The passenger pigeon. Vol. 52, No. 2 Summer 1990

Madison, Wis.: Wisconsin Society for Ornithology, Summer 1990

THE PASSENGER PIGEON
Vol. 52 No. 2
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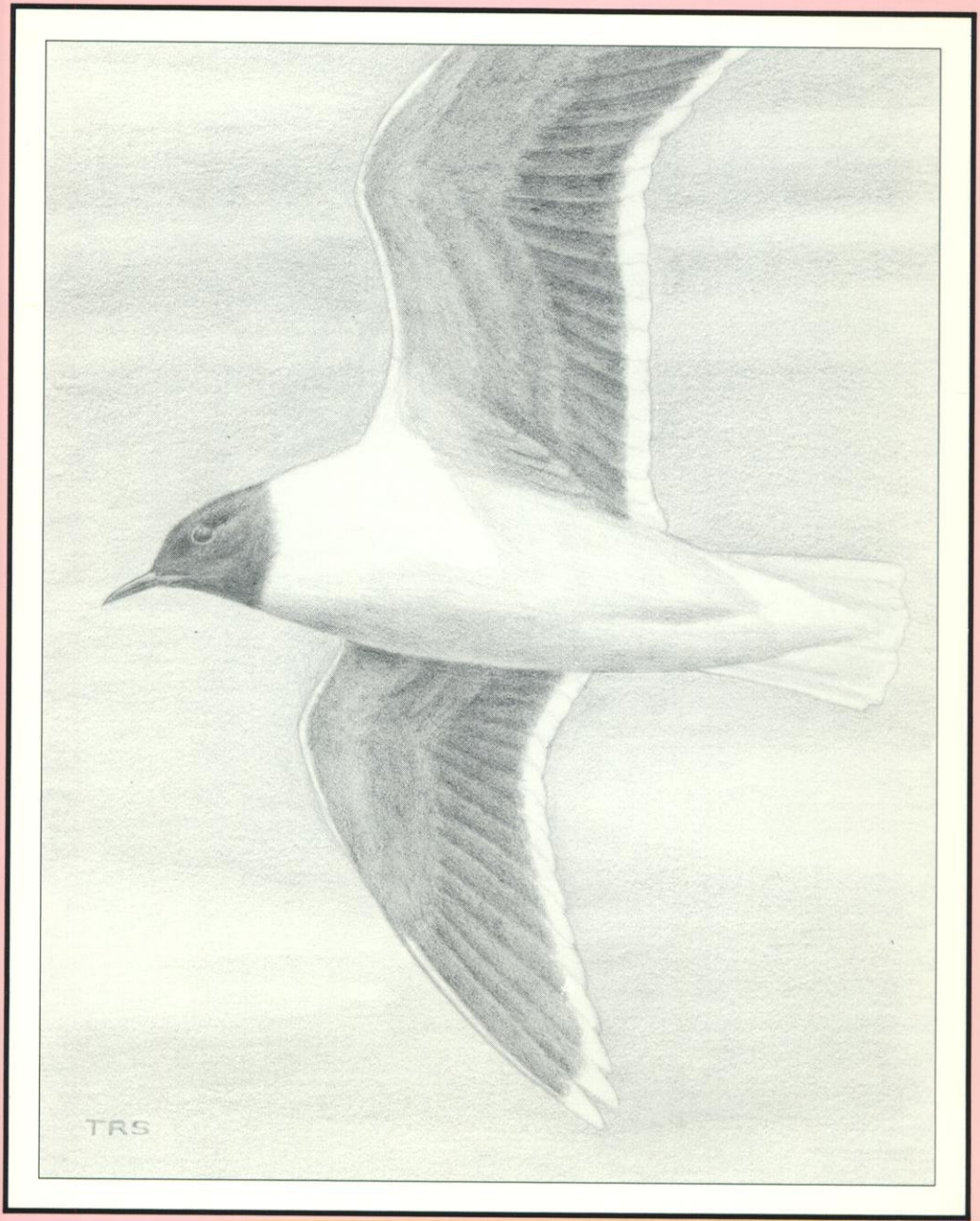
JOURNAL OF THE WISCONSIN SOCIETY FOR ORNITHOLOGY



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The Passenger Pigeon (ISSN 0031-2703) is published quarterly (Spring, Summer, Fall, and Winter) by The Wisconsin Society for Ornithology, W330 N8275 West Shore Drive, Hartland, WI 53029. Subscription rates are: Individual, $12 per year; Family, $15 per year; Sustaining, $25 per year; Library, $18 per year; Life, $200; and Patron, $750. Back issues may be obtained from the Supply Department for $5.00 each. Send change of address requests to Memberships, W330 N8275 West Shore Drive, Hartland, WI 53029.

Send all manuscripts and correspondence to the Editor; information for "Seasonal Field-Notes" should be sent to the Associate Editor or the appropriate Field-Note Compiler. Manuscripts that deal with information on birds in the State of Wisconsin, with ornithological topics of interest to WSO members, or with activities of the WSO will be considered for publication. All manuscripts submitted for possible publication should be typewritten, double-spaced, and on only one side of page-numbered typing paper. Illustrations should be submitted as photographs or good-quality drawings. Keep in mind that illustrations must remain legible when reduced to fit on a journal page. All English and scientific names of birds mentioned in manuscripts should follow *The A.O.U. Checklist of North American Birds (6th Edition)*. Use issues after Vol. 50, No. 1, 1988, as a general guide to style.

BOARD UPDATE

In any volunteer organization, some dedicated individuals regularly do more than what is perceived to be their routine duties. Alex Kailing is one of those individuals. In addition to his duties as membership chair, Alex has taken on the task of being our interim Treasurer. Because our former Treasurer, Gwyn Tuttle Goy, has resigned, WSO is looking for a new Treasurer. We are looking for a person that can give a few hours a month to the organization. The new Treasurer would have to know how to keep double-entry books and handle our checking account.

During what we hope is the brief interim between the former Treasurer and the new Treasurer, Alex has stepped in to assure that we take care of our financial responsibilities. In addition, he is also rewriting the handbook for the Treasurer position; this document will insure that the new Treasurer will have an understanding of why some accounts are set up, what each account's history is, and how our bookkeeping system works. We salute the extra effort! This commitment by Alex is only for this year. We do need to find a new Treasurer. If you would like to contribute, please contact any board member.

I would also like to recognize two other board members who have given a great deal of time to WSO. These are our field trip chairs Tom Schultz and Jeff Baughman. They have brought WSO-sponsored field trips to a new level. Tom and Jeff are currently leading as many as twelve trips per year for WSO, and the response has been fantastic. So good, in fact, that the average for the past several trips has been 65 to 70 people. To me, this is a testament to the outstanding work of our field trip chairs, not only because they are excellent birders and they know where to go, but most importantly, they are simply a pleasure to be with.

Tom and Jeff are in a bit of a predicament though. They want to provide more field trips, but they have less time because they both have growing families. In a conversation with Tom, he outlined the future they envision for WSO-sponsored field trips. First of all, they want to continue their popular trips. Since they lead virtually all of the field trips, they could use additional help. If anyone would like to lead a trip, let Tom or Jeff know.

Secondly, WSO would like to offer more local field trips. This would permit more cooperation between the state-wide organization and local bird clubs. The benefits to the local clubs would be substantial: greater exposure for the club, an increase in understanding of local birding hot spots, the chance to meet local experts. These trips would preferably be lead by local-area experts or interested birders, and they could range from expert level to beginners.

Finally, WSO is now going to offer, as a service to our membership, trips further afield. Initial trips are now being arranged with Arête Tours of Madison to distant locations. Arête is a new company offering tours specifically designed

for birders. We are tentatively planning tours in 1991 to south Texas and Venezuela. More details will be forthcoming. We hope these expanded trip opportunities will be appreciated by the membership.

President

50 Years Ago in *The Passenger Pigeon*
Excerpts from Volume 2 (1940)

"Sam Robbins, a native of New England and student of birds for nine years, keeps a detailed journal of daily observations in the field, noting the peak of the migration in each individual species, as well as the departures and arrivals. He also keeps a record of the number of hours spent in a given area, a fact essential to scientific study and one often neglected by bird students. Now attending the University of Wisconsin, Robbins hopes to be in the state several years."

"Conservation Warden John Adamski reports that on May 15, 16 and 17 the streets of Sparta in Monroe County were filled with American Redstarts with males in the greatest number. The birds were feeding on something which was not identified, but because of this attraction 20 to 25 of them were killed by cars."

"Earl Loyster reports that on a recent trip to Four Mile Island in Horicon Marsh (Dodge County) he observed a very large heron rookery. His estimates of the number of nests ran as high as 500, with Black-crowned Night-Herons far out-numbering the Great Blue Heron. Loyster visited the marsh to study waterfowl nests and luckily found a number of them before the heavy rains wrought their destruction."

The Winter Wren in Wisconsin

The Winter Wren is a widespread bird throughout the north temperate regions of the world. Little has been recorded about Winter Wrens in Wisconsin. In this paper we review the life history and ecology of Winter Wrens in Wisconsin and elsewhere.

by Amy T. Wolf and Robert W. Howe

Troglodytes troglodytes is one of the world's most widespread passerines, yet in many regions its habits and ecology are largely a mystery. Interestingly, the habitat of this diminutive bird varies significantly across its wide range. The dense, damp homes of Wisconsin's Winter Wrens, for example, contrast rather sharply with hedgerows in Great Britain, where the species can be found with some regularity. In this paper we aim to develop a broad perspective for understanding the Winter Wren in Wisconsin. We summarize existing information from other geographic areas, identify details of the Winter Wren's distribution in Wisconsin, and present results from our analysis of local populations near the edge of its geographic range. Although the Winter Wren is by no means rare and has never been seriously considered for addition to Wisconsin's list of endangered and threatened birds, it is part of a suite of sub-boreal species (e.g., Hermit Thrush, Black-throated Green Warbler, Red-breasted Nuthatch) which become rare and sparsely distributed between northern and southern Wisconsin. The peripheral status of these birds makes them particularly significant members of our state's avifauna.

Methods

Information presented in this paper has been gathered from many sources. Although very little has been published on the Winter Wren in North America, much more detailed observations have been reported for European subspecies. We have gathered general information about the Winter Wren from regional and state sources and from DeSante and Pyle (1986). A second source of information comes from North American collections of Winter Wren eggs and nests. We reviewed data from Cornell Laboratory of Ornithology's nest record program and data labels from major collections of Winter Wren nests in North America (Kiff and Hough 1985). Wisconsin records have been taken from published observations in the *Passenger Pigeon* and other sources (e.g., Mossman

and Lange 1982), the annual Nicolet National Forest Bird Survey (Howe, 1987), and our own research in Kewaunee County, approximately 20 miles east of Green Bay. This work was funded in part by grants from the Wisconsin Society for Ornithology and the UW-Green Bay Research Council. Major contributors to the field work were: Jennifer Nieland, Andrew Zovnnic, Nancy Meyer, Brian Henrickson, Nick Lesperance, Joanne Finnell, Matt Greutzmacher, and Ann Strotz. Additional information for Wisconsin and elsewhere has been compiled from results of the United States Fish and Wildlife Service Breeding Bird Surveys (USDI 1986 and personal communications) and the Breeding Bird Census Program (Hall 1964). Sam Robbins graciously provided personal records and information from his forthcoming book on Wisconsin birds.

Distribution

The Winter Wren is the only representative of the family Troglodytidae which occurs outside the New World. The American Ornithologists' Union (1957) recognizes 12 subspecies in North America. Nine of these are found only on Alaskan islands. Wisconsin is inhabited by the most widespread subspecies, *T. t. hiemalis*. The breeding range of *T. troglodytes* includes the northern half of North America south of the treeline, much of Europe, and an irregular band from North Africa (Atlas Mountains) and the Middle East through the Himalayas of Tibet and China. Winter Wrens also occur in Korea, Japan, and a northern band from the western Himalayas through Mongolia (Armstrong 1955). Despite this relatively large range, the Winter Wren has an irregular and rather interesting distribution. Its abundance varies considerably across its range. Highest North American densities have been reported in the Pacific Northwest, parts of Canada, and locally in northeastern United States (Figure 1). Disjunct populations occur during winter in the Black Hills and Western Kansas (Root 1988).

The Winter Wren is migratory in the northern portions of its range. Birds of eastern North America winter mainly in southeastern United States, whereas western birds are either sedentary or migrate toward coastal regions. A similar pattern seems to occur in Eurasia (Armstrong 1955). During mild winters the Winter Wren can be found north of its usual wintering grounds. Several sources (Holmes 1988, Cawthorn and Marchant 1980, Paine 1985) report significant declines in breeding populations following severe winters; mortality on wintering grounds apparently is a significant factor in the population dynamics of Winter Wrens.

In Wisconsin, Winter Wrens breed primarily north of the tension zone although, again, disjunct breeders are found well south of this region (Figure 2). Notable southern locations include the Baraboo hills, Cedarburg Bog, and probably Wyalusing State Park (Robbins 1990). Virtually all of Wisconsin Winter Wrens are migratory.

Individuals first arrive in Wisconsin late in March (or more commonly April). According to Robbins, most spring records fall between April 10th and May 5th. Fall migrants occur from late September through October with some birds lingering into November and even December or later in the south. Successful overwintering in Wisconsin has been reported by C. R. Songtag in Manitowoc County (Robbins 1990).

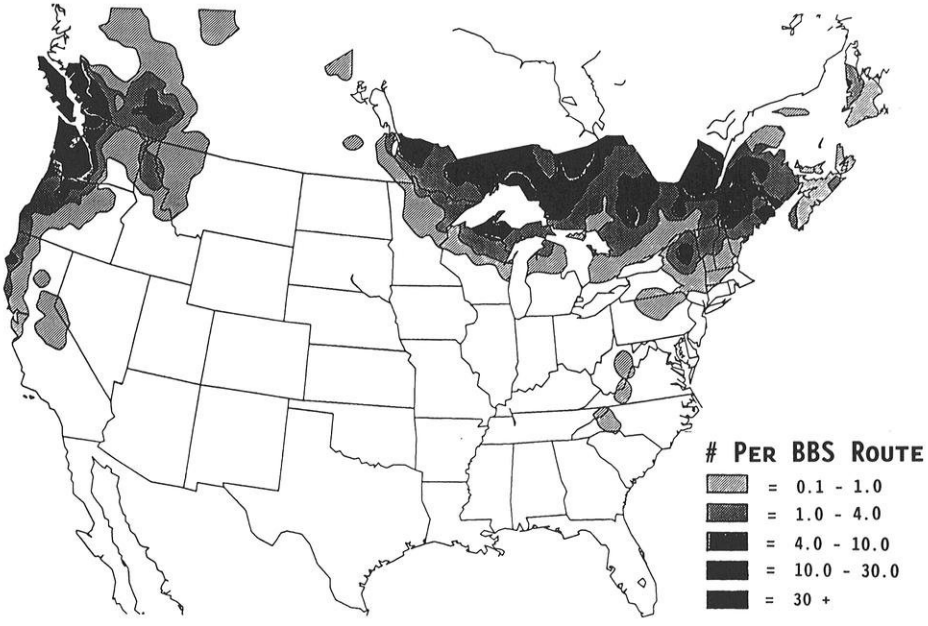

Figure 1. Distribution of Winter Wrens in North America based on Breeding Bird Survey Routes coordinated by the U.S. Fish and Wildlife Service. Map was provided by the Migratory Bird Laboratory in Patuxent, Maryland, courtesy of Sam Drogge.

