banded: 2 females and 2 males on 12 June (Fig. 3)

West Allis: Froedtert Malt Complex

The adult male here appears to be **"Leopold" (b/r) C/D,** a captive-produced peregrine released at Pleasant Prairie, Wisconsin in 1992, and present here since 1994. The adult female is **"Raynie" (b/r) A/*H**, a 1995 wpr female from Chicago. This is Raynie's 9th year at this site.

Eggs: 4 laid between 12–18 April
Projected Hatch Dates: 19–21 May
Eggs Hatched: 2 between 19–21 May
Banded: 1 female and 1 male on 7 June

Port Washington: We Energies Port Washington Generating Station

An adult pair of falcons was present here until mid-April when an immature female arrived and displaced the adult female. This immature female laid a single egg on 24 April. When I visited this site again on 3 May, I found a new banded adult female on site. Employees reported seeing three falcons that morning with two flying west away from the site in what was likely a chase. During this visit the resident male, **"Flaps" (b/r) 8/*T**, a falcon produced in 1998 at the WPS Pulliam Power Plant in Green Bay, Wisconsin,

Figure 4. "Icon" (b/g) 50/D was the third (possibly fourth) female to spend time at We Energies' Port Washington Generating Station this spring. She laid three eggs next to an egg laid by a previous female and produced two young. Icon was wild-produced at the LTV Steel site in Cleveland, Ohio, in 2004. This is her first known successful nest.

was clearly trying to attract this new female to nest box.

On 11 May this new adult female (Fig. 4) laid her first of 3 eggs in the nest box next to the previously laid egg. On 2 June I was able to read her band number. She is: **"Icon" (b/g) 50/D** produced at the LTV Steel site in Cleveland, Ohio, in 2004.

Eggs: 1 laid on 24 April, 3 laid by new female between 11–15 May

Projected Hatch Dates: 18–20 June

Eggs Hatched: 2 on 19 June

Banded: 1 female and 1 male on 12 July

Sheboygan: Edgewater Generating Station

The adult female here is **"Liberty" (b/r) E/*D**. This is Liberty's 9th year at Edgewater. No identification yet on the adult male but he is banded b/g.

Figure 5. A rare clutch of six eggs at the Edgewater Generating Station in Sheboygan, Wisconsin. Five eggs hatched and four young successfully fledged.

Eggs: 6 laid between 31 March–8 April (Fig. 5)
Projected Hatch Dates: 8–14 May
Eggs Hatched: 5 between 8–14 May
Banded: 2 females and 2 males on 2 June

Note: On 22 June, Liberty was found dead in the switchyard at this site. She had nested at Edgewater since 1998, producing a total of 33 young (3.7/year).

Manitowoc: Busch Agricultural Resources

The adult female (Fig. 6) here is: **(b/g) 7/*U** produced in 2001 at the New Center in Detroit, Michigan. This is her second year at this site. No identification yet on the adult male.

Eggs: 5 laid between 23 –31 March
Projected Hatch Dates: 29 April–3 May
Eggs Hatched: 4 between 4–8 May
Banded: 3 females and 1 male on 25 May

Green Bay: WPS Pulliam Power Plant

The adult female here is **"Beth" (b/g) 25/B**. She was wild-produced in 2003 at the Midwest Generation Power Plant in Waukegan, Illinois. No Identification on the adult male.

Eggs: 4 laid between 25–31 March
Projected Hatch Dates: 1–3 May
Eggs Hatched: 3 between 1–3 May
Note: One chick died shortly after hatching
Banded: 2 males on 25 May (Fig. 7)

Figure 6. An obviously defensive mother, (b/g) 7/*U, who is not named was present for her second year at the Busch Agricultural Resources nest site in Manitowoc, Wisconsin. She laid five eggs, hatched four and fledged four young.

Inland Nest Sites

Jefferson: Cargill Malt Complex

An adult pair of falcons is nesting once again at this site. The female is **"Smokey" (b/g) 82/A** who was produced at the Edgewater Generating Station in Sheboygan, Wisconsin in 2003. The adult male is banded b/g.

Eggs: 5 laid between 17–25 April
Projected Hatch Dates: 24–28 May
Eggs Hatched: 4 between 24–28 May
Banded: 1 female and 3 males on 12 June

Rothschild: WPS Weston Power Plant—New Site

Although early reports indicated both adults here were unbanded, I was able to see that the adult male here is banded b/g. The adult female is unbanded.

Eggs: 4 laid between 29 March–4 April
Projected Hatch Dates: 5–7 May
Eggs Hatched: 4 between 5–7 May
Banded: 2 females and 2 males on 31 May

Figure 7. The two offspring produced this year at the Pulliam Power Plant bring the total number of young produced here since the site became active in 1996, to 33. We know that at least 30% of the young produced at this site have survived and successfully nested; the highest percentage of any man-made site in Wisconsin.

Fox Valley Sites

Kimberly: StoraEnso Kimberly Mill

"Louise" (b/g) V/U hatched in 2002 at the Ameren UE Labadie Power Station in St. Louis, Missouri and **"Darrel" (b/g) 44/M,** a falcon produced in 2003 at the Busch Agricultural Resources site in Manitowoc, Wisconsin, are here for their second year.

Eggs: 4 laid between 29 March–4 April
Projected Hatch Dates: 5–7 May
Eggs Hatched: 3 between 5–7 May

Note: On 11 May a storm flooded the nest ledge and all 3 chicks were lost. Plans are underway to modify this ledge as well as install a nest box.

Active/Non-productive Sites

Milwaukee: US Bank (formerly Firstar Center)

This site has remained unproductive since Sibella (20V) ended her 15-year presence here in 2003. Peregrines have been observed here regularly but no nesting attempt has been made. Once again, it may be that the Liberty (b/g) O/*T (who is very aggressive), who is nesting at the nearby Valley Power Plant, is commanding a much larger territory than other falcons in the past and preventing another nesting from occurring at the nearby US Bank. We're remaining hopeful that this prime site will once again host a nesting pair of peregrines!