NATURAL HISTORY

Although North Americans usually associate this species with moist coniferous forests, Winter Wrens can be found in a surprisingly wide range of habitats. Armstrong (1955) states that "in the British Isles there is no more widely distributed species than the wren." There it occurs in woodlands, thickets and even the Shetland moors.

In North America and Eurasia it is observed in old-growth forest (Wesolowski 1983) as well as in regenerating forests. The common thread that seems to link these habitats is dense tangles of undergrowth or forest debris. Wesolowski believes that the primeval habitat of the wren in Europe is old-growth vegetation, such as occurs today in Bialowieza national Park of Poland. Apparently the wren has adapted favorably to secondary habitats, such as hedgerows and shrubby thickets. Cody and Cody (1972) report nesting in coastal heath and gardens in islands of the North Atlantic. Winter Wrens do not seem to have readily exploited such habitats in mainland North America. Since 1937 Winter Wrens have been recorded in at least 112 North American breeding bird censuses (Cornell Laboratory of Ornithology, personal communication). Most of these sites include a significant component of coniferous tree species, but alder swamps, aspen forests, and deciduous forests also have yielded Winter Wrens during the breeding season. On islands of the Pacific Northwest it occurs abundantly in dense tangles of salmonberry (*Rubus spectabilis*) and other shrubs (Paine 1985).

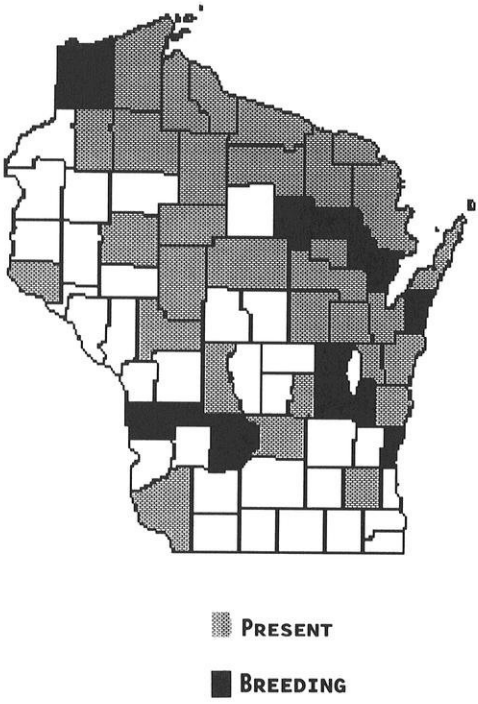

Figure 2. Distribution of Winter Wrens in Wisconsin during summer. Only confirmed or published records have been listed for the "breeding" category.

The Winter Wren's habitat preference reflects its selection of nesting sites. In Europe, nests have been reported most commonly from roots of upturned trees or "tip-ups" (Wesolowski 1983). Other sites include "niches" in ivy and crevices on trees and walls (Armstrong 1955). North American Winter Wrens nest most frequently in tip-ups and to lesser degree in rock outcrops. Of 156 nests reported from North American museums and Cornell Laboratory of Ornithology nest record cards, 70% were located in tip-ups. The remainder are primarily in overhanging banks along streams, but even these sites are associated with root systems. Others were found in rock crevices, hollow stumps, old woodpecker holes, between loose bark of trees and even in an old rusty stove. The few nests reported from Wisconsin are consistent with this North American pattern (Robbins 1990). Nearly all reported nests consist of sphagnum moss lined with hair and occasionally feathers. Nests collected by Carl Richter, stored at the Richter Museum of Natural History in Green Bay, were composed of sphagnum moss and cedar twigs, lined with soft materials including deer hair, grouse feathers, fine grass and mouse fur.

Winter Wren nests can be exceedingly difficult to find. Bent (1948) states that "I have never been fortunate enough to find a nest of the Winter Wren . . . but I believe I have seen the only nest recorded in southeast New England." Kiff and Hough (1985) list 443 collections of nests and eggs of Winter Wren in North American bird egg collections, but a significant number of these are from European subspecies. Nests of the more familiar House Wren, in comparison, total more than 2000.

The Winter Wren is known to build extra (supernumerary) nests, perhaps as roosting sites, for courtship purposes, as decoys, or "through super abundant energy on the part of the male" (Bent 1948). In the related Marsh Wren, nests used for breeding can be distinguished from supernumerary nests by lining of soft materials (Verner, 1965). Egg collectors have noted similar habits for the Winter Wren. Wesolowski (1983) and colleagues located 325 nests in Bialowieza Forest, but only 101 of these were actually used for breeding purposes.

Clutch size ranges between 4–7. Armstrong reports an average clutch size of 5 in Europe, with larger clutches in northern latitudes. A similar trend has

not been verified in North America. Cody and Cody (1972) found reduced clutch size of Winter Wrens on islands. Data from North American collections show average clutch size of 5.3, with a standard deviation of 0.94.

Winter Wrens are almost exclusively insectivorous, feeding on beetles, spiders, true bugs, ants and insect larvae (Bent 1964). Individuals forage on the ground or amongst thick undergrowth or debris. The bird seems to spend most of its time on or near the ground, seldom flying even to escape potential predators. This feeding habit, as well as the limited migration distance, is reflected by the bird's short wings. The range of wing lengths in Winter Wrens (♂ = 44–52mm, ♀ = 40–48mm) is considerably shorter than their counterpart the House Wren (♂ = 48–54mm, ♀ = 46–52mm). Eastern populations tend to have slightly larger wings than those of western North America (Pyle et al. 1987). Our data from Winter Wrens in Kewaunee County also show sexual dimorphism [♂ = 47.4mm (n=16), ♀ = 45.6 (n=12)].

One exception to the terrestrial habits of Winter Wrens is the tendency of territorial males to sing from perches high in trees or from other elevated perches (Godfrey 1986, and personal observations).

Winter Wren males are strongly territorial. Confrontations between rivals were noted by Wesolowski (1983) and Armstrong (1955). In Europe, males arrive on breeding grounds about a month earlier than females (Wesolowski 1983). Territory size is quite variable. Densities in Europe range from as many as 32 per 10 hectares in Britain to less than 5 per 10 hectares in the undisturbed habitat of Bialowieza Forest. Wisconsin territories are similar in size to those of Bialowieza forest records. Our results from Kewaunee County show densities of approximately 3–4 per 10 hectares. Results from North American breeding bird censuses show a mean density close to this value (Figure 3).

Male Winter Wrens invest considerable time and energy singing. The unmistakable, complex and melodious song may last as long as 9 seconds. Our records from Kewaunee County show an average song length of 6.4 seconds. Kroodsma (1980) believes that the song of the Winter Wren is "near the pinnacle of song complexity." In North America the song of western populations of Winter Wrens is far more complex than that of eastern populations (Kroodsma 1980). We recorded a mean frequency of 2.7 songs per minute during early morning. This intensity decreases in the afternoon and later during the breeding season, when birds may remain silent for an hour or more. Although we have heard Winter Wrens singing as late as October, these post-breeding songs are much shorter and less energetic.

The period from egg-laying through fledging is approximately 32 days (Armstrong 1955, Ehrlich et al. 1988). Our survey of North American oological collections revealed nesting dates from mid April through late July, compared with early April through mid July reported for European populations. Observations of active nests during August (Armstrong 1955) suggest that this species may raise more than one brood during a single breeding season.

Nest predators in Europe include domestic cats and other undetermined species (Armstrong 1955, Wesolowski 1983). None of the 156 egg sets reported to us had been parasitized by Brown-headed Cowbirds, suggesting

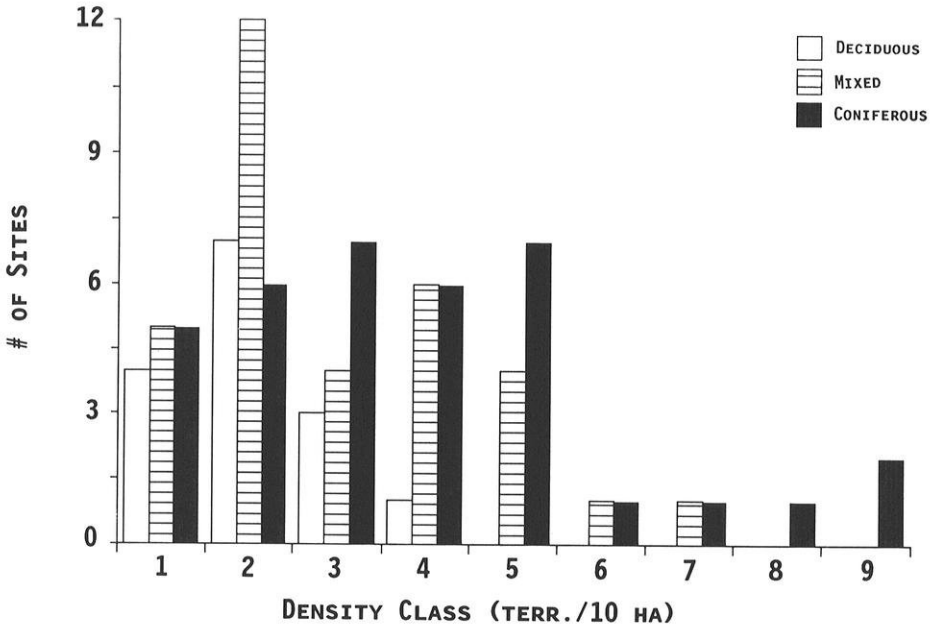

Figure 3. Density of Winter Wrens in 112 Breeding Bird Censuses (Hall 1946) coordinated by the Cornell Laboratory of Ornithology.

that brood parasitism in North America is low. European birds, on the other hand, are occasionally parasitized by cuckoos of the genus *Cuculus*.

Winter Wrens in Northeastern Wisconsin

Northeastern Wisconsin presents an excellent opportunity to study the ecology of Winter Wrens. Extensive forests of northern Wisconsin give way southward to more dissected forests and finally to scattered woodlots in southeastern Wisconsin. Kewaunee County lies in the heart of this habitat fragmentation gradient. At the time of European settlement in the mid 1800's Kewaunee County was nearly 100% forest, dominated by American beech, sugar maple, and hemlock (Finley 1976). Today only 17% of the county is forested. Most remnants are smaller than 100 acres, with only three contiguous forest areas larger than 1000 acres. Most of the smaller woodlots are uplands; virtually all of the largest woodlots are lowlands dominated by black ash, birch, and conifers.

Since 1985, researchers at the University of Wisconsin-Green Bay have studied birds in 72 representative woodlots in Kewaunee County. Recently, efforts have focused on several large lowland forest tracts, particularly two sites of 2142 and 388 acres along the upper reaches of Krok Creek, a tributary of the East Twin River.

Winter Wrens have been recorded at 53% of 103 sampling points in these forest remnants. A more detailed analysis of our results will be presented elsewhere. Here we summarize our major conclusions. Within the two intensively

studied areas, Winter Wrens do not seem to avoid canopy openings within the forest, nor do they seem to be associated with any particular tree species. Elsewhere in Kewaunee County they occur in woodlots of varying quality, from relatively undisturbed lowlands to degraded sites with small diameter trees. These results are consistent with the findings of Titterington et al. 1979 and Webb et al. 1977, who recorded Winter Wrens in regenerating forest clearcuts of Maine and New York, respectively. Surveys from the Nicolet National Forest in northern Wisconsin identified Winter Wrens in a broad range of habitats ranging from their preferred lowland conifers to young stands of aspen. In all of the northern Wisconsin areas, including Kewaunee County, Winter Wrens do not occur regularly in mature upland hardwoods.

Winter Wrens in southern Wisconsin occur along rocky slopes forested by oak and other hardwoods, with a significant element of conifers (Mossman and Lange 1982). In the St. Croix Valley of western Wisconsin, it is characteristic of "lowland coniferous forests dominated by black spruce, balsam fir, and yellow birch." A nest in nearby Minnesota was found in a hardwood forest of sugar maple, yellow birch, American elm, ash, white pine and red pine (Faanes 1981). In general, Winter Wrens in Wisconsin favor moist sites with at least some conifers and significant amounts of slash, or other microhabitats (e.g., rock outcrops) suitable for their cryptic nests. Such conditions might be found in old-growth forest as well as in stands that have been recently logged.

Despite rather broad habitat tolerance, Wisconsin's Winter Wrens are surprisingly sensitive to habitat fragmentation. Within our two intensive study sites, distance to forest edge was the most significant variable affecting Winter Wren occurrence; individuals were rarely recorded near the forest perimeter. On a broader scale, Winter Wrens in Kewaunee County tended to avoid small woodlots (Figure 4), even those of seemingly acceptable habitat type. We found individuals at 13% of sampling points in woodlots smaller than 100 acres, compared with more than 40% in woodlots larger than 100 acres. Winter Wrens were recorded during approximately 80% of point samples in our two intensively studied areas. Statewide the distribution of Winter Wrens corresponds with regional levels of habitat fragmentation. During 1988 Winter Wrens were recorded in 77% of lowland conifer sites in the northern half of the Nicolet National Forest, whereas they were present in only 56% (1987) and 38% (1989) of lowland conifer sites in the more sparsely forested southern half of the forest (Nicolet National Forest Bird Survey, unpublished data). In most of southeastern Wisconsin, where forest cover ranges from 5% to 17%, Winter Wrens are rare or absent altogether. A notable exception is the Baraboo Hills region where contiguous forest extends across much of an area extending 25 miles long and 5 miles wide (Mossman and Lange 1982).

Why are Winter Wrens sensitive to habitat fragmentation in Wisconsin but (apparently) not in Europe? Why are Winter Wrens common in lowland forests of northern Wisconsin, but rarer in lowland forests of central and southern Wisconsin? We do not pretend to have answers to these questions, but our results provide some clues. Perhaps the physical changes associated with forest fragmentation make isolated woodlots

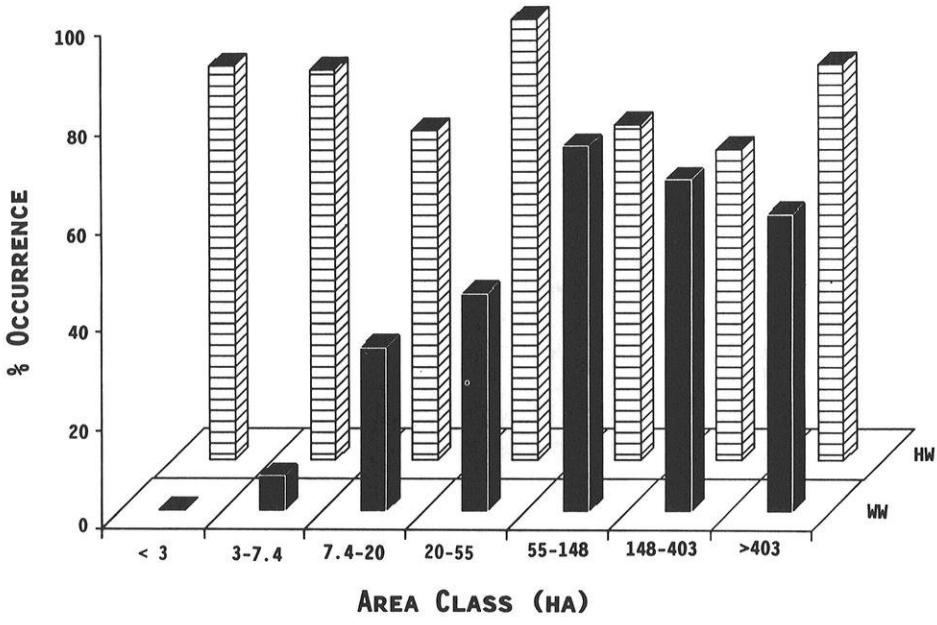

Figure 4. Incidence of Winter Wrens (WW) and House Wrens (HW) in woodlots of different size categories in Kewaunee County, Wisconsin. Size categories are scaled by natural logarithm of area.

unfavorable for Winter Wrens. Increased exposure of edges to wind and sunlight might transform moist forests into drier woodlands with fewer nesting sites. Yet European Winter Wrens seem to have adjusted very successfully to agricultural landscapes. Our results suggest that another factor, presence of House Wrens, might play a significant role in Winter Wren distribution. Occurrence of House Wrens was significantly associated with the absence of Winter Wrens in our Kewaunee County study areas, even after distance to edge had been taken into account. In other words, not only did Winter Wrens avoid forest edges (where House Wrens tended to occur) but they also avoid places within the forest where House Wrens are present. We did not observe any direct interactions between these two species, but House Wrens are known to destroy nests of other songbirds, a behavior that is believed to be related to interspecific competition (Belles-Isles and Picman 1986). This aggressive behavior has never been reported for Winter Wrens. Perhaps the larger scale distribution of Winter Wrens is also related, at least in part, to a competitive interaction with House Wrens. House Wrens, of course, are absent in Europe (where Winter Wrens are abundant) and they are uncommon in northern Wisconsin (where Winter Wrens are widespread and pervasive). Increase in competition from forest-edge birds was suggested by Ambuel and Temple (1983) as an important consequence of habitat fragmentation in southern Wisconsin. The interaction between House Wrens and Winter Wrens might represent another example of this phenomenon.

Conclusions

The Winter Wren is not a rare species in Wisconsin and current land management practices in northern forests probably do not threaten its continued existence. On the other hand, fragmentation of forests in central and southern Wisconsin has created an unfavorable environment for the Winter Wren. We propose that presence of the House Wren, an aggressive and closely related species, might contribute to the absence of Winter Wrens in fragmented forest landscapes. Perhaps this interspecific interaction has undermined the success of Winter Wrens in human-dominated landscapes of North America, unlike those of Europe.

Our analysis of Winter Wrens rests on a rather small number of observations in a limited portion of the Winter Wren's range. Literature references in general are scarce for North American Winter Wrens. Thus, many opportunities exist for future studies of the behavior, population dynamics and ecology of this interesting and elusive bird.

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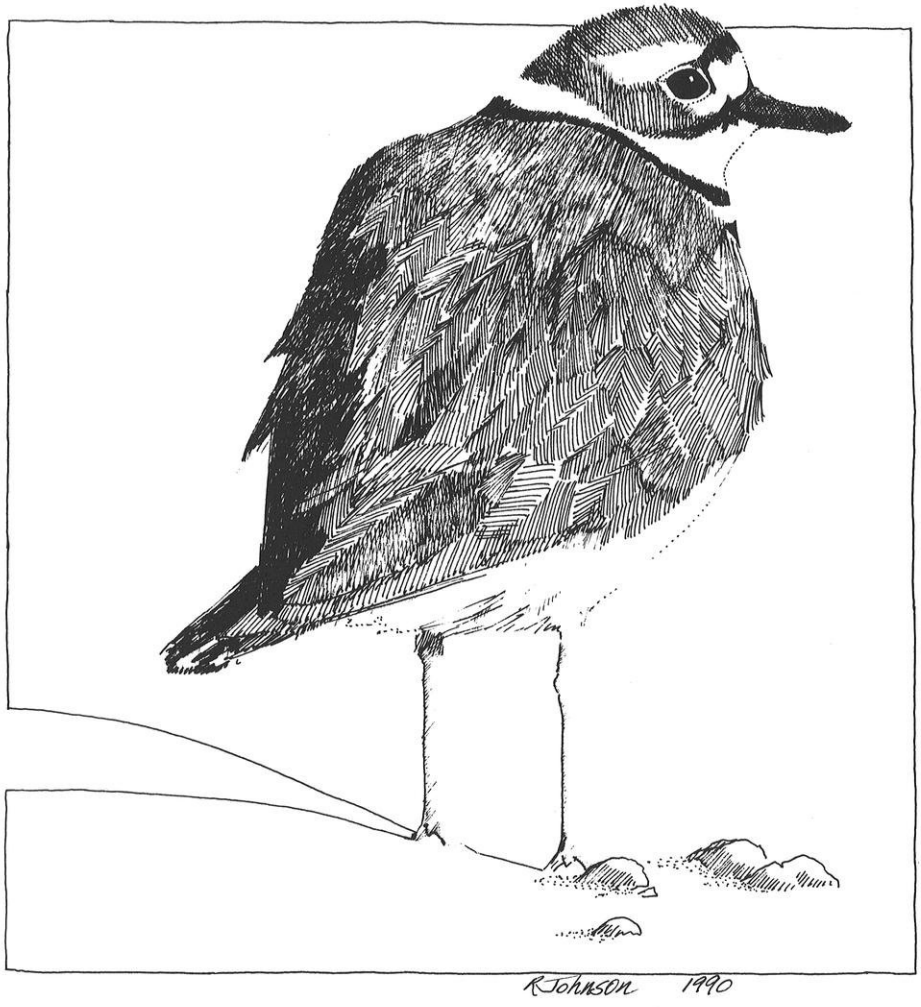

Killdeer *by Robbye Johnson*

Early Fall Sightings of White-winged Crossbills on the Chequamegon National Forest

This paper describes the 1989 invasion of northwest Wisconsin by White-winged Crossbills. The significance of these invasions is discussed, but much remains to be learned about the movements of crossbills.

by John C. Robinson

During the months of July, August and September 1989, White-winged Crossbills (*Loxia leucoptera*) staged an invasion into northwest Wisconsin, with many birds being found on the Chequamegon National Forest. This paper presents a summary of the sightings of this species made by the author and Keith Merkel from 16 July 1989 through 18 September 1989. The area covered by these sightings is primarily the Chequamegon National Forest, specifically the entire Hayward Range District of the Forest, small portions of the southern and west-central regions of the Glidden Ranger District, and small portions of the extreme northeast and southeast corners of the Washburn Ranger District of the Forest. A handful of sightings occurred off National Forest lands.

Methods and Results

The data presented in this paper were collected during routine visits to the field; many of the sightings are the result of opportunistic or serendipitous observations. Only one specific survey of crossbills was conducted, occurring on 25 August 1989 and covering approximately 32 linear miles of Forest Service lands. Many of the birds were initially detected by call note; however, several males were observed singing, and some birds could be found simply by examining the tops of conifer trees bearing a large supply of cones.

A total of 1294 birds was found between 16 July and 18 September 1989 (Table 1). The majority of the sightings were made by the author; Keith Merkel provided data for the following dates: 16 and 23 July, 27 August, and 15–16 September. No field trips were made by the author during the following periods: 3–18 August and 19–30 September. Of 22 visits made to National Forest land, crossbills were found on a total of 20 (91%) trips. Peak numbers were re-

Table 1. Abundance, location and habitat association of White-winged Crossbills found during the July–September 1989 period on the Chequamegon National Forest.

Date	Number	Location	Habitat
16 July	6	Sawyer Co., T40N, R3W, Sect. 31	flyover
20 July	7	Sawyer Co., T42N, R5W, Sect. 35	balsam fir, alder
22 July	10	Bayfield Co., T49N, R6W, Sect. 10	jack pine
23 July	5[1]	Bayfield Co., T50N, R6W, Sect. 27	black spruce
23 July	5	Sawyer Co., T40N, R4W, Sect. 3	hemlock
24 July	2	Sawyer Co., T41N, R6W, Sect. 33	black spruce
25 July	2	Sawyer Co., T42N, R5W, Sect. 29	spruce-fir[2]
26 July	1	Sawyer Co., T41N, R6W, Sect. 2	flyover
27 July	0		
31 July	2	Sawyer Co., T42N, R5W, Sect. 10	black spruce
31 July	2	Sawyer Co., T42N, R5W, Sect. 14	black spruce
31 July	2	Sawyer Co., T42N, R5W, Sect. 30	flyover
18 August	4	Bayfield Co., T43N, R5W, Sect. 14	spruce-fir
18 August	1	Sawyer Co., T41N, R5W, Sect. 5	hemlock
24 August	250	Ashland Co., T42N, R4W, Sect. 14	spruce-fir, alder
25 August	350	Ashland Co., T42N, R4W, Sect. 14	spruce-fir, alder
25 August	9	Ashland Co., T43N, R4W, Sect. 30	black spruce
25 August	1	Ashland Co., T42N, R4W, Sect. 17	black spruce
25 August	27	Bayfield Co., scattered locations	spruce-fir
25 August	50	Sawyer Co., scattered locations	spruce-fir
27 August	300	Sawyer Co., T42N, R5W, Sect. 25	spruce-fir
27 August	1[1]	Sawyer Co., T41N, R7W, Sect. 6	flyover
29 August	2	Bayfield Co., T44N, R7W, Sect. 13	white pine
1 September	20	Sawyer Co., T42N, R5W, Sect. 27	spruce-fir
5 September	12	Sawyer Co., T42N, R5W, Sect. 27	spruce-fir
7 September	78	Sawyer Co., scattered locations	spruce-fir
10 September	30	Ashland Co., T42N, R4W, Sect. 14	spruce-fir, alder
10 September	73	Sawyer Co., scattered locations	black spruce
10 September	2[1]	Sawyer Co., T42N, R9W, Sect. 20	black spruce
13 September	11	Sawyer Co., scattered locations	spruce-fir
15 September	12	Sawyer Co., T40N, R3W, Sect. 31	white spruce
15 September	6	Ashland Co., T42N, R4W, Sect. 28	black spruce
16 September	11	Sawyer Co., T40N, R3W, Sect. 32	white spruce
18 September	0		
	1294		

[1]Sighting occurred off National Forest Service lands.
[2]"Spruce-fir" generally included a mixture of black spruce, white spruce and balsam fir.

corded on 25 August (437 birds) and 27 August (300 birds).

A gross estimate of the predominant forest type(s) being used by the birds was made for each observation (exclusive of "flyovers"). The birds were primarily associated with black spruce (*Picea mariana*) bog habitats, but many birds were also found in habitat characterized by a "spruce-fir" mixture of black spruce, white spruce (*Picea glauca*) and balsam fir (*Abies balsamea*). Varying concentrations of tamarack (*Larix laricina*) were found in many of the sites dominated by black spruce. Six birds in Sawyer County were found in stands of eastern hemlock (*Tsuga canadensis*); two birds in Bayfield County were found in an isolated stand of white pine (*Pinus strobus*); and 10 birds in northern Bayfield County were found feeding on the cones of a well-stocked jack pine (*Pinus banksiana*) stand. Sightings off the National Forest included a flock of five birds in

a black spruce bog east of Siskiwit Lake in northern Bayfield County; one bird flying over the northeast end of the Tiger Cat Flowage in Sawyer County; and two birds feeding in a black spruce tree on the Totogatic Flowage in northwest Sawyer County (Table 1). No Red Crossbills (*L. curvirostra*) were found.

Sightings from mid July through mid August consisted of from one to ten birds. However, in late August, an extremely large concentration of crossbills was found at one site on the Glidden Ranger District along the east fork of the Torch River. A brief visit to this site on 24 August yielded approximately 250 birds. On 25 August, this site was more thoroughly investigated and it was determined that the flock using this area contained a minimum of 350 birds. This particular area consisted of a 49-year old white spruce plantation that was 34 acres in size and which had just received its first thinning. Balsam fir was at scattered locations throughout this site, and speckled alder (*Alnus rugosa*) occurred in the riparian zone along the Torch River. The birds were observed feeding on all three of these plant species. On 27 August, Keith Merkel documented 300 birds using a spruce-fir area in Sawyer County less than five-and-a-half miles west of the Torch River site. Birds were frequently found in September, but flocks generally did not exceed 30–40 birds in size (Table 1).

Discussion

The mandibles of crossbills are crossed and are specifically adapted for extracting seeds from the hard closed cones of coniferous trees. Both species of crossbills are considered to be irruptive species (i.e., species which migrate southward during the autumn period, usually in response to food shortages farther north). Irruptions are generally irregular phenomena, but there may be a certain degree of synchrony (i.e., the interval of years between irruptive events) in irruptions among populations within a species.

The White-winged Crossbill breeds throughout much of Alaska and Canada south to Washington, northeastern Oregon, western Montana, central Saskatchewan, southeastern Manitoba, and southcentral Ontario to Maine, New Brunswick and Nova Scotia; breeding in the Lake States is confined to northern Minnesota, northern Wisconsin and northern Michigan (American Ornithologists' Union 1983). However, the only valid nesting record for Wisconsin was documented in Oconto County in April of 1894 (Samuel D. Robbins, personal communication). The species is very infrequently encountered during the mid March to mid September period.

Although it may be assumed that food shortages somewhere in the boreal forests of Canada forced White-winged Crossbills into northern Wisconsin, it should also be noted that 1989 was a bumper-crop year for several coniferous tree species in northwestern Wisconsin. Cone production for white spruce and black spruce was very heavy, while cone production on balsam fir was moderately heavy. White pine and jack pine cone production was very good, but at scattered locations. Cone production for red pine (*Pinus resinosa*) was low, although a few select sites did well. It appears, however, that the abundance of white and black spruce cones had a net effect of "catching and retaining" migratory flocks of crossbills during this irruptive season. Based on a long-term study in northeastern Wisconsin, white

spruce produced good seed crops (61% or more of full crop) in 13 years (38%) over a 34-year observation period; good seed crops for black spruce occurred in 15 (44%) years during the same period (Godman and Mattson 1985). This same study also showed that the maximum number of successive years of good crops is three years for white spruce and six years for black spruce. While it is,therefore, feasible that spruce trees in northwestern Wisconsin could produce another large cone crop in 1990, it should also be noted that the timing and intensity of weather-induced factors such as frosts, heat, hail, wind or drought have an impact on seed development (Schopmeyer 1974).

A review of *The Passenger Pigeon* for the last 30 years reveals that the White-winged Crossbill is an erratic wanderer, with a handful of birds being found in most years during June and July, usually in northern Wisconsin (Table 2). The average arrival date for "fall migrants" is mid to late September. Peak numbers usually do not occur until late December. These findings contrast sharply with the notably early arrival of this species in 1989, as evidenced by the relative consistency in observations throughout late July (Table 1). Moreover, the total of 437 birds found on 25 August 1989 has only been surpassed twice in the last 30 years (see the Christmas Bird Counts for the 1977–78 winter in Table 2), and the only significant fall concentrations in recent years involve 200 birds on 6 July 1969 at Pelican Lake, Oneida Co. (Table 2) and 290 birds at one site on 19 November 1977 in Ozaukee Co. (*Passenger Pigeon* 40(3):471).

One obvious question generated by the data in Table 1 is: where will all these birds go, and what will they do once they get there? It is possible that a certain percentage of birds will remain on the Forest and breed, thus taking advantage of the abundant food supply. However, are flocks of 300 and 350 birds in late August a sign of an impending "crossbill" winter for Wisconsin? Availability of suitable habitat (i.e., wooded and urban areas with large numbers of spruce and pine trees that have produced a heavy supply of cones) will likely be the most important variable behind the answer to this last question. During the 1969–1970 season, 200 birds were found on 6 July, but published records for the corresponding winter months did not exceed this 1-day total (Table 2). In 1977, however, the appearance of 290 birds in mid November foretold the winter invasion that resulted in the two largest 1-day totals for the state in the last 30 years (Table 2).