Kewaunee: Kewaunee Nuclear Power Plant

Falcons present. No additional Information.

Neenah: Minergy Glass Aggregate Plant

There had been a turnover of falcons at this site where young were produced last year and a new immature female was present for some time this spring. However, last year's female **"Karla" (b/g) 4/*5** returned and is now paired with a new adult male named **"Thor" (b/g) 76/N** who was produced at the Busch Agricultural Resources site in Manitowoc, Wisconsin in 2004. Thor replaces "Riot" (b/g) 55/H who nested here last year. Unfortunately with the territorial skirmishes and turnover of falcons late into the nesting season, eggs were never laid here this year.

***Kaukauna: Thilmany Mill**—New Site*

An adult male and an immature female were on site here this spring although no eggs were laid. Greg Schuh, an employee at the Thilmany site, was able to get a few great photos of the female as well as her bands. She is **"Nora" (b/g) P/76** who was produced last year at the Graysolon Plaza in Duluth, Minnesota.

One hopes this site will produce young next spring!

Mississippi River Sites

For complete information on Mississippi River nest sites check out the Raptor Resource Project web site at: www.raptorresource.org

Web Sites

For live web cam images of nest sites during the nesting season, check out the following links:

We Energies Nest Sites—http://www.we-energies.com/environmental/peregrine_falcons.htm

Wisconsin Public Service Nest Site—http://www.wisconsinpublicservice.com/news/falcons.asp

WISCONSIN PRODUCED PEREGRINES NESTING IN OTHER STATES

Over the past 20 years we've had numerous Wisconsin-produced peregrines survive and nest in other states including Illinios, Indiana, Iowa, Kentucky, Michigan, Minnesota, North Dakota, Ohio, and Pennsylvania. Following is some preliminary information on Wisconsin-produced peregrines that nested this year in other states:

Illinois

"Auntie Em" 5/*P, a female produced at Milwaukee's Landmark on the Lake site in 1999 paired with male Tracy *P/M produced at the Broadway site in 1997. The pair nested at 5821 N. Broadway, in Chicago, producing 4 young.

"Rosie" *6/D, a female produced at Milwaukee's Landmark on the Lake site in 1997 nested at the University of Illinois, Chicago. She laid 4 eggs but the nest failed. Adult male is unbanded.

"Fran" 5/*X, a female produced at Milwaukee's Hoan Bridge site in 1999 paired with an unidentified male producing 4 eggs and hatching all 4 in Waukegan, Illinois.

"Hops" 58/M, a male produced at Milwaukee's Miller Brewery in 2003 paired with female Kelliwatt 60/D produced in 2004 in Aberdeen, Ohio, producing 4 young at the St. Michael's Old Town site in Chicago.

"Magnolia" 22R, a female hacked in La Crosse, Wisconsin, in 1991 paired with male S/T who was produced in 2000 at the Unitarian Church site Hyde Park. The pair failed nesting at this Hyde Park Chicago site.

"Nitz" 2/*Y, a female produced at Milwaukee's Froedtert Malt complex in 2001 paired with Dave 14/K produced in 2001 in Chicago. Their nest at the Lawndale site in Chicago failed.

"Rahn" 01/A, a female produced at the Edgewater site in Sheboygan, Wisconsin, in 2001 paired with male Etienne 7/6 produced at Etobicoke, Canada, in 2002. The pair nested at the Wacker Drive site in Chicago and produced 4 young.

Indiana

"Chantal" *B/*C, a female produced at Milwaukee's Froedtert Malt complex in 1998 paired with male Kinney 7/*3 hacked at Lexington, Kentucky, in 1993. The pair produced 3 chicks at the Market Tower nest site in Indianapolis.

"Latesha" Z/K, a female produced in Genoa, Wisconsin in 1999 paired with male Rollin K/*8 produced in 1996 in Gary, Indiana. They produced 5 chicks at the NIPSCO Schahfer Plant in Wheatfield.

"Cloud Dancer" *B/*G, a female produced at the Pulliam site in Green Bay, Wisconsin, in 1998 paired with Uncle Billy 3/*B who was produced at Milwaukee's Landmark on the Lake site in 1995. They produced 2 chicks at the NIPSCO Plant in Michigan City.

Ohio

"Newton" 18/A, a female produced at the Kewaunee Nuclear Plant in Kewaunee, Wisconsin, in 2001 paired with male Bolt 18/P produced at the Bohn Building site in Cleveland, Ohio, in 2003. The pair produced 3 young at the I-90 Bridge site in Cleveland.

Mary Ellen *B/*B, a female produced in 1998 at Milwaukee's Froedtert Malt complex paired with an unbanded male at the Miami Fort Station Cinergy Site in Cleves producing 5 young.

"Princess" *B/*S, a female produced at the Busch Agricultural Resources site in Manitowoc, Wisconsin, in 1998 paired with male Powerhouse 31/K produced at the Miami Fort Station Cinergy site in Cleves, Ohio, in 2002. This pair produced 3 young at the PNC Bank site in Cincinnati.