Conclusion

The actual significance of the abundance of White-winged Crossbills on the Chequamegon National Forest during the July–September 1989 period still remains to be determined. Although these birds occurred at a time of the year when they are infrequently found in Wisconsin, and at levels that generally exceed most concentrations recently reported in the state, there has probably not been enough consistent coverage of the Chequamegon National Forest to determine how regular such occurrences may be. Furthermore, I acknowledge that there are probably a number of unpublished records that could shed significant light on the actual abundance of White-winged Crossbills in northwestern Wisconsin during the early fall season of a good cone crop year.

Table 2. Seasonal arrivals and peak numbers of White-winged Crossbills in Wisconsin: 1960–1989.

Season	First Summer/ Early Fall Records	Date of Peak Number[1]	Location	*Passenger Pigeon* Reference
1960–61	6 July		Bayfield Co.	23(1):21
			Hiles CBC, Nicolet National Forest	
		1 Jan. (209)		22(4):173
1962–63	25 Nov.		Lincoln Co.	25(2):86
			Hiles CBC, Nicolet National Forest	
		22 Dec. (27)		25(1):9
1963–64	2 July		Douglas Co.	26(1):67
	13 Aug.		Door Co.	26(2):103
		———[2]		
1964–65	16 June		Douglas Co.	27(2):87
	20 Oct.		Milwaukee Co.	27(3):127
			Hiles CBC, Nicolet National Forest	
		1 Jan. (35)		27(3):97
1965–66	7 June		Price Co.	28(2):83
	23 Aug.		Bayfield Co.	28(3):123
		2 Jan. (17)	Lake Geneva CBC, Walworth Co.	28(3):95
1966–67	25 June		Oneida Co.	29(2):42
	20 Aug.		Marinette Co.	29(3):94
		30 Dec. (127)	Bayfield Co.	29(4):140
1967–68	19 July		Douglas Co.	30(2):97
	9 Aug.		Bayfield Co.	30(2):97
		29 Dec. (48)	Iron Belt CBC, Iron Co.	30(4):158
1968–69	22 Nov.		Milwaukee	31(3):300
		26 Nov. (3)	Portage Co.	31(3):300
1969–70	15 June		Oneida Co.	32(2):67
	4 July		Langlade Co.	32(2):67
		6 July (200)	Pelican Lake, Oneida Co.	32(2):67
1970–71	26 June		Forest Co.	33(2):96
		———[2]		
1971–72	———[2]			
		22 Dec. (389)	Fifield CBC, Price Co.	34(1):9
1972–73	16 Sept.		Washington Island, Door Co.	35(3):147
			Hales Corner CBC, Milwaukee Co.	
		17 Dec. (8)		35(1):8
1973–74	27 Sept.		Milwaukee	36(3):131
	Aug.-Nov.	up to 70+	Location/Date unspecified	36(3):131
1974–75	1–6 June		Price Co.	37(1):29
	13 Aug.		Oneida Co.	37(3):131
		22 Dec. (15)	Fifield CBC	37(1):13
1975–76	14 June	14 June (5)	Vilas Co.	38(2):79
	22 July		Forest Co.	38(2):79
1977–78	21 June		Douglas Co.	40(2):412
	26 July		Manitowoc Co.	40(2):412
	14 Oct.		Chippewa Co.	40(3):471
		18 Dec. (592)	Wausau CBC, Marathon Co.	40(1):360
			Woodland Dunes NE CBC, Manitowoc Co.	
		1 Jan. (484)		40(1):362
1978–79	18 June		Douglas Co.	41(2):89
	2 Nov.		Ashland Co.	41(4):174
		17 Dec. (3)	Waukesha CBC, Waushara Co.	41(1):11
1979–80	11 Nov.		unknown location	42(3):118
		———[2]		

continued

Table 2. (*Continued*)

Season	First Summer/ Early Fall Records	Date of Peak Number[1]	Location	*Passenger Pigeon* Reference
1980–81	21 Oct.		Manitowoc Co.	43(4):136
		3 Jan. (137)	Woodland Dunes NE CBC, Manitowoc Co.	43(1):14
1981–82	19 Dec.		Fond du Lac Co.	44(1):9
		14 Jan. (200)	Sauk Co.	44(4):166
1982–83	9 June		Milwaukee Co.	45(2):64
	1 Aug.		Bayfield Co.	45(3):101
		27 Dec. (28)	Ephraim CBC, Door Co.	45(1):13
1983–84	28 Nov.		Eau Claire Co.	46(3):123
		26 Dec. (6)	Cloverland CBC, Douglas Co.	46(1):16
1984–85	2 Aug.		Forest/Vilas Co.	47(3):118
		Feb. (up to 200)	Unknown Location/Date	47(4):150
1985–86	5 June		Price Co.	48(2):88
	19 Aug.		Douglas Co.	48(3):146
		21 Dec. (33)	Adams Co. CBC	48(1):16
1986–87	2 Oct.		Vilas Co.	49(3):156
		1 Nov. (30)	Ozaukee Co.	49(3):156
1987–88	30 June		Douglas Co.	50(2):169
	1 Aug.		Ashland/Bayfield/Douglas Co.	50(3):246
		Nov.–Feb. (up to 50)	Unknown Location	50(3):258
1988–89	3 June		Douglas Co.	51(1):119
	15 Nov.		Milwaukee Co.	51(2):226
		1 Jan. (94)	Three Lakes CBC	51(1):79

[1]Exact numbers are not always given in the seasonal field notes of *The Passenger Pigeon*; therefore, in some years, unpublished data may reveal larger peak numbers than those reported here.
[2]Insufficient Information.

Acknowledgements

I wish to thank Sam Robbins, Richard Bailey and Keith Merkel for providing information necessary for the successful completion of this manuscript.

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Water Quality and the Summer Distribution of Common Loons in Wisconsin

The water quality of 176 lakes in northern Wisconsin is compared with information on loon occupancy. Loons in Wisconsin occupy large clear, deep lakes of low productivity. Implications of lake acidification for loons are discussed.

by Robert B. Blair

The Common Loon (*Gavia immer*) is virtually dependent on water. In North America, it overwinters on coastal waters from the Gulf of Mexico to Labrador in the east and from Baja, California to the Aleutians in the west. In the summer, it is found on freshwater inland lakes across the northern United States and Canada (Scott 1987). Loons are poorly adapted for terrestrial travel, and consequently appear on land only to construct their nests and incubate eggs on the shores of their summering lakes (Olson and Marshall 1952). Within a few hours of egg hatching, the adult loons return to the water with their chicks and, except when flying, remain on water until their next breeding foray onto land.

Recent work on loons and water quality has centered around acid deposition and whether changes in lake acidity have affected loon populations. Parker (1988) found that the acidity of Adirondack lakes had no significant effect on loon reproductive success. He did find that lake acidity affected adult feeding behavior of chicks in that the adults fed chicks prey items that were smaller or larger than those normally preferred. Alvo et al. (1988) examined an area in Canada that was more severely acidified and suggested that greater brood mortality on acidic lakes could be attributed to a shortage of food for the young. They also concluded that successful breeding was associated with large, clear, high-alkalinity lakes while lack of breeding was associated with small, brown, low-alkalinity lakes. Both of these studies noted that loons continue to breed on marginal, critically acidified lakes rather than moving to areas where food is readily available.

In this study, I continue examining the possible links between the distribution of Common Loons and the quality of the water of their summering lakes by analyzing 176 lakes in northern Wisconsin. I employed information gath-

ered by the Sigurd Olson Institute and the Wisconsin Project Loon Watch on the use of these lakes by loons, combined it with 37 lake- and water-quality characteristics collected by the U.S. Environmental Protection Agency (EPA), and examined the combination for trends using logistic regression. My overall goal is to determine whether certain lake- and water-quality characteristics are associated with use of lakes by loons and whether these characteristics could be used to predict the presence of loons on these lakes.

Some parameters that were not in the EPA study, including shoreline development (Dahmer 1986), availability of islands (Olson and Marshal 1952), and recreational pressure (Titus and VanDruff 1981), may also influence loon distribution, but as these data were not available they are not analyzed here.

Material and Methods

I combined loon-distribution information collected by Wisconsin Project Loon Watch with water quality information garnered from the U.S. EPA and examined the data for trends using logistic regression.

Loon Distribution.—The information provided by the Wisconsin Project Loon Watch was divided into three different eras. In 1976 and 1977, Zimmer (1979) surveyed all lakes larger than 12 ha for the presence of loon adults, young, and nests. From 1979 until 1985, Project Loon Watch compiled information from volunteers on most of these lakes for the presence of adults, pairs, and chicks. In 1986 and 1987, the Project conducted more intensive surveys of these areas noting presence of adults, nests, chicks and location of nests (P. Strong, personal communication).

On the basis of these surveys, I classified lakes that were also in the EPA database into three categories: lakes on which loons had bred (n=55), lakes on which adult loons had been seen with no evidence of breeding (n=51), and lakes on which loons had never been seen (n=70).

Water Quality

I gathered the lake- and water-quality information from the U.S. EPA-sponsored Eastern Lakes Survey-Phase I, which was part of EPA's National Surface Water Survey and a contribution to the National Acid Precipitation Assessment Program (Linthurst et al. 1986). This survey was conducted in the fall of 1984 and involved sampling more than 1700 lakes randomly selected in the eastern United States that were larger than four ha in surface area. The physical measurements of each lake—such as elevation, lake area, and watershed area—were determined from USGS topographic maps. They gathered water quality characteristics by landing fixed-pontoon helicopters on the apparently deepest part of the lake where they took most samples 1.5 m below the surface.

Lake- and water-quality characteristics measured included: acid neutralizing capacity (ANC), calcium (Ca), calculated conductance (cal. cond.), the ratio of cations to anions (cations/anions), chloride ion (CI), dissolved inorganic carbon (closed DIC), closed system pH (closed pH), true color (color), dissolved organic carbon (DOC), elevation of the lake surface (elevation), air-equilibrated dissolved inorganic carbon (equil. DIC), air-equilibrated pH (equil. pH), extractable aluminum (ext. Al), to-

tal dissolved fluoride (F), dissolved iron (Fe), bicarbonate (HCO_3), lake hydrologic type (hydro. type), dissolved potassium (K), lake surface area (lake area), conductance (meas. cond.), dissolved magnesium (Mg), dissolved manganese (Mn), dissolved sodium (Na), ammonium ion (NH_4), nitrate ion (NO_3), Secchi disk transparency (Secchi depth), silica (SiO_2), depth at sampling site (site depth), sulfate ion (SO_4), sum of anions (sum anions), sum of cations (sum cations), surface temperature (surface temp.), total aluminum (tot. Al), total phosphorous (tot. P), turbidity, ratio of watershed area to lake area (WA/LA), and watershed area. For details concerning the methods used in sampling these characteristics, see Linthurst et al. (1986).

Statistical Analysis.—Data from the loon distribution information and the water quality survey were analyzed using logistic multiple regression provided by the MIDAS (Michigan Interactive Data Analysis System) statistical package at the University of Michigan. Logistic multiple regression differs from multiple linear regression in that it requires only two states for the response variable (loons or no loons) and that the restrictions concerning the normality of data are relaxed (Cox 1970, McCullagh 1980, Smith 1981). Logistic multiple regression allows prediction of the probability of being in one group versus another—for example, whether a lake is occupied or not occupied by loons—based on the values of the independent variables in the equation. I assume that the probability of being in one group—for example, a lake not occupied by loons—is the form of $e_{x\beta}/(1+e_{x\beta})$, where $x\beta$ is a linear combination of the predictors. The probability of being in the other group is then $1-[e_{x\beta}/(1+e_{x\beta})]=1/(1+e_{x\beta})$. In this form $x\beta$ is the logarithm of the probabilities of the two outcomes (loon-occupied, not loon-occupied) (King et al. 1988). In this particular instance, $x\beta$ is taken as a linear combination of lake- and water-quality parameters: $x\beta=a+\beta_1x_1+\beta_2x_2+....\beta_ix_i$ where a is some constant, x_i is the value of a specific lake- or water-quality parameter, and β_i is a coefficient.

The method of maximum likelihood was used where a and the coefficient $\beta_1 \ldots \beta_i$ were computed so that the likelihood (reconstructed probability) of the data as they were actually observed was a maximum. This reconstructed probability is the product of terms like $1/(1+e_{x\beta})$ for loon-occupied lakes and terms like $e_{x\beta}/(1+e_{x\beta})$ for unoccupied lakes. The method of maximum likelihood supplies approximate statistical significance tests for the logistic multiple regression as a whole (that is the probability that the water quality parameters have nothing to do with loon presence or absence) and partial significance tests for each coefficient β in the formula for the logs-odd x (King et al. 1988). Problems with correlated variables may arise in multiple logistic regression models, in this case variables with correlation coefficients of more than 0.50 were not used in the same model.

For analysis, I compared lakes occupied by loons with breeding activity ($n=55$) to those where loons had been spotted with no evidence of breeding ($n=51$). A variable-by-variable comparison using logistic regression showed no substantial differences between these two sets of loon-occupied lakes, and consequently I combined them into one large group representing lakes on which loons were present.

The next step was to compare lakes

where loons were present (n=106) to those where they had never been seen (n=70) using logistic regression on a variable-by-variable comparison.

Finally, I used the lake- and water-quality parameters that were significantly different between lakes occupied by loons and not occupied by loons in a multiple logistic regression model. To find the best model possible, I deleted those variables that did not add significantly to the model as indicated by a significant increase in the difference between the two likelihoods for the models using the likelihood-ratio test statistic (Cox 1970, McCullagh 1980, Smith 1981). The likelihood-ratio test statistic has a chi-square distribution with degrees of freedom equal to the difference in the number of variables in each model. In this instance, where I deleted one variable at each step, there was one degree of freedom. Consequently, at the $P = 0.05$ level, if the difference between steps of the two likelihoods for the models was greater than 3.84, the more inclusive model became the 'best model' for the study. This procedure is roughly analogous to the parametric, backwards, stepwise, multiple linear regression.

This 'best model' was subjected to a validating jacknife procedure (T. TenHave, personal communication). In this procedure, the data from lakes were deleted from the data set one lake at a time and the model was recalculated without information concerning that particular lake. Then, for that lake, a prediction was made as to whether loons would occupy that lake or not based on the model for all the other lakes. This model-based prediction was then compared to the deleted data. Thus, I could determine whether the prediction from the model concerning the lake was correct, and determine the percentage of correctly classified lakes.

Results

Differences Between Breeding and Non-breeding Lakes.—The comparison of single water quality characteristics between lakes where loons were reported to have shown breeding activity (n=55) to those lakes where loons had been seen but did not show any evidence of breeding (n=51) resulted in significant differences between these two groups of lakes in only two instances. The ratio of cations to anions was higher in lakes where loons were only seen (mean = 1.22) compared to lakes where loons bred (mean = 1.13). The concentration of nitrate ion was also higher in lakes where loons were seen (mean = 2.4 μeq/L) compared to lakes where they bred (mean = 1.4 μeq/L). Neither of these factors was significantly different between loon-occupied and non-occupied lakes.

Differences Between Loon-occupied Lakes and Non-occupied Lakes.—Many water quality parameters did not differ ($P > 0.05$) between lakes in Wisconsin that were occupied by loons (n=106), and lakes not occupied by loons (n=70). These included the following characteristics: watershed area, the ratio of watershed to lake surface area, turbidity, dissolved iron, sum of anions, sum of cations, air-equilibrated pH, closed system pH, acid neutralizing capacity, measured conductance, calculated conductance, air-equilibrated dissolved inorganic carbon, closed dissolved inorganic carbon, dissolved organic carbon, total aluminum, calcium, magnesium, sodium, potassium, sulfate, bicarbonate, chloride ion, nitrate ion,

total dissolved fluoride, total phosphorous, silica, and manganese.