Acknowledgments

Throughout the year numerous individuals and corporations support and assist in looking after Wisconsin's peregrines. Without the long-term corporate stewardship and dedicated efforts of employees at each site, it is unlikely that peregrines would have recovered to the degree they have today. With this in mind, I would like to express my heartfelt gratitude to the following corporations and individuals among many who have helped make 2006 another successful year. The corporations were: We Energies, US Bank, Wisconsin Public Service, Busch Agricultural Resources, Cargill Malt, Froedtert Malt, Wisconsin Power & Light, Alliant Energy, Miller Brewing, United Hospital System, Racine County, StoraEnso, and Thilmany

Mill. Employees and volunteers were: Bill Bain, Tony Bernier, Terry Carroll, Noel Cutright, Rose Dehli, Pete Dempsey, Tim Ellestad, Calvin Frazier, Tony Giordana, Dave Groshek, Darrel Heckman, Doug Herzog, Mark Hoeff, Bill Holton, Karl Jeske, Jim Keaton, Tom Koenitzer, Al Labinski, Greg Labonte, Bob Lauer, Walt Lehman, Dawn Lemke, Karmen Lemke, Dave Luckow, Jim Marks, Beth Martin, Joe McClurg, Tom McLean, Nathan McNeil, Matt Meeuwsen, Bob Meidl, Mark Nessman, John Noegle, Joe Piette, David Polster, Bob Reske, Sue Schenk-Drobny, Jan & Ed Schmidt, Greg Schuh, Wendy Sky, Bob VanThiel, Don Verbsky, Chuck Vincent, Bob Wunsch, and Bob Zahn.

With over 30 years of museum experience, Greg Septon has lectured in 17 countries and published over 70 articles on museum techniques, birds, and natural history. For the past 20 years he has directed and managed urban Peregrine Falcon recovery efforts in Wisconsin.

During 2005, he analyzed many of the data he has compiled on Wisconsin's peregrines and assembled these into a comprehensive presentation for the annual Raptor Research Foundation conference in Green Bay, where he was the keynote speaker.

As an independent contractor/researcher, he continues to manage urban nesting peregrines in Wisconsin. He also serves as Vice President and Chairman of the Projects and Research Committee of the Society of Tympanuchus Cupido Pinnatus, Ltd. which recently translocated 40 Greater Prairie-Chicken hens from northwestern Minnesota to central Wisconsin in an effort to improve the genetics of Wisconsin's isolated, remnant population.

For information regarding peregrine management and speaking engagements he can be contacted by phone or email, as given at the beginning of this article.

Common Raven from a painting by David Kuecherer.

Eastern Screech-Owl by David Kuecherer.

50 Years Ago in *The Passenger Pigeon*

Horicon Marsh is known for its wading bird rookeries. In this issue, long-time bird bander, Harold Mathiak from Horicon, reports on a Black-crowned Night-Heron rookery. "The first Black-crowned Night-Herons of 1956 were seen on April 6 when much of Horicon Marsh was still covered with ice. When the large heron rookery on Four Mile Island was visited on May 18, no Black-crowned Night-Herons were seen on or around the island although nesting should have been in full swing by this time.

Only a few Black-crowned Night-Heron nests were found on the island later in the summer in contrast to 1955 when there were probably in excess of one thousand. On July 18, a canoe trip with Arlyn Linde into the federal portion of the marsh disclosed an unreported Black-crowned Night-Heron rookery. The nests were built in the bases of dead willows, and nearly all nests were within one foot of the water. At least two hundred nests were seen, but movement among the tangled willows was so difficult that the extent of the rookery was not determined.

Although quite a few young were still in the nests, less than a dozen adults were seen during the hour spent in the rookery. This rookery was probably started by the herons which deserted Four Mile Island."

Excerpt from Vol. 18 (4), 1956 by WSO Historian Noel J. Cutright, 3352 Knollwood Road, West Bend, WI 53095. h. 262 .675. 2443, w. 262. 268. 3617, noel.cutright@we-energies.com.

This Townsend's Solitaire was pictured with wild grapes in February 2006 at Devil's Lake State Park by Alan Stankevitz.

Townsend's Solitaires and Devil's Lake State Park

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After reading of so many birders finding the Townsend's Solitaires at Devil's Lake State Park during the winter of 2005–2006, the three authors decided to try for them also. This is not only our account of our visit, but we are posing some questions about why solitaires spend winters in this location and where they go for the rest of the year.

SETH'S ACCOUNT

On 31 January 2006, Noel, Bettie, and I went to Devil's Lake State Park to try to see the Townsend's Solitaires. Bettie and I went up Balanced Rock Trail. When we got to the top we then went east. We first spotted two solitaires about half-way between Balanced Rock and Potholes Trails. Potholes Trail will have meaning later in this story. At first we saw two of the birds for a short time on the south side of the trail on top of some trees. They then flew into a bigger red cedar tree where another one was singing. After seeing two and hearing the one, we walked down the trail farther, still going east. As we walked along we started to hear and see more solitaires. At one point we could see and count nine birds. A few of them were on top of trees by themselves with others in tree tops close by, but most of them were in a red cedar tree close together. I think we had about 5–6 in one of the cedar trees at one time with the others on top of other nearby trees.

We kept walking and a few times were only 10–15 feet away from them; they kept flying around us and landing in different locations as we went. We could hear many of them sing for a few minutes from time to time. They sang maybe 3–4 times total, but many birds each time. From the point we first found them to about 60 or so feet down the trail, where Devil's Doorway Trail starts, was about the range that they stayed in. After that point we did not really see them or hear them much.

So now to go down. After the hard and long walk up Balanced Rock Trail, we did not really want to go down that way because it is mostly a very steep trail with bigger rocks to use as steps. We wanted something with smaller rocks or spaces between rocks that might be a little flatter and easier to get down. At first we tried the Devil's Doorway Trail, which did not really work out well because it was hard to see where this trail started and stopped. So after being slightly lost on that trail, we went back up to the top/main trail. We kept going east on that trail until we found a trail that looked better. Here is where Potholes Trail comes into the story.

We decided to take this trail back down. It was a slightly better and easier trail to see than Devil's Doorway had been. Also, as we found out, it had smaller rock steps and spaces than Balanced Rock Trail. It was much easier to go down for us than either of the other trails. Potholes Trail took us onto Grottos Trail, which takes one back to where Grottos splits off from the start of Balanced Rock Trail.

Noel's Version

If you are seriously out of shape (like me) or have other physical limitations, like recent back surgery (like me), there is still a way to enjoy the Townsend's Solitaires at Devil's Lake State Park.

Park in the far northwestern corner of the parking lot at the southeastern corner of the Park (there is quite a complex of parking lots, trails, roads, buildings, etc.). This is the lot that is closest to the railroad track and where the walking trails start that go up the hill (or cliff or mountain depending upon your point of view).

At this location, on a quiet day, if your hearing is good, and you know the whistle (call note) of the solitaire, you should be able to hear them. Sibley describes this call as "heeh," similar to the call of a Northern Pygmy Owl. In about a 3-hour period yesterday, I could clearly hear their calls on about four occasions, with one calling bout lasting about 5–10 minutes. The birds were in the red cedars and oaks on top of the ridge and on the steep side slopes (Fig. 1).

Now for seeing them—carry a scope and tripod just a short distance north from where you park, past the large green dumpster, and place it near the sitting bench (there are 2 benches along this black-topped trail—the eastern one [closest to the rail track] is too close to trees; the westernmost one has a plaque on it listing several names) or near the wide trail intersection. This allows a look past the tall white pines along the rail track and allows one to

Figure 1. The bluff at Devils' Lake State Park where Townsend's Solitaires winter each year. Photo by Alan Stankevitz.

see a long stretch of ridge-top. From there, several solitaires could be seen in the area of the ridge-top east of where the dense conifers stop. This part of the ridge-top is dominated by mostly oaks and as you scope farther east, there are a couple of sickly looking white pines that extend higher than the oaks. Solitaires perched in the tops of both of these pines and in a couple of the oaks. Even under cloudy conditions, at 30x, one could easily identify the birds. I could see Bettie on the ridge trail looking at the birds, and since we had our 2-way radios on, we could talk to each other as she watched and listened to the birds while I watched them in my scope.

(*Wisconsin's Favorite Bird Haunts* has an excellent map of the trails—much better than the one that can be downloaded from the WDNR web site.)

Just before Bettie and Seth arrived back to take a look at the sapsucker that was diligently drilling many holes in a Siberian elm near the eastern bench, a flock of 12 Blue Jays flew over, and a Sharp-shinned Hawk decided to tackle one of the jays. The jay and sharpie were out of sight on the ground in a small depression, but the jay screamed mightily for at least a minute. We were not sure of the final outcome, as the sharpie flew over our heads, empty-footed, about 5 minutes later.

At about the same time, Seth spotted an immature Bald Eagle sailing over the "solitaire" ridge-top, and as we watched with binoculars, at least two solitaires flew up and mobbed the eagle.

Something to ponder—where do these solitaires breed? Take a look at its breeding range in some field guides, and wonder . . .

BETTIE'S THOUGHTS

Seth and Noel have given their versions of our pilgrimage to Devil's Lake State Park to see Townsend's Solitaires. Here's the third version: I was impressed with what is called Balanced Rock "Trail." I saw the "balanced" rock, so I understand that part of the name, but not the "trail" part. If someone with their dog had not been down the trail before us that morning, we would probably not have been able to tell exactly where the trail was—and not from too much snow, just too little difference between the trail and the talus slope.

I was also impressed with the number of solitaires and how close they came to us—I like to think they were rewarding us for getting up that "trail."

So, at least nine solitaires are in the park, but are there more than that either in the Park or in the general area? There are plenty of red cedar-covered hillsides in Sauk and western Dane and Columbia Counties; do they too have wintering solitaires? In *Wisconsin Birdlife,* Robbins (1991) stated the "favored habitat includes the steep cedar slopes in Sauk (notably Devil's Lake State Park), western Columbia, and northern Dane Counties. One or more of these berry-eaters have overwintered in this region nearly every year since 1979." And if you check the Winter Season reports in *The Passenger Pigeon* since Robbins' book was published, you find they continue to be found here most winters (Lange 1993, 1995, 1998, 2000, 2002, 2003, 2004, 2005).

And then I wondered about breeding (Atlasing habits die hard). According to Robbins (1991), this species has been observed in Wisconsin between 9 October and 14 May, and they certainly were not found during the six years of atlasing in Wisconsin (Cutright et al. 2006). Where do they go? Checking some references I see that according to Sibley (2003), the breeding range is from Mexico to Alaska and as far east as Colorado and Wyoming. Further checking in the *Colorado Breeding Bird Atlas* (Kingery 1998), reveals that solitaires nest ONLY between 7,000 and 12,000 feet in wooded areas, at least in Colorado. *The Birds of North America* account (Bowen 1997) gives a wide altitudinal breeding range between 350 m (1,148 ft.) and 3,500 m (11,483 ft.), and also shows a year-round population in nw South Dakota, se Montana, and ne Wyoming for the closest breeding to Wisconsin. So I wonder where the birds that winter with us breed, Alaska and nw Canada, or Wyoming, South Dakota, and Montana? Most populations of this species do not migrate except to move to lower elevations than where they breed; the ones that breed in Alaska and nw Canada are known to move south but it is not known exactly where to the south (Bowen 1997). Are "our" solitaires from the Alaska/northwest Canada breeding population?

As for nest sites: Nest sites are almost always on the ground in nooks or hollows beneath some sort of overhanging object that shelters the nest: rocks, logs, tree roots, stems of small shrubs, leaning trees, small cavities in the face of dirt banks, decaying stumps (Bowen 1997), and even one down a mine shaft in Colorado (Kingery 1998). And they are always within conifer forests of some type. That talus slope around Balanced Rock Trail would make great nesting habitat, and it is within the altitudinal range mentioned above, although at the lower end. The Baraboo Range, which includes Devil's Lake State Park, has a summit altitude between 347 m (1,140 ft) and 494 m (1,620 ft), as given in Martin (1932).