Several physical measures differed significantly between lakes occupied by loons and not occupied by loons. Compared to non-occupied lakes, loons frequented lakes with higher elevations, larger surface areas and sampling site depths, higher water surface temperatures, deeper Secchi depths, higher ratios of cations to anions, and lower levels of dissolved organic carbon, ammonia, potassium, extractable aluminum (Table 1).

The Model for Predicting Loon Presence or Absence.—The stepwise logistic multiple regression of the lake- and water-quality parameters indicated that the best predictors of loon presence or absence on Wisconsin lakes were: lake elevation, the level of extractable aluminum, the level of ammonia, and the surface area of the lake were the best predictors, in that order (Figure 1). These four variables, when combined, explained 57 percent of the variance and were significantly ($P < .00005$) related to lake use. For discrimination between loon-occupied lakes and non-occupied lakes, the best expression for log-linear modeling of odds-ratios was obtained by the following expression:

$$P(\text{Loon-Occupied}) = 1/(1+e_{x\beta})$$

where $x\beta = 2.3482 - 0.007296$ [elevation (m)] $+ 0.041125$ [extractable aluminum (μg/l)] $+ 0.1152$ [ammonia (μeq/l)] $+ 0.00555$ [lake area(ha)]

The validating jacknife procedure classified 68.2 percent of the lakes correctly which is a relatively high percentage of correctly classified lakes.

Discussion

The factors that differ between lakes occupied and not occupied by loons are physical factors that can be assessed by sight: loons are using large, deep, clear lakes in Wisconsin. Other factors that differed between these two groups of lakes, such as dissolved organic carbon, ammonia, and extractable aluminum, have a direct effect on water clarity because they are measures of lake productivity or have a direct effect on lake metabolism.

Table 1. Lake and water quality parameters with significant differences between lakes occupied by loons and not occupied by loons in Wisconsin.

Parameter	Loon Occupied (±S.E.)	Not Occupied (±S.E.)	*P*-value
Surface Area	129 ha ± 50.8	34 ha ± 6.31	0.000
Sampling Site Depth	7.9 m ± 0.48	5.9 m ± 0.57	0.007
Secchi Depth	2.7 m ± .11	2.1 m ± 0.14	0.000
Color	30 PCU ± 3	45 PCU ± 0.3	0.005
Elevation	445 m ± 6.47	410 m ± 9.44	0.000
Surface Temperature	6.3°C ± 0.31	5.2°C ± 0.36	0.026
Dissolved Organic Carbon	5.18 mg/l ± 0.298	6.65 mg/l ± 0.419	0.004
Ammonia	2.3 μeq/l ± 0.26	5.0 μeq/l ± 0.78	0.000
Extractable Aluminum	5.4 μg/l ± 0.82	10.1 μg/l ± 1.69	0.005
Cations/Anions	1.17 ± 0.021	1.26 ± 0.035	0.030
Potassium	14.0 μeq/l ± 0.474	17.5 μeq/l ± 1.34	0.005

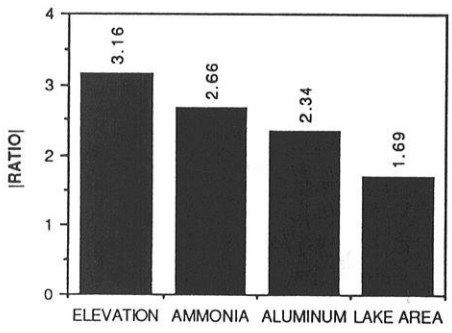

Figure 1. The relative value—the absolute value of the ratio of the estimated coefficient for the variable under the model and its asymptotic standard deviation—of water quality parameters best predicting occupancy of lakes in Wisconsin by Common Loons.

Physical Measures—Size, Elevation, Clarity, Temperature

Compared to unoccupied lakes, loons frequented large lakes in Wisconsin as indicated by both the total surface area of the lake and by the depth of the lake. Both of these measures point to the fact that loons may be using lakes of larger volume. A combination of depth and surface area to indicate lake volume may actually be a better predictor of use of a lake by loons, but the combination would require some gross assumptions concerning lake basin shape. For this reason, I did not combine these factors into a single measurement.

Loons may prefer larger lakes because they tend to provide the extremely long 'runway' that loons need to get airborne (Bent 1919), or provide adequate refuge from human activity. I suspect, however that the major benefit may be in food supply. Barr (1973) estimated that a loon pair and a single chick require 430 kg of prey, usually yellow perch, in a single season. In general, larger lakes produce greater fish yields (Youngs and Heimbuch 1982) and that may benefit loons. The benefit of a large lake is highlighted by Alvo et al. (1988) who found that the breeding success of loons was connected to both deep lakes and large lakes.

Loons occupied clearer lakes as measured by Secchi depth and lake color. This, too, may be related to food supply; loons depend on sight when diving for fish and, consequently, clear water makes easier hunting (Barr 1973, Ericksson 1985). Unfortunately this may run counter to current lake conditions where highly acidified lakes, which are also clear, may lack any fishery. Loons also occupied warmer water lakes, which may hint at their preference for yellow perch. Perch are traditionally referred to as cool water fish—as opposed to cold water trout—and occupy areas a few degrees warmer than the less-preferred trout (Magnuson et al. 1979).

The last physical factor that was different between lakes was elevation. Loons occupied lakes at higher elevations in Wisconsin. This may imply that these lakes were in rougher terrain or in more remote areas, away from flatland and farmland.

Measures of Lake Metabolism—DOC, Ammonia.—Compared to non-occupied lakes, loons frequented lakes with lower levels of dissolved organic carbon and ammonia in Wisconsin. Dissolved organic carbon originates from both terrestrial runoff into the lake and from photosynthesis within the water (Wetzel 1983). Ammonia is the most significant source of nitrogen for plankton within the lake and is lower in oligotrophic lakes. Ammonia is primarily generated by heterotrophic bacteria while decomposing organic matter (Wetzel 1983). The combination of these factors sug-

gests that loons are occupying less productive lakes. Loons may be striking a balance between two different trends. They are selecting larger lakes, which have larger fisheries, but they are also selecting clearer, less productive lakes, apparently for better hunting success.

Ions—Aluminum, Cations/Anions, and Potassium.—Several factors, which may affect loon distribution, are difficult to evaluate. Compared to unoccupied lakes, loons frequented lakes with lower levels of potassium, a lower ratio of cations to anions and lower levels of extractable aluminum. Aluminum may affect loon distribution in that too much aluminum, which may originate from acid deposition leaching aluminum from surrounding soils, eliminates the fauna in a lake (Cronan and Schofield 1979). However, the levels in Wisconsin were below those levels reported in New York where that study was completed. The relationship of potassium or the ratio of cations to anions to loon distribution is obscure.

Conclusion.—Loons are occupying large, clear, deep lakes of low productivity in Wisconsin. They may be selecting lakes on outward appearance, as physical factors, such as depth and clarity, may be the most important to a fish-eating diver, which depends on sight to pursue and capture its prey. Unfortunately, such a preference for clear lakes may have an adverse effect, in that loons may incorrectly identify acidified lakes as preferred lakes. Acidified lakes are often strikingly clear and may give the illusion of perfect feeding grounds for loons, but they may also lack adequate fisheries. This reinforces both Parker's (1988) and Alvo et al.'s (1988) contentions that loons attempt to breed and raise young on highly acidified lakes though these lakes may be poor sources of food. Evidence for this point of view is further enhanced by my observation that few, if any, substantial differences existed between lakes where loons displayed breeding activity and where they were merely reported as present. In other words, those factors that I identified as related to loon distribution are apparently not related to breeding success among those lakes.

Future work on the summer distribution of loons in Wisconsin should focus on anthropogenic influences on these lakes. The degree of summer home development, the availability of public lake access, the management of these lakes for fisherman, and the effects of acid deposition may all influence loon distribution and breeding success as well.

Acknowledgements

I thank Mary Whitmore, Terry Root, and Bobbi Low for their guidance with this project; Paul Strong for providing information on loon distribution in Wisconsin; and Tom TenHave and Kathy Welch for their statistical expertise and advice.

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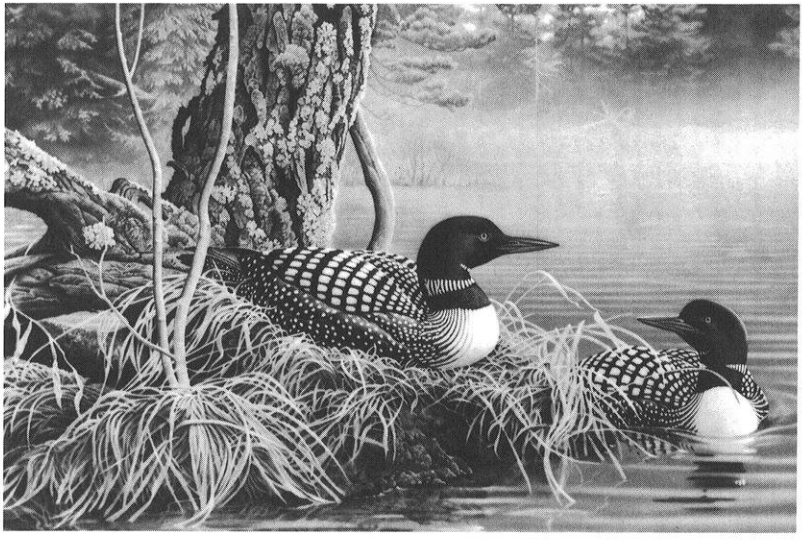

"Stillwater Loons" *by Jerry Gadamus* (A limited edition print reprinted with the permission of the artist and the publisher, Northwoods Craftsman, Menomonee Falls, WI 53051)

Where Do Wisconsin's Neotropical Migrants Spend the Winter?

An analysis of the winter ranges of bird species that breed in Wisconsin and winter in the Neotropics shows that most migrants winter in Central America. Smaller numbers of species winter in South America. Implications for conservation are discussed.

by Robin P. White

Each spring thousands of migrant birds arrive in Wisconsin to nest and raise young. They are here for a relatively short breeding season and are then on their way south again by late summer and early fall. Where do these migrants go?

Neotropical Avian Migrants

The term Neotropics refers to the zoogeographic region south of about 25 degrees north latitude (25°N) and includes both Central and South America. Wisconsin's Neotropical migrants are birds that breed in Wisconsin (the Nearctic region that includes the United States and Canada south to northern Mexico) but winter in the Neotropics.

Methods

As part of a study on wintering ranges of avian migrants, maps were made of the distributions of 244 species that breed in the Nearctic and winter in the Neotropics (White 1987). A grid of 5-degree latitude-longitude blocks was superimposed over Central and South America and marked for presence or absence of the wintering species using Fish and Wildlife Service data (Rappole et al. 1983) (Figure 1).

To determine wintering areas in Central and South America that are important to Wisconsin migrants, we separated Wisconsin breeding species from the list of all Neotropical migrants. Of the total 244 migrants, we considered 133 to be Wisconsin breeders (Table 1). Wintering ranges of these 133 species, mapped on the 5-degree grid, shows birds wintering from Mexico south to Tierra del Fuego. The majority of Wisconsin migrants, however, winter from central Mexico south to central Colombia and east to eastern Venezuela (Figure 2). Southern Mexico has the highest number of wintering species per degree block.

Figure 1. The grid of 5-degree blocks of latitude and longitude used to map the distributions of migrants in the Neotropics.

Wintering Distributions by Feeding Guilds

Water Feeders.—Of the 133 Wisconsin migrant species, 7 were classified as surface-water feeders (Table 1) and 8 were classified as diving feeders (Table 1). Species in these guilds feed most typically on plant or animal material on or beneath the water. These species winter mainly from 25°N south to southern Colombia (Figures 3 and 4). Only one surface-water feeder, the Blue-winged Teal, winters in northern Argentina, and there are no migrant diving feeders included in this study that winter south of the equator. Migration distance and presence of water bodies are probably important considerations in determining wintering locations for species in these guilds.

Small Shore Feeders.—Of the 133 Wisconsin migrant species, 9 were classified as small shore feeders—a guild characterized by feeding on mud flats and sandy shores (Table 1). Species in this guild winter throughout the Neotropical region, from Mexico south to Argentina and Chile, but they are found in the heaviest concentrations in Central America and along the coasts of Colombia, Ecuador and Peru (Figure 5). The use of coastlines close to the breeding grounds permits these migrants to reach their breeding grounds in early spring (Hutto 1985). Interior land areas provide the least amount of shoreline and support the lowest number of Wisconsin's migrant small shore feeders.

Aerial Water-Surface Feeders.—Of the 133 Wisconsin migrant species, 7 were classified as aerial water-surface feeders, including 3 gulls and 4 terns (Table 1). This guild is characterized by feeding over oceans and inland lakes on fish and small aquatic organisms. These 7 species winter in Central America and along the northern and northwestern coast of South America (Figure 6). As with the small shore feeder guild, these migrants are found along coastlines relatively close to the breeding grounds.

Salliers.—Of the 133 Wisconsin migrant species, 10 were classified as salliers (Table 1). This guild is characterized by sallying or what Fitzpatrick (1978) describes as "true flycatching" or "aerial hawking" and involves locating flying insects from a perch, snapping the prey from the air, and returning to the former perch or flying to a new perch to resume searching. Migrant salliers are found in heaviest concentrations in most of Central America, Colombia, Ecuador and northern Peru. There are no Wisconsin migrant salliers included in this study wintering beyond 25°S, or in east-

Table 1. Wisconsin's neotropical avian migrants arranged by group.

Species	Member of indicated group of migrants[1]										
	1	2	3	4	5	6	7	8	9	10	11
Eared Grebe		X								X	X
American White Pelican										X	X
American Bittern										X	
Black-crowned Night-Heron										X	
Great Blue Heron										X	
Wood Duck	X									X	
American Wigeon										X	X
Gadwall	X									X	
Green-winged Teal	X									X	
Pintail										X	X
Blue-winged Teal	X									X	
Northern Shoveler	X									X	
Canvasback		X								X	X
Redhead		X								X	
Ring-necked Duck		X								X	
Lesser Scaup		X								X	X
Hooded Merganser		X								X	
Red-breasted Merganser		X								X	
Ruddy Duck		X								X	
Osprey										X	X
Northern Harrier											
Sharp-shinned Hawk									X		
Cooper's Hawk									X		X
Broad-winged Hawk									X		
American Kestrel											
Merlin									X		X
Peregrine Falcon											X
Sandhill Crane										X	
King Rail			X							X	X
Virginia Rail			X							X	
Sora			X							X	
Semipalmated Plover			X							X	X
Killdeer			X							X	
Upland Sandpiper											
Lesser Yellowlegs			X							X	X
Spotted Sandpiper			X							X	
Wilson's Phalarope			X							X	X
Common Snipe			X							X	
Ring-billed Gull				X						X	
Herring Gull				X						X	
Bonaparte's Gull				X						X	
Black Tern				X						X	
Caspian Tern				X						X	
Common Tern				X						X	X
Forster's Tern				X						X	X
Mourning Dove											
Black-billed Cuckoo									X		
Yellow-billed Cuckoo									X		
Short-eared Owl											
Common Nighthawk											
Whip-poor-will									X		
Chimney Swift											
Ruby-throated Hummingbird									X		

continued

Table 1. (*Continued*)

Species	Member of indicated group of migrants[1]										
	1	2	3	4	5	6	7	8	9	10	11
Belted Kingfisher										X	
Yellow-bellied Sapsucker									X		
Eastern Phoebe					X						
Eastern Kingbird					X						
Western Kingbird					X						X
Great Crested Flycatcher					X				X		
Olive-sided Flycatcher					X				X		
Eastern Wood-Pewee					X				X		
Yellow-bellied Flycatcher					X				X		
Acadian Flycatcher					X				X		X
Least Flycatcher					X				X		
Traill's Flycatcher					X				X	X	
Tree Swallow										X	
Bank Swallow										X	
Barn Swallow										X	
Cliff Swallow										X	
Loggerhead Shrike											X
Cedar Waxwing							X		X		
Long-billed Marsh Wren										X	
House Wren									X		
Gray Catbird							X		X		
Veery							X		X		
Swainson's Thrush							X		X		
Hermit Thrush							X		X		
Wood Thrush							X		X		
American Robin							X		X		
Blue-gray Gnatcatcher						X			X		
Ruby-crowned Kinglet						X			X		
Lincoln's Sparrow								X			
Swamp Sparrow								X		X	
Savannah Sparrow								X			
Grasshopper Sparrow								X			
Chipping Sparrow								X			
Field Sparrow								X			
Vesper Sparrow								X			
Lark Sparrow								X			
Dickcissel								X			
Rose-breasted Grosbeak								X	X		
Indigo Bunting								X	X		
Scarlet Tanager							X		X		
Black-and-White Warbler						X			X		
Golden-winged Warbler						X			X	X	
Blue-winged Warbler						X			X		
Tennessee Warbler						X	X		X		X
Nashville Warbler						X			X	X	
Parula Warbler						X			X		
Yellow Warbler						X			X	X	
Chestnut-sided Warbler						X	X		X		
Cerulean Warbler						X			X		X
Pine Warbler						X			X		
Black-throated Green Warbler						X			X		
Blackburnian Warbler						X	X		X		
Magnolia Warbler						X			X	X	

continued

Table 1. (*Continued*)

Species	Member of indicated group of migrants[1]										
	1	2	3	4	5	6	7	8	9	10	11
Yellow-rumped Warbler						X	X		X		
Palm Warbler						X			X	X	
American Redstart						X			X	X	
Ovenbird						X			X		
Northern Waterthrush						X			X	X	
Louisiana Waterthrush						X			X	X	
Worm-eating Warbler						X			X		X
Prothonotary Warbler						X			X	X	
Common Yellowthroat						X				X	
Kentucky Warbler						X			X		X
Connecticut Warbler						X			X	X	X
Mourning Warbler						X			X	X	
Hooded Warbler						X			X		X
Wilson's Warbler						X			X		X
Canada Warbler						X			X	X	
Yellow-breasted Chat						X			X		X
Bell's Vireo						X			X		X
Solitary Vireo						X			X		
Yellow-throated Vireo						X			X		
Northern Oriole									X		
Orchard Oriole									X		
Yellow-headed Blackbird										X	
Western Meadowlark											
Brewer's Blackbird											
Brown-headed Cowbird											
Bobolink											
American Goldfinch								X			

[1]1 = surface-water feeders, 2 = diving water feeders, 3 = small shore feeders, 4 = aerial water-surface feeder,s 5 = salliers, 6 = small insectivores, 7 = small frugivores, 8 = small seedeaters, 9 = forest species, 10 = wetland species, 11 = rare species.

ern Brazil or southern South America (Figure 7).

Small Insectivores.—Of the 133 Wisconsin migrant species, 30 were classified as small insectivores (Table 1). This guild is characterized by picking or gleaning insects from vegetation and other surfaces. Migrants in this feeding guild are most numerous in Central America and are absent in eastern Brazil and southern South America (Figure 8).

Small Frugivores.—Of the 133 Wisconsin migrant species, 12 were classified as small frugivores (Table 1). The species included in this guild are predominantly fruit-eaters, but their diets probably include other food items on both the breeding and wintering grounds. Wisconsin's migrant frugivores winter most commonly in Central America and are absent in areas south of Paraguay (Figure 9).

Small Seedeaters.—Of the 133 Wisconsin migrant species, 12 were classified as small seedeaters (Table 1). Species in this guild generally forage on the ground using their short-thick bills to crack seeds. Wisconsin's migrant seedeaters are found in heaviest concentrations in northern Mexico and are least numerous in northern South

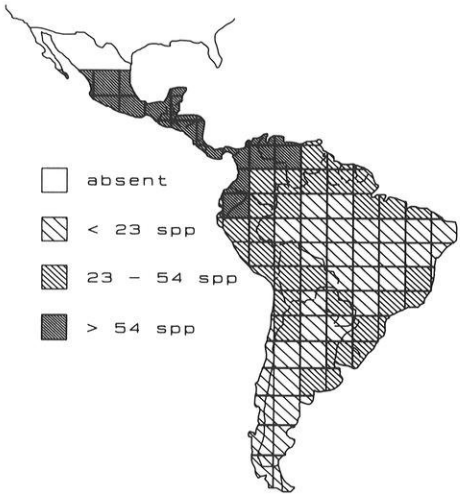

Figure 2. Winter distribution in the Neotropics of species that breed in Wisconsin.

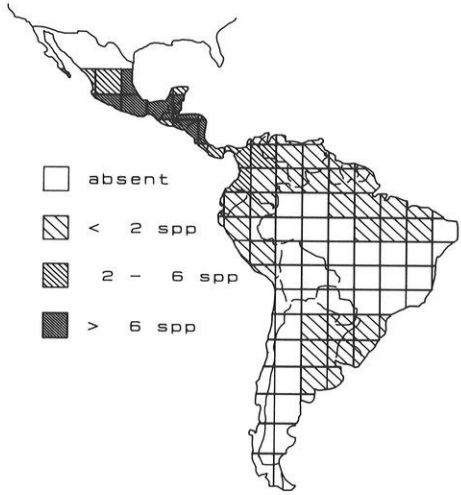

Figure 3. Winter distribution in the Neotropics of surface-water feeders that breed in Wisconsin.

America. No migrant seedeaters included in this study winter south of 5°S (Figure 10).

Wintering Distributions by Habitat

Forest.—Of the 133 Wisconsin migrant species, 59 were classified as species that use forest habitat (Table 1). Their winter distribution is shown in Figure 11.

Wetland.—Of the 133 Wisconsin migrant species, 60 were classified as species that use wetland habitat (Table 1). Their winter distribution is shown in Figure 12.

Wintering Distribution of Rare Species

Of the 133 Wisconsin migrant species, 28 are considered rare (Wisconsin Department of Natural Resources, Bureau of Endangered Species; Barger et al. 1988; Temple and Cary 1988) (Table 1). The rare species winter throughout Central and South America but are found most commonly in southern Mexico and northern South America. The

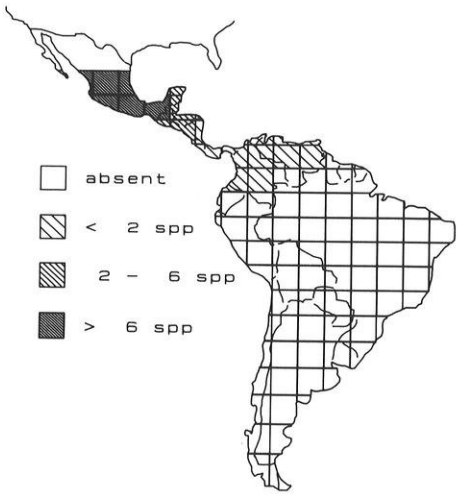

Figure 4. Winter distribution in the Neotropics of diving birds that breed in Wisconsin.

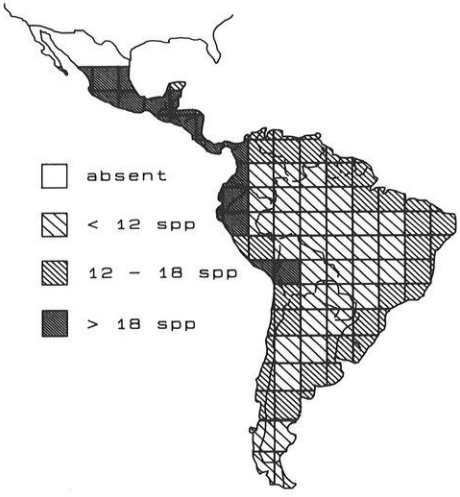

Figure 5. Winter distribution in the Neotropics of small shore feeders that breed in Wisconsin.

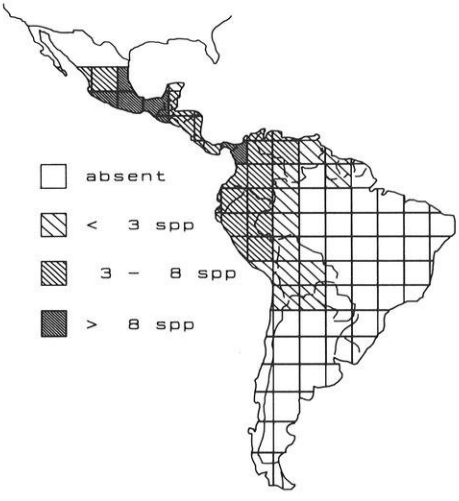

Figure 7. Winter distribution in the Neotropics of salliers that breed in Wisconsin.

maximum number of these rare species per degree block is found in southern Mexico (Figure 13).

Wintering Distributions of Individual Species

Although most of the species that breed in Wisconsin winter in southern

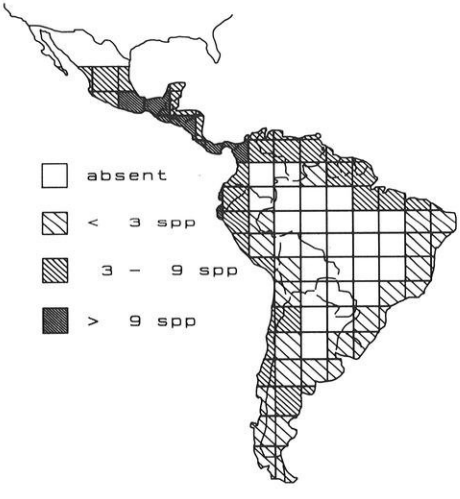

Figure 6. Winter distribution in the Neotropics of aerial water-surface feeders that breed in Wisconsin.

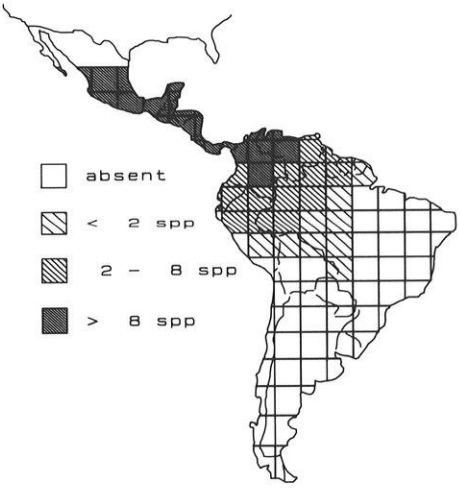

Figure 8. Winter distribution in the Neotropics of small insectivores that breed in Wisconsin.

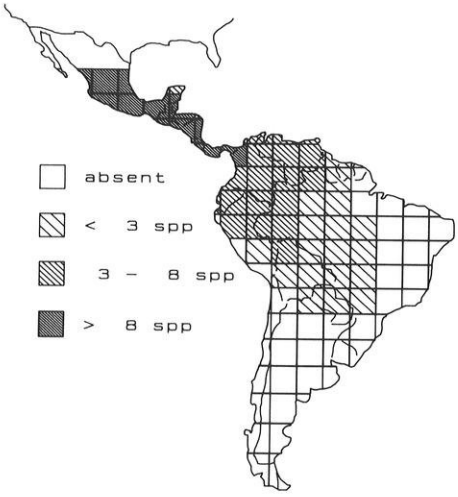

Figure 9. Winter distribution in the Neotropics of small frugivores that breed in Wisconsin.

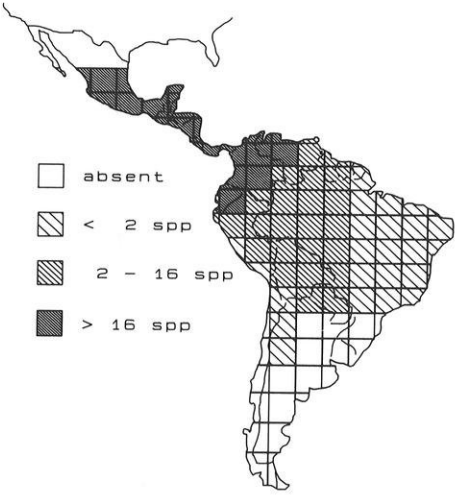

Figure 11. Winter distribution in the Neotropics of forest-dwelling birds that breed in Wisconsin.

Mexico, some species do winter farther south. The wintering range maps of four species—Least Flycatcher, American Redstart, Veery, and Upland Sandpiper—illustrate a progression of wintering distributions of individual species from the northern Neotropics in Mexico to the southern Neotropics as far south as the pampas of Argentina (Figures 14–17).

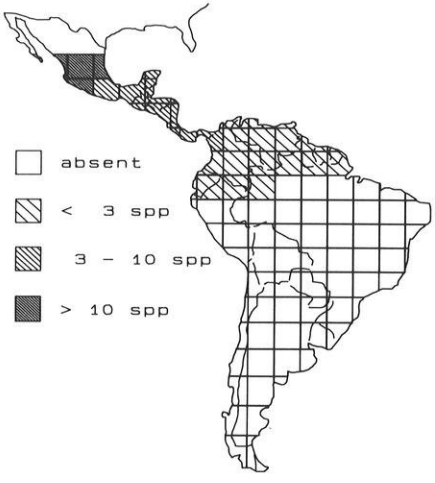

Figure 10. Winter distribution in the Neotropics of small seedeaters that breed in Wisconsin.

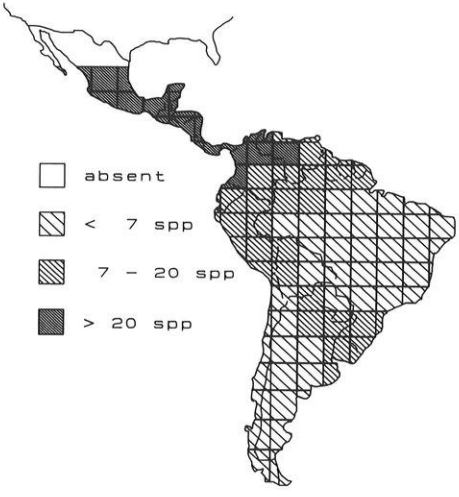

Figure 12. Winter distribution in the Neotropics of wetland-dwelling birds that breed in Wisconsin.

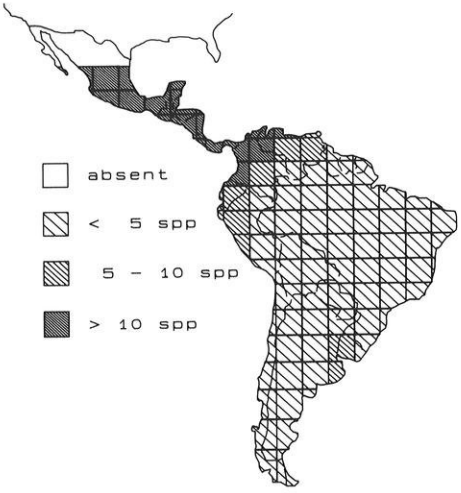

Figure 13. Winter distribution in the Neotropics of rare species that breed in Wisconsin.