I think I can understand why Townsend's Solitaires would like to winter in Devil's Lake State Park. But I find it fascinating to speculate on how they found this location: One fall in the 1970s, one lone solitaire finds this lovely place to winter, with habitat much like where he nests in summer. So he keeps returning each winter, and starts bringing his offspring with him? Until almost thirty years later we find as many as 9 to 12 (see The Winter Season 2005–2006, in *The Passenger Pigeon,* 68[3]) happily feeding on fruits and berries in Devil's Lake State Park in Sauk County, Wisconsin—many, many miles from where they spent the breeding season.

Or maybe, it is not the same individual who has returned at all, but different solitaires who continue to find this location year after year?

John Idzikowski pointed out that Rhys Bowen, who has done extensive research on this species, considers the Wisconsin Devil's Lake birds as an interesting tentative wintering population—prehaps a relict of a once more expansive range of the species when the climate was colder at the end of the last ice age. They return simply because of the habitat at Devil's Lake is similar to what they are found in out West and the food supply they rely upon is abundant.

Idzikowski went on to say, "It has always been fanciful to imagine that they might be here permanently and nest, representing an isolated, relict, disjunct population. They could easily be difficult to find in such a vast area as Devil's Lake State Park in late spring and summer. But could such a group survive genetic isolation for thousands of year?" He also wonders if there is a continuous genetic infusion of birds dispering or migrating from the West or from the northwest population.

Idzikowski states, "if someone wants to try to hit an ornithological home run in Wisconsin [they should] make an intensive effort to find them here post 1 May." He suggests one look for males that may briefly sing on the tops of cedars above a well hidden ground nest, under an overhanging rock outcrop of quartzite on the essentially inaccessible talus slopes of the Devil's Lake gorge—in habitat similar to sites where they nest out West.

And this author promises to publish any probable or confirmed nesting records that dedicated birders discover. Good luck!

Literature Cited

Bowen, R. V. 1997. Townsend's Solitaire (*Myadestes townsendi*). *In* The Birds of North America, No. 269 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Cutright, N., B. Harriman, and R. Howe. 2006. Atlas of the Breeding Birds of Wisconsin. Wisconsin Society for Ornithology. Waukesha, WI.

Kingery, H. E. 1998. Colorado Breeding Bird Atlas. Colorado Bird Atlas Partnership and Colorado Division of Wildlife. Colorado.

Lange, K. I. 1993. The Winter Season: 1992–93. Passenger Pigeon 55(3): 253–264.

Lange, K. I. 1995. The Winter Season: 1994–95. Passenger Pigeon 57(3): 187–198.

Lange, K. I. 1998. The Winter Season: 1997–98. Passenger Pigeon 60(3): 251–267.

Lange, K. I. 2000. The Winter Season: 1999–2000. Passenger Pigeon 62(2): 185–197.

Lange, K. I. 2002. The Winter Season: 2001–2002. Passenger Pigeon 64(3): 171–186.
Lange, K. I. 2003. The Winter Season: 2002–2003. Passenger Pigeon 65(3): 149–161.
Lange, K. I. 2004. The Winter Season: 2003–2004. Passenger Pigeon 66(3): 245–257.
Lange, K. I. 2005. The Winter Season: 2003–2004. Passenger Pigeon 67(3): 347–364.
Martin, L. 1932. The Physical Geography of Wisconsin. Second Edition. Wisconsin Geological and Natural History Survey, Bulletin No. XXXVI, Educational Series No. 4, page 55.
Robbins, S. D. 1991. Wisconsin Birdlife: Population and Distribution Past and Present. University of Wisconsin Press, Madison. 736 pp.
Sibley, D. A. 2000. The Sibley Guide to Birds. Alfred A. Kropf. New York

Bettie Harriman is a past president of WSO and is currently co-editor with her husband Neil of this journal. She served as the Project Director for the Wisconsin Breeding Bird Atlas and was one of the three editors of the resulting "Atlas of the Breeding Birds of Wisconsin." She is currently Chair of the Board of Directors of the American Birding Association.

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Noel Cutright is a past president of WSO and the current Historian. He was the lead editor on the recently published "Atlas of the Breeding Birds of Wisconsin." One of his passions is conducting Breeding Bird Surveys each June and in 2005 he accomplished 30 counts in 30 days to raise funds for bird conservation in an effort he called Quad 30. He is a very frequent presenter of bird related programs around the state.

"Ring-necked Pheasant" by David Brandon.

"From Field and Feeder"

The four observations on unusual behaviors or fascinating occurrences concern Snow Geese; Mallards; Wild Turkeys and a Northern Goshawk; and Barn Swallow, Belted Kingfisher, Sandhill Crane, Great Blue Heron, and Cooper's Hawk.