Figure 15. Winter distribution in the Neotropics of the American Redstart.

Least Flycatcher.—The Least Flycatcher is a sallier that feeds on flying insects. This bird uses forest and shrub habitats in southern Mexico south to northern Colombia (Figure 14). It winters relatively close to its breeding grounds and well north of the peak occurrence of resident flycatchers found in western Amazonia.

American Redstart.—The American

Figure 14. Winter distribution in the Neotropics of the Least Flycatcher.

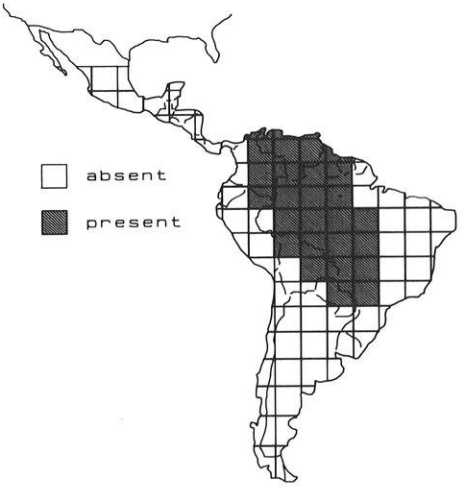

Figure 16. Winter distribution in the Neotropics of the Veery.

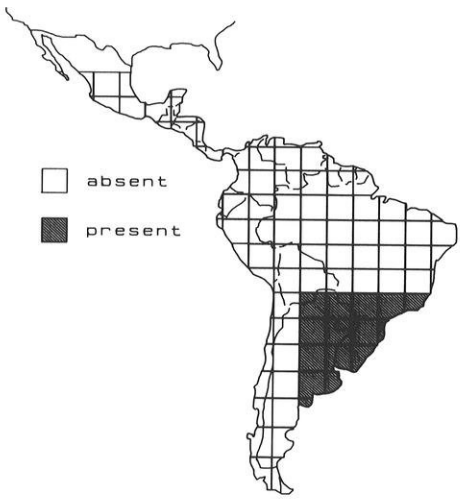

Figure 17. Winter distribution in the Neotropics of the Upland Sandpiper.

Redstart is a small insectivore that picks or gleans insects from vegetation. This species winters from southern Mexico south to northern Paraguay and east to Surinam (Figure 15). In this more extensive wintering range, the American Restart winters where there is forest habitat within a relatively short migration distance from its breeding grounds. Although the wintering range of the American Redstart overlaps somewhat with the highest density of resident species in this feeding guild in the Amazon Basin, much of the American Redstart's wintering range is farther north.

Veery.—The Veery is a small frugivore that may feed on insects as well as fruit on its wintering grounds, and it is found wintering wholly within South America (Figure 16). The Veery's wintering range overlaps with the peak numbers of resident species in this feeding guild. Several studies (Leck 1972, Willis 1980) suggest that competitive interactions between migrants and residents in this guild are not strong and that the two groups have established seperate niches, exploiting different types and sizes of fruit.

Upland Sandpiper.—The Upland Sandpiper feeds mainly on insects and is an upland species that uses open short-grass landscapes (White 1983). This sandpiper winters on the pampas of Argentina and most likely on the grasslands of both Bolivia and southern Brazil (White 1988). Unlike the forest and shrub habitats used by the preceding 3 species, the Upland Sandpiper winters on grasslands that are of limited occurrence in Central America or northern South America (Figure 17).

Conservation of Wisconsin's Neotropical Migrants

Birdwatchers, in Wisconsin as well as other parts of the Nearctic region, have expressed concern about population declines of Neotropical migrants (Greenwood 1990). These declines have been blamed on habitat alterations on both the wintering and breeding grounds (Keast and Morton 1980; Hutto 1988, 1989; Morton and Greenberg 1989). An important preliminary step to investigating the reasons for the declines is to find out where the migrants are spending their time, both on the breeding and wintering grounds.

This paper has reviewed where Wisconsin's Neotropical migrants spend their winters. Results show that wintering areas most important to Wisconsin migrant species are in Central America, from southern Mexico south to Northern Colombia. In terms of conservation practices, this pattern suggests that when we search for explanations for declining numbers of Wisconsin's Neo-

tropical migrants, we must investigate environmental changes in Wisconsin and Central America or the northern Neotropical region rather than changes in the central part of the Neotropics, such as forest clearing in Brazil. Causes for population declines are related most likely to environmental changes in both Wisconsin and the northern Neotropics and require us to look carefully at any major alteration of habitat used by the migrants in these areas.

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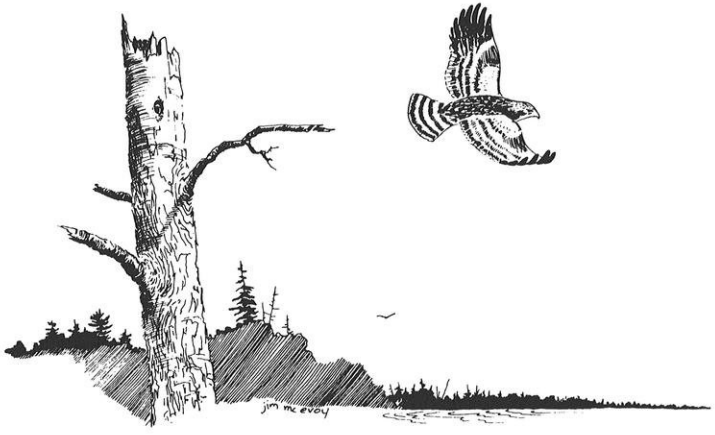
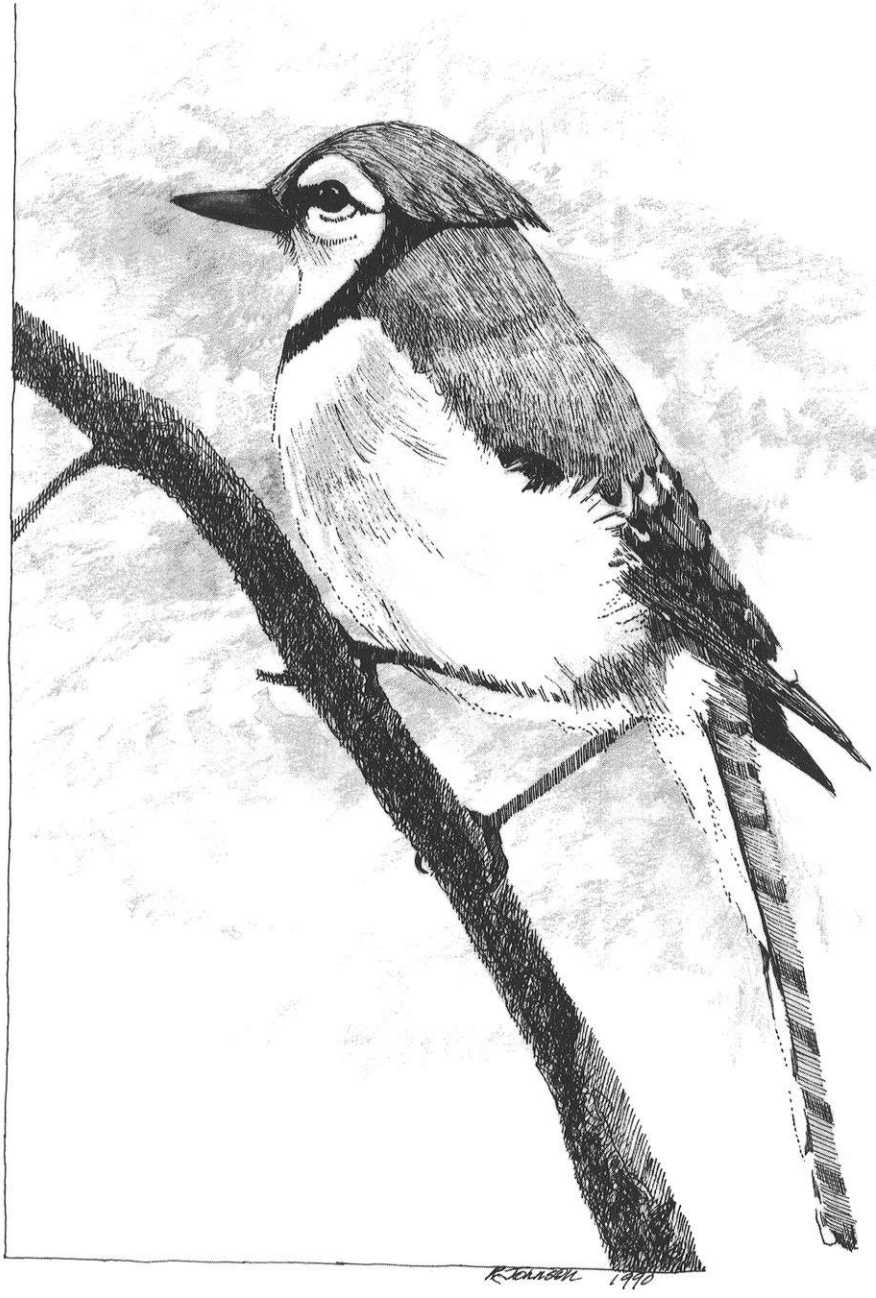


Red-shouldered Hawk *by Jim McEvoy*



Blue Jay *by Robbye Johnson*

Francis Zirrer: Unheralded Naturalist of the North Woods (Part 2)

by Sumner W. Matteson

This is the second in a 3-part series (Matteson 1990) on Austrian-born naturalist Francis Zirrer and his observations of birds, other wildlife, and plants in northwestern Wisconsin, mainly during the years 1934–1949.

One of the most unusual birds Zirrer claimed to have seen in northwestern Wisconsin was the Black Rail, a southern bird still not confirmed as occurring in the state. Kumlien and Hollister (1903) reported one record for Lake Koshkonong in 1877. Zirrer's observation, presumably credible but certainly unusual in fall in northwestern Rusk County, is worth quoting in full from a letter to A.W. Schorger on 4 October 1935:

> "September 23 I made a trip to a cranberry marsh a few miles distant to see about some berries and at the same time ascertain if there are any *Gentiana* [gentian] growing in this neighborhood. I was disappointed in this, but I found a few other interesting plants; my first *Linnaea* [*borealis* twinflower] in this locality and a few *Spiranthes* [ladies' tresses]. I was in a hurry as the distance is considerable and I wanted to be on the road before dark. . . . About three miles from here I had to pass a secluded woodland marsh, stretched for about one mile on both sides of a small creek, which flows in a narrow valley lined on the east and west side with hills of considerable height and steepness, emptying finally into a small lake. At this time of the season the marsh is wet or flooded in a few places only, indicated by a dense growth of *Carex* [sedge], *Scirpus* [bulrush], *Phragmites* [reed grass], *Juncus* [rush], *Typha* [cattail], etc; higher parts are dry, but densely overgrown with *Eupatorium, Aster, Solidago* [goldenrod], *Urtica dioica* [stinging nettle], *Helianthus* [sunflower], *Rudbeckia* [coneflower], interwoven in places with a species of *Galium* [bedstraw] in such a way that it is almost impossible to get through. . . . The marsh is never grazed and no haying is done as is the case with so many other marshes nearer the roads and farms. That the marsh was not burned over for many years is indicated by a comparative abundance of *Habenaria psycodes* [small purple fringed orchid] and a few other rarer plants.
>
> "It was about 5 p.m., the sun disappeared beyond the western hills and it began to grow dark in the bottom of the valley. Here and there a bird flew up, but I hustled to get out of the dense vegetation and to the road before it got

too dark. Suddenly a bird rose in front of me— small, dark, with dangling legs and short fluttering wings— flew almost vertically to about 5 or 6 feet high and descending disappeared into the thicket some 10–12 feet away. All my effort to flush it again, failed! As I said I was not after the birds and did not expect anything unusual, least of all a Black Rail. I am positive of this, in fact, I do not know with what other species a person could confuse it. I do not know the present status of the bird in Wisconsin. You, in your work do not mention it. Kumlien and Hollister . . . do not include it in their list . . . and . . . hope that it would be found in Wisconsin some day. . . . Bearing all this in mind, I never expected that bird this far north. At any rate, next year I shall watch that marsh very closely."

Zirrer's description, though intriguing, is insufficient to confirm a Black Rail sighting in northwestern Wisconsin. In his 1951 revision of Kumlien and Hollister's work, Schorger did mention several other observations by Zirrer but not this one, so it would appear that he did not accept Zirrer's Black Rail sighting as valid. There is no evidence of correspondence between Zirrer and Schorger for the year 1936 or most of 1937. Two years of no correspondence between the two men? Did Schorger for some reason not choose or forget to submit letters from this period? In any event, when letters resumed on 12 November 1937, Zirrer wrote: "It might interest you that I have seen a Black Rail again!" He provided no further information. This was his last reference to the bird.

Among Zirrer's relatively few publications was his description of the habits and habitat of the Pileated Woodpecker in the deep woods of northwestern Rusk County during the 1930s (Zirrer 1952):

"In autumn and early spring, when the sound rings far through the leafless upland woods, the insects are dormant and other food rather scarce, these big woodpeckers appear to be at the peak of their hammering activity. Their greatest activity, however, accentuated undoubtedly by the mating urge, they display the first few weeks in spring. Then we saw them flying with powerful jerky leaps across our little clearing and from one tree to another. Amazed, we watched them splitting big chunks of decaying wood from old hardwood trees, peeling large slabs of bark from dead conifers and drilling deep holes into rotting maple stumps. . . . Their most conspicuous work, however, the excavating of numerous cavities in dead and dying trees and old stumps, is done mostly when deep snow covers the ground. The food obtained through this activity is practically their only sustenance during the winter months. . . . During the summer months when food—insects, especially ants, and wild fruit—is plentiful, they rarely betray their presence with loud, noisy hammering; similarly to flickers they obtain much food on the ground."

Zirrer (1952) reported that Pileated Woodpeckers "disappeared from the neighborhood some time in November and appeared again, suddenly, with the first softening of the snow (end of March or in the beginning of April), announcing its arrival with many loud, ringing calls and much hammering. . . . Then we also heard its loud, somewhat slow, measured drumming, which reminded us of the sound produced by the big wooden rattle in a church steeple on Good Friday."

Zirrer's winter observations of the Pileated provide an interesting comment on the bird's opportunistic food habits:

"On my many trips through the woods to the rural mailbox, several miles away,

and to the distant spring for drinking water, I have not seen or heard the bird all winter. But judging by what I saw on an occasional trip to the farming country and heard from farmers, these birds, then, often appeared near farms and came into the barnyards, especially in those near woods. But I also saw these birds near farms in the well cultivated Barron County where the woods were few and far between. On farms these birds fed on the heads of domestic animals, intestines, scraps of meat and tallow, which the farmers, when slaughtering, usually threw away. These birds, forsaking their native timber for the winter, had evidently learned that near farms abundant food may be had for the taking."

Zirrer (1941) also studied habitat use and feeding behavior in the Pine Grosbeak. His observations are noteworthy:

"Upon their arrival, which usually falls in the end of October or the first part of November, they show a decided preference for the buds of maple. Sumac, no matter how plentiful, is almost entirely ignored. The writer recalls one winter only, when the immature males predominated, that sumac was taken before the end of the year. After the beginning of the new year the feeding is reversed, buds are almost completely ignored and sumac eagerly taken. This year [1941], however, they are seen feeding on the ground, although they are not ground-frequenting birds at all, jumping and running around in the tall stalks of *Chenopodium* [lamb's quarters] and *Amaranthus* [pigweed]. In fact, so much so, that in order to see them, one must visit woodland fields overgrown with these weeds. Perhaps this is due to the scarcity of other food and also the almost complete lack of snow during November this year."