Extremely Early Northward Return of Snow Geese

8 January 2006, southern Rock County, Wisconsin and north-central and east central Illinois—I left Madison in the late morning to return to my other home in Columbus, Ohio. Wisconsin temperatures had been well above normal for the entire three weeks of Christmas vacation that I spent at Madison, with daily highs and nightly lows varying only from plus 2–4 to minus 2–4 degrees C, (32–38 and 25–32 degrees F, respectively) under constant low heavy skies. The snows present on my 20 December arrival had melted by 4 January. On my long drive home to Columbus I was surprised to see a number of Snow Geese (*Chen caerulescens*) mixed in among the Canada Geese on roadside "borrow-pit" ponds near overpasses along Interstate 90/39 in southern Wisconsin, near Janesville and Beloit. As I shifted onto I-39 south from Rockford to Bloomington-Normal Illinois, and then onto I-74 east to Indianapolis the numbers of Snow Geese in fields and ponds rose. In total I would estimate I saw 2–3000 Snow Geese mixed into flocks of both Giant Canada resident (*Branta canadensis maxima*) and migratory Interior (Todds') Canada Geese (*B. c. interior*). Increase in total numbers of Canada Geese seen along my travel route versus normal numbers of residents seen was obvious with perhaps 4–5000 more Canada Geese seen in fields, and corporate and roadside ponds than usual for this time of year. Since I've spent the last 30 years of my life studying Canada Geese and their behavior the distinction of those two subspecies was relatively easy due to differences in size and breast coloration, even at 70 mph. I have made this drive every week for the past two years, and alternate weeks for most of the 14 years since my biology teaching job took me to Capital University in Ohio from my Wisconsin home. In all that time this is the first occasion where I have observed large numbers of Snow Geese before the normal mid-to late March migration of the species through this latitude. The normal migration pattern of Mississippi River Flyway Snow Geese has them over-fly Wisconsin and most of Illinois in fall and complete a direct non-stop migration to Texas and Louisiana, with a smaller segment ending in southern Illinois and Missouri. In spring they and Interior Canada Geese from southern Illinois refuges at Crab Orchards and Horseshoe Lake normally come north in short incremental hops that parallel the 31 degree (F) isotherm. Upon reflection on the temperatures of Madison during my stay there, daily average temperatures were in that 31 degree (F) range for a protracted period and temperatures farther south where the Snow Geese winter were above seasonal averages as well. I can only presume from the very rare sight of all these Snow Geese in scattered flocks across Illinois and southern Wisconsin at this time of year that the early and protracted warm weather triggered an early northward movement of large numbers of geese, both snows and Canadas. That would help to confirm past speculation that temperature is more of a trigger to northward migration in geese than is increasing day length.—*Philip C. Whitford, Columbus, OH.*

Bird in the Hand Story

(*A recent theme on Wisbirdn was sharing experiences with birds in one's hands. This story is from many years ago when the author, Keith Lea, was about 10 years old.)*

1933 or 1934, near Amherst, Portage County—While I was growing up on a farm, our family was given a pair of Mallard ducks that the previous owner had used for live decoys when duck hunting. We really did not want them as we did not eat duck or hunt them (only hunted Ruffed Grouse and Ring-necked Pheasant) but with some reservations, agreed to give them a home. They had had their wing feathers clipped and could not fly but for a few yards. They were not afraid and we were able to keep them in the area of the barn by feeding them there. They were constantly together and soon grew accustomed to the surroundings. They were kept in the barn during the winter and had a ready supply of corn, oats, and water. We did not continue to clip their feathers and they would fly around the farm but always returned to their barnyard area. They would become noticeably agitated during the fall migration period and we expected them to join the other ducks for migration as we were less than a mile from a couple of lakes; they flew around the farm more but always came back. One day on a short flight the hen Mallard came in for a landing on the hard surface of the driveway and broke her leg; a duck can stand on one leg, even hop a bit, but it was obvious she needed help. I caught her and wrapped her in a bath towel, upon examining the leg it appeared to be a simple fracture and could be put in a splint to immobilize it while it healed. My mother collected the adhesive tape, a few tongue depressors, cotton, and scissors. I found the depressors too thick and stiff so used the thinner wood sheets that were used in boxes to market Concord Grapes in those days; they made perfect splints. We put cotton under the wood splints and taped the splints around her leg. She was able to stand but could hardly walk, or I should say waddle. I moved her to a safe place inside the barn and made a feeding station of corn and oats and a large dish of water that she could reach without getting up. I anxiously watched to see if she would eat, because eating is a sure sign that a sick or injured animal has a chance to recover. The drake kept her constant company; when she would stop eating, I was amazed to see the drake pick up corn and try to put it in her bill; he would drop the corn, pick it up, and go through all the motions of eating, urging her to eat. Another change in the drake's behavior was that when I would come to replenish the food and water supply he would rush straight at me trying to drive me away; when his bluff did not work he would settle down but stay within a few feet of his mate. He must have realized that with her lack of mobility he had to exercise his role of protector. He had never rushed at me before and this was behavior he started after her accident. After a month I removed the splints, found the leg firm, straight, and with a noticeable larger lump where the break had healed. She was able to waddle along without any noticeable limp and the drake never rushed at me again. I had not only learned I could set a duck's broken leg but gained tremendous respect for their intelligence and their loyalty to their mate. They lived on accident free for several more years and both died of old age.—*Keith Lea, Plover, Portage County, WI.*

Goshawk vs Turkey

19 November 2005, Marinette County—Every November I join some of my relatives for a weekend in northern Marinette County for the deer hunting season. During the long hours spent in the woods we normally see some interesting wildlife, including some good bird sightings. On 19 November 2005, having already seen a black bear, a Northern Saw-whet Owl, and a Red Crossbill, I didn't think that a group of Wild Turkeys could bring as much excitement as they did.

While sitting in my tree stand in the mid-afternoon, I watched the group of 24 Wild Turkeys walk past me and down a path out of my view. A few minutes later the group of turkeys came running back down the same path toward me. The turkeys came to a stop, and then what looked to me to be a fight between two of the turkeys began. The birds were about 75 yards away as I watched one of the birds pin the other one down to the ground. I put up my binoculars to get a closer look, and just then all of the other turkeys jumped on top of the two birds, and it looked as though they all started fighting. The turkeys were flapping their wings, jumping, and kicking violently, and the entire group was very vocal. After about 10 seconds of this all-out fighting, one smaller bird broke away from the group, and spread its wings out on the ground in a defensive position. I could see that the lone bird was smaller than a turkey and was lighter brown in color, but at this point I still had no idea what I was watching. A few seconds later one turkey ran out of the group and kicked at the bird on the ground, and the bird flew from the ground to a low branch in a nearby maple tree. Once it was in the tree I could see the bird clearly, and only then was I able to tell that it was actually an immature Northern Goshawk. For the next 10 minutes the 24 turkeys stayed in a tight group and did not move, while the goshawk sat in the tree less than eight feet above them. During this time the goshawk cleaned up a bit, preening and straightening up its feathers, all the time watching the group of turkeys. While looking at the goshawk through my binocs, I heard a Ruffed Grouse start drumming to the south of me. It may have been a coincidence, but the goshawk flew away in the direction of the drumming grouse a short time later. After the goshawk finally flew away, the group of turkeys walked away in the opposite direction. Most of the turkeys stayed together, but one trailed behind and was moving slowly, possibly due to injuries from the hawk.

Afterwards I walked down to the area where all of this action had occurred. I found several turkey feathers and quite a bit of blood in the snow where all of the turkeys had been standing. Next I checked the snow under the tree where the goshawk had sat, but I found no blood. So, it looked as though the young goshawk may have been taught a lesson by the group of turkeys, but I think it also injured the turkey that it attacked.

I would have never thought a goshawk would try to kill a bird anywhere near the size of a turkey. The encounter left me wondering how rarely does something like this happen? Do Northern Goshawks try to prey on Wild Turkeys more than one would imagine, or was this just a young bird that had never encountered turkeys before? Either way, it was an encounter that I will never forget.—*Aaron Holschbach, Arena, WI.*

Unusual Avian Roadkill Observations

***19–20 May 2006, west-central Ohio, northeastern Indiana, and Marquette and Portage Counties, Wisconsin*—**Perhaps I should preface this article by stating that I did my Master's thesis research on bird thermoregulatory use of little traveled roads in Marquette County, Wisconsin back in 1973–1976, so I am well acquainted with birds near roads and roadkill. In addition, I have driven some 1.5 million miles since then and, as a biologist with federal salvage collecting permits, I have made close inspection and note of most of things seen dead on the highway—and/or picked them up for preservation in school specimen collections (much to the embarrassment and/or disgust of my daughter, my late wife, and occasional other passengers). Given my background of things seen, miles driven, and birding, I have to admit that the experiences and sights of 19 and 20 May struck me as very unusual and worth writing up. It began with my weekly drive to the home farm in Central Wisconsin from my job teaching in Columbus, Ohio, a drive I've done most weeks of the past 12 years, since taking the position as a biologist at Capital University. In my many miles of driving over the past decades I can clearly remember each bird and species I've hit with cars. Several stand out very clearly, and were reported in an article in the Bird Watcher's Digest some years ago—a Clark's Nutcracker and a pair of Sage Sparrows, all killed within 12 hours on a long road trip to Oregon for a family reunion. My late wife accused me of needing to keep a death-list instead of a life list for birds after that debacle. Yet, after that trip, I returned to my lifetime average of killing one bird every 4–5 years in my travels—until last May, that is. On 19 May, I hit a low swooping adult Barn Swallow (*Hirundo rustica*) while west bound on I-70 about 15 miles east of Dayton, Ohio. A quick puff of feathers at 70 mph, and a carcass not worth salvaging were all that remained. The bird had been well clear of my path when I first saw it, or I would have braked to avoid it, but it made an abrupt and fatal direction change at the last instant in pursuit of a meal never attained. There was no time for reflex or avoidance on my part. Imagine my surprise when less than three hours later, just south of Merrillville, Indiana on I-65, I hit a second bird. This one was even more unusual in my experience, for I had never even seen a Belted Kingfisher (*Ceryle alcyon*) as road kill in all my years driving, much less come near hitting one. The bird flashed upward from under the median side of a small bridge—a streak of steel blue and white with a rufous collar and a small fish in its ebony black bill. It rose to about 10–12 feet above the highway and then turned to dart back across the road to the other side of the bridge it had just passed under. In the middle of my lane with a car alongside me, it suddenly lost its grip on the 2-inch fish in its bill. The bird was 15–20 feet from my car when the fish began to fall. The events that followed were immediately predictable, but still unavoidable. The fish fell—the bird dove and followed. Both disappeared beneath the hood followed by a light thump and a puff of blue and white feathers, only the second time in my life that I hit two birds in one day—or even the same year.

Perhaps, those two bird strikes—a term I recently acquired from lecturing pilots about midair impacts with birds as part of my expertise in Canada Goose behavior and their danger to planes—are what sensitized me to notice the feathered remains of three other rare victims of the highway later that day and the following day. As I completed my trip to my farm in Marquette County late the evening of the 19th, I passed the remains of a young reddish/yellow Sandhill Crane (*Grus canadensis*) colt, roughly 12 inches from toes to tip of bill, at a site along County Highway J, about 300 meters west of the Mecan River Bridge, some 5 miles west of Princeton, Wisconsin. I had gained a colt of slightly older age at the very same site 20 years earlier and given it to UW-Stevens Point for their collection. They are a very rare member of the roadkill community in Wisconsin in my experience, even as a life long resident of the county with the highest counts of nesting cranes for most of the past two decades. On the morning of the 20th, I planted the last of my garden and headed south to Madison to join my wife of the past 7 months at her home. On my way there I passed the remains of a Great Blue Heron (*Ardea herodias*) roughly one mile south of Highway 33 just below Portage on I-39 where it passes a wetland area along the Wisconsin River. Its position at the road side suggested that it had failed to achieve adequate height before attempting to cross the roadway after feeding in the marsh. Eleven miles north of Portage on I-39 I stopped to identify a recent roadkill and discovered the strongly barred, narrow tail feathers and carcass of a Cooper's Hawk (*Accipiter cooperi*). In my 2 decades of "Road Hunting" for specimens, beginning in 1986 at

Winona State University, these are the first times I have seen either the hawk or the heron dead at the roadside, and the Belted Kingfisher was a first for me as well. I'm quite used to finding robins, starlings, catbirds, Mallards, cardinals, Canada Geese, Great-horned Owls, and even the occasional young swallow as road victims—especially during mating seasons for the other species, but this sudden presence of birds only rarely seen near roads definitely surprised me, especially when they were all seen and/or hit by me in a two-day span of time. I must admit to being totally at a loss to explain why I saw/killed these rare birds in only two days' time.—*Philip Whitford, Columbus, OH.*

"Crows in Sumac" by Janet Flynn.

About the Artists

David Brandon is a self-taught artist who has taught basic drawing and illustration at the college level. This award-winning artist's interests are in nature and landscape painting. He does freelance illustration work from his home in Minnesota.

Janet Flynn interprets nature in watercolor as a full time endeavor. She finds the beautiful Baraboo Hills to be both a classroom and a source of inspiration for her vibrant, unique watercolors. Her work has been juried into numerous national and international exhibitions including "Birds in Art" and is marketed at the International Crane Foundation gift shop.

David Kuecherer, Art Editor for this publication, taught art at the high school level for 30 years and at UW-Oshkosh for several years. He combines his artistic talents with his love of birdwatching to paint birds. His work has been exhibited in "Birds in Art" and other shows in Wisconsin.

Robert Kirsten is the father of a co-worker at We Energies of Noel Cutright. Noel was shown the photograph that is seen in this issue and thought it would be of interest to the readers of this journal.

Dennis Malueg is a serious amateur bird and wildlife photographer who travels Wisconsin in search of his photos. He also works from his own backyard, prairie, and 80-acre forest in Waushara County to capture wildlife images.

Alan Stankevitz is a bird photographer from southeast Minnesota. Besides photographing birds, Alan devotes his time to eco-friendly endeavors such as building cordwood homes, installing renewable-energy systems, and living a self-sufficient lifestyle. You can learn more about Alan and his photographs at his website: www.daycreek.com.

William E. Stout took the cover photo of Cooper's Hawk during his urban research on this species. See the last page of the first article in this issue for more information about W. E. Stout.

INDEX TO VOLUME 68

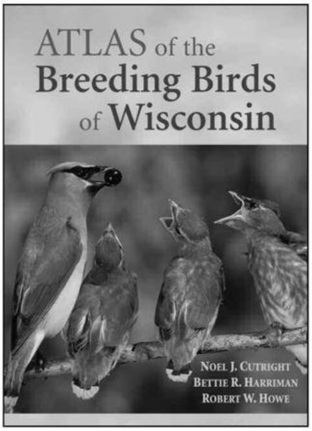
F

G

H

I

Y



Atlas of the Breeding Birds of Wisconsin

- Features almost 1,400 photographs, distribution maps, and figures – **all in color**!
- Based on studies done by more than 1,600 field observers between 1995 and 2000.
- Edited by Noel J. Cutright, Bettie R. Harriman, and Robert W. Howe.

The largest natural history survey ever conducted in Wisconsin has resulted in this comprehensive guide to birds that breed in the state.

Hardcover, large format (9" x 11.25"), 624 pages. Copyright 2006. ISBN-10: 0-9774986-0-3; ISBN-13: 978-0-9774986-0-4.

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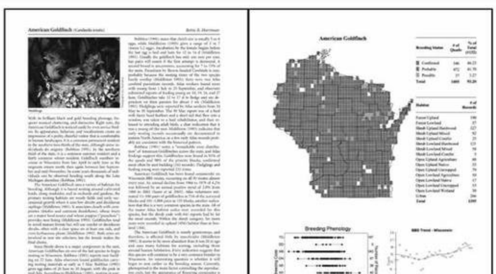

The two-page species accounts – 214 of them in all – provide a host of information on the state's breeding species, including their range, habitat preference, breeding biology, conservation concerns, and population trends. An additional 23 less-common species also are covered. Also included are chapters on Atlas methodology, results, history, habitats, and conservation.

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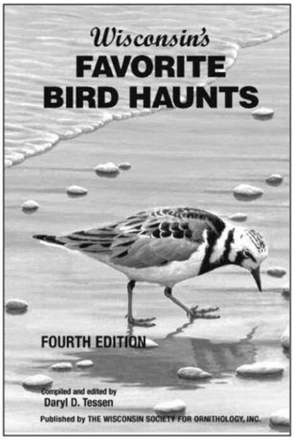
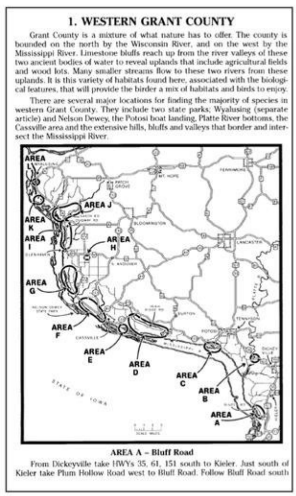


Wisconsin's Favorite Bird Haunts,

Fourth Edition (2000)

Compiled and edited by Daryl Tessen with contributions from birders throughout the state. Features artwork by Thomas Schultz, David Kuecherer, Rockne Knuth, Judith Huf, and Jeannie Perry.

- Covers all 72 counties
- Contains 135 favorite haunts, detailing more than 1,000 areas
- Includes detailed directions as well as a map for each location
- Features some 45 bird illustrations, 15 of them in color
- Includes a list of 400 valid Wisconsin state species and 15 hypothetical species (current as of January 2000)



1. WESTERN GRANT COUNTY

Grant County is a mixture of what nature has to offer. The county is bounded on the north by the Wisconsin River, and on the west by the Mississippi River. Limestone bluffs reach up from the river valleys of these two ancient bodies of water to reveal uplands that include agricultural fields and wood lots. Many smaller streams flow to these two rivers from these uplands. It is this variety of habitats found here, associated with the biological features, that will provide the birder a mix of habitats and birds to enjoy.

There are several major locations for finding the majority of species in western Grant County. They include two state parks; Wyalusing (separate article) and Nelson Dewey, the Potosi boat landing, Platte River bottoms, the Cassville area and the extensive hills, bluffs and valleys that border and intersect the Mississippi River.

AREA A – Bluff Road

From Dickeyville take HWYs 35, 61, 151 south to Kieler. Just south of Kieler take Plum Hollow Road west to Bluff Road. Follow Bluff Road south

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CONTENTS WINTER 2006

Volume 68, Number 4