In a 24 December 1937 letter to Schorger, Zirrer complained about the condition of the forest and the effects of logging on the Pine Grosbeak. He also worried that the persistent drought of the mid-30s was taking its toll:

"Since Dec. 15, Pine Grosbeaks have become much less numerous; yesterday I saw one adult male only. Our neighborhood is not very favorable to these birds, owing to the complete absence of coniferous forests and comparative scarcity of such trees. Due to the drought, nearly all of our *A. balsamea* [balsam fir] are dead; *P. canadensis* [early scientific name for white spruce], *P. resinosa* [red pine] and *Tsuga* [*canadensis* eastern hemlock] are very rare (Until a few years ago, there was a nice stand of virgin timber of a few acres, four miles east of here, where the *Tsuga* in fine specimens predominated. But to the bright minds of the Conservation Commission and Rusk County authorities this little speck of original flora was an eyesore and had to go.) *P. banksiana* [jack pine] and *Thuja* [*occidentalis* northern white cedar] are nonexistent; sphagnum bogs are limited in numbers and area, so *P. mariana* [black spruce] and *Larix* [*laricina* tamarack] are none too plentiful. . . .

"The only coniferous tree of any abundance is *P. strobus* [white pine], found in scattered specimens throughout the woodlands. So our [Pine Grosbeaks] have to depend on the buds and seed of leaf-trees. Upon their arrival last fall they fed almost exclusively on the seed of *Betula lutea* [yellow birch], but since most of our numerous yellow birches are dying (due to the drought) and only a few produced any seed, this did not last long. The birds are now feeding mainly on the maple buds. . . ."

Schorger was intrigued by these observations of the Pine Grosbeak's food habits. He asked for more information. Zirrer responded on 16 January 1938:

"They feed usually at a considerable height (60–80 feet), but before snow

were occasionally seen on the ground. . . . I have seen these birds feeding on small maples (about 30 feet) grown in a thicket of *Rhus* [*typhina* staghorn sumac], when only a few feet lower were hundred or more of the most temptingly looking clusters of [sumac] seed. . . . That I have seen them taking maple buds only, it is probably just coincidence, due to the fact that nine-tenths of trees in our vicinity are maples; [*Acer*[*saccharum* [sugar maple] predominating; [*Acer*] *rubrum* [red maple] reasonably abundant; with a sprinkling of [*Acer*] *spicatum* [mountain maple]. . . . Late in Jan. and in Feb., I have seen them feeding almost exclusively on *Rhus*, hanging onto a single cluster for many minutes at a time, permitting such close approach, that with a broom or some similar weapon I could have knocked one or the other down. . . .

". . . . [And yet] *Rhus* seed is apparently not relished; clusters remain on the branches well into spring. The only other bird occasionally seen pounding on them is the Hairy Woodpecker, although it is possible that some birds, esp. the *Bonasa* [Ruffed Grouse], pick the seed from the ground."

In this same letter, Zirrer discussed the foods of spring and fall migrants and winter residents in his northwestern Rusk County locale:

"A very important item [in the diet of] our seed-eating birds during the fall and spring migration is the seed of different species of *Polygonum* [smartweeds]. . . . During the spring migration our insect eaters, esp. the ground birds, feed extensively on the larva of certain species of Diptera, presumably of the family Bibionidae [march flies], Sciaridae [dark-winged fungus gnats], or Mycetophilidae [fungus gnats], and which live in such enormous numbers in woodland soil and decaying vegetable matter, that in a single very small puddle of melted snow water a good handful can be seen, washed together. Another item relished by our Robins and Thrushes are the double berries of *Mitchella repens* [partridgeberry]. Around every one of these little evergreens the leaves are scratched away and berries eaten. I am inclined to believe that this is very beneficial to the little plant, which would otherwise have probably remained buried under the weight of leaves, pressed down by the heavy snows."

In his 16 January 1938 letter, Zirrer also commented on the epicurean tastes of birds at his feeders:

"As to the sense of taste among birds, I have noticed that our regular winter residents, Bluejays, Hairy and Downy Woodpeckers, White-breasted Nuthatches and Chickadees have it quite well developed. Mashed potatoes are eaten in the following order: prepared with plenty of butter and milk go first; next are those with plenty of suet, and finally those just mashed without any fat. . . . With good mashed potatoes I am able to attract several species of warblers during their spring and fall migrations. To be sure, they do not come as readily or abundantly as our winter birds; however, when one of them has tasted it, it invariably returns, often every few minutes. The most abundant visitor of this tribe is the Myrtle [Yellow-rumped] Warbler, esp. during its fall migration. It is quite pugnacious, chasing away every small bird, even the nuthatch. Two other common boarders last year were the Baltimore [Northern] Oriole and Scarlet Tanager."

In field notes summarized for the *Passenger Pigeon*, Feeney (1942) added this:

"On the brink of a narrow peninsula stretching into a marsh, not far from a grove of tamarack and black spruce, and about one-hundred feet from the build-

ings is one of Frank Zirrer's feeding tables. At this place [the bog site in Sawyer County] he observed that a Marsh Hawk [Northern Harrier] ate a variety of unusual foods including bread, boiled rice and potatoes when the ground was covered with snow and other food hard to find. At another table when feed was plentiful, Zirrer noted a Hairy Woodpecker watching and robbing the caches of a Red-breasted Nuthatch as soon as the latter had deposited food in the crevices of trees and posts."

Pileated Woodpeckers sometimes visited a Zirrer feeder when they returned in early spring:

> "Attracted by the wintering birds around our cabin it [came] to our feeding tray and nearly wrecked it while trying to break off some of the hard tallow, which was, when melted, poured over the board." (Zirrer 1952)

One species that intrigued Zirrer was the Turkey Vulture. Its status and distribution were little known in Wisconsin in the mid-1930s. Although now fairly common in the state, this species was then a comparative rarity, and nesting was not confirmed until 1948 (Mossman 1990). Zirrer described his first observation of the bird in a 10 June 1935 letter to Schorger:

> ". . . August 2 [1934] at 4:30 p.m. I went for water at the spring situated nearly 3/4 of a mile from the house [in northwestern Rusk County] and 1/4 of a mile from the road in a small valley or a ravine. The bottom of the ravine was lying in semidarkness due partly to the dense foliage of the trees, which at that point are about 60 feet high, and partly by the shade thrown by the ridge on the west side of it. . . . A few yards from the spring stands a yellow birch stump about 15 feet high encircled everywhere by the higher trees, so that it forms a comparatively narrow opening above the stump. Without looking around much, as I was in a hurry to get the water . . . all of a sudden a large dark bird arose right in front of me from that stump, working itself with considerable difficulty from the narrow surroundings of trees and dense foliage to above the top of the trees. This all was the work of a few seconds and not much time to look, but when the bird gained the open space above the trees, its large dark form, long wings and red-colored head were plainly visible. . . . Last year drought was the worst; for miles around every creek or spring was dry, excepting this one. Considerable number of frogs accumulated around the last remaining waters and I presume that the bird was looking for a meal. . . . I presume that at times they are forced to hunt for something alive, as the carrion is not always obtainable."

It is possible that Zirrer had actually disturbed this bird from its nest. In Wisconsin the species occasionally nests in large hollow stumps similar in height to the one described here, and nestlings probably would still be present in early August (Mossman 1990).

Other interesting observations by Zirrer involved the "natural" nesting of Chimney Swifts and Purple Martins. On 10 June 1935, he wrote to Schorger:

> "It might interest you that [Purple Martins] occasionally still nest in hollow trees, away from the haunts of man; at least this was or still is the case a few miles from here [in northwestern Rusk County]. This, only on a much larger scale, holds good for [Chimney Swifts]. These birds sometimes meet death by coming down the stove pipes and burn[ing]. I saved them on several occasions and pulled once one's charred body from our stove. This lasted until I capped the entrance with wire. Last year two or three females fought for the pos-

session of one nest, all sitting and laying, with the result that a number of eggs were thrown out and broken, until one predominated and hatched the brood. Doesn't this appear as a polygamy of swifts?"

Then, apparently in response to Schorger's inquiry about the nesting swifts, Zirrer said in a 29 July 1935 letter:

"My remarks about the swifts some time ago appeared somewhat vague. I want to correct this insofar that of three birds fighting for the possession of the nest one probably was a male. That there were more than one female is proved by the fact that in two or three days the nest contained four or five eggs, which were repeatedly thrown out and broken, until finally one bird predominated and raised the brood. The nest in question is built and occupied for a number of years already, in a most ridiculous place. The building is a country style toilet, used probably twice or thrice daily. Under the roof, which is only about 6 feet above the ground, are cut 2 small holes for ventilation. The door is always closed, so the birds enter through those holes.

"Instead of building the nest right under the roof as a person would expect, they insist to build the nest only about a foot above the board and within six inches of the party who happens to use the toilet. Sometimes they use the same nest; sometimes they build a new one a few inches higher or lower. Before the nesting commences, the old birds roost, hanging on the wall above the nest every night. Later the young ones do the same. Mr. Gromme, when here, saw the nest and tried to photograph the old birds at night with the help of the flashlight and long exposure, but apparently without a good result.

"It might interest you that the swift often [builds a nest] inside . . . a barn or hayloft . . . but are generally not observed. I have seen a number of nests built this way, since I [have been] living in [northwestern Wisconsin]. It might also interest you that the bird builds a nest about the size of a teaspoon, deposits an egg, enlarges the nest a little next day, and deposits another egg and so on until the nest and set is completed. I have seen this on several occasions."

Here was information on the process of nest-building by Chimney Swifts not previously recorded in Wisconsin. It points up Zirrer's special attention to detail in his observations.

It is not clear whether Schorger ever visited Zirrer at his Rusk County home. Zirrer repeatedly invited him, and Schorger occasionally expressed an interest in coming. At the end of Zirrer's 1 July 1939 letter, he wrote:

"In your letter of Sept. 16— 1938 you spoke of coming up here this year, if time permits. If you do and care to rough it a little, there is a nice, level spot right here for camping, and the rest can be arranged easily. We are somewhat crowded and live in very primitive fashion, but the woods are almost within arms reach. You can hear the birds singing you to sleep, owls [in] concert at night, and plenty of music at dawn. I shall do my best to make you comfortable, provided you are satisfied with what we have to offer."

Over two years elapsed before Zirrer's next known letter to Schorger. Zirrer had moved in 1940 to a cabin in northwestern Sawyer County. This was unknown to Schorger, who had sent Zirrer a copy of his latest publication. Zirrer responded on 24 August 1941 with an 8-page letter that provides a window into the bird life of what today is part of the 160-acre Kissick Alkaline Bog Lake State Natural Area (formerly designated a state Scientific Area).

"Thank you sincerely for your newest publication which I received yesterday. Birchwood P.O. notified me more than a week ago, but after I sent the required postage it took them more than a week before they sent it here.

"I regret that I did not notify you of the change [of] address and so much more as I feel greatly indebted to you. . . .

"We live now in Sawyer County, about 3 miles west of Hayward and about half of a mile from the Washburn County line. The dwelling is some 30 rods from the town road, situated at the very brink— and only 5 feet above the water level—of [a] very extensive tamarack, black spruce, and cedar bog, our end of which is taken in by a small pond of some 30–40 acres, surrounded on all sides by low, wooded hills.

"The rear of the small building is shaded by a dense growth of tamarack and black spruce; ground underneath is overgrown with deep cushions of sphagnum and thickets of leatherleaf, Labrador tea, swamp laurel, swamp rosemary, blueberries, and a little further toward the pond where the treeless bog begins, with cranberries and other characteristic bog flora. The open sphagnum forms a narrow belt of various width around the pond (which is no more than 50–60 yards from the dwelling). . . .

"Owing to the soft bottom, water is devoid of vegetation; at a few places only, one sees lily leaves and blossom[s] floating on the surface; on the whole, [the] ground is too soft to give plants good, safe anchorage; when windy and [the] surface [is] greatly disturbed, one sees uprooted plants with their thick roots drifting back and forth. Muskrats carry the leaves away and porcupines sit for hours at a time on the end of some snag chewing the leaves and the roots. Still, the water is too deep, even near the shores, to permit the surface-feeding ducks to procure their food in any other way but by diving; only at both ends of the pond, on a very limited space, they can obtain it by tipping.

"Excepting the mudminnows, the pond contains no fish. There are, however, very many good-sized turtles. According to the neighbors some are as big as a bushel basket, but the largest I have seen so far was about a foot in length. . . . Often one end of the bog is occupied by different species of ducks . . . a bittern watches occasionally the water from an elevated perch, and if everything is real quiet, and one is patient and lucky, a glimpse of [a] sora or Virginia rail can be had. (Walking on the shore through the narrow belt of sedges and other weeds, one can raise one or the other of the two rails.). . . . During the breeding season redwings were extremely abundant. . . . Different species of swallows, swifts, cedar waxwings, and nighthawks were abundant and some still are. They dart, especially toward the evening, over the placid, sunlit waters. Even the black tern, with its stream-lined body and long, narrow wings visited us daily for several weeks. Needless to say that practically every land bird that I know from N. Wisconsin, and a number of water birds, is often or occasionally seen in, or in the vicinity of, our bog or pond; at times their abundance is astounding.

"In the afternoon of June 19 after a week of almost continuous rain, a male Connecticut warbler was observed in a small oak tree a few feet from one of our windows. The bird was busy picking and carrying away small green caterpillars. It even sang a little! June 28 another was seen in the tamarack bog about half of a mile from here. . . . I mentioned it to Gromme in a letter, and he informed me that it is perfectly well possible [that it is] breeding here because they had found it breeding at about the same time in the Burnett County.

"In the same letter [to Gromme] I mentioned among other birds the palm warbler as breeding here, and he thinks that it might be another new record. [In

a 12 March 1942 letter to Schorger, Zirrer stated: "I think the Connecticut Warbler breeds sporadically in N.W. and is nowhere abundant. . . . The same I presume is the case with the Palm Warbler."] I had not paid much attention to it thinking that it is one of the regular breeders in N. Wisc. I am sorry now because a pair nested here, barely 50–60 yards from the dwelling although I did not see the nest. Watching wild ducks on the pond, I saw and disturbed the bird daily for quite a while, but thinking it [was] nothing unusual I failed to investigate. . . . In the evening [of] July 5, I noticed the whole family feeding in small tamaracks a few yards from the house, calling incessantly 'zit, zit, zit'. . . . If it had not been for the parent birds I would have been unable to identify them, for the young birds look very much like some sort of sparrow, excepting for the longer and thinner bills. At the time they were moving in the direction of the nesting site, coming closer to it, and seeing me following the whole family started to fly around me, chirping excitedly. From this I concluded that they roost near the nesting site, at least for a number of nights after they leave the nest. This happened again until after July 12 when they disappeared from the vicinity. . . ."

Zirrer referred again to the nesting of Connecticut and Palm warblers, as well as the "myrtle warbler" [Yellow-rumped Warbler], in a 5 August 1942 letter to Schorger:

"I had planned to explore the bog this year as much as possible, especially for orchids and our rarer species of warblers, but since this was not so easy to do, the birds were considerate, and presented themselves right at our swamp and woodland home. The first, about 3 weeks ago, was the myrtle warbler with its family. Although suspecting their breeding here last year already I was not absolutely sure until now. The young just off the nest look in the dim light of the swamp evergreens very much like some sort of sparrow, and similar to the young of the palm warbler. However, the yellow rump, and the motionless tail distinguish them from the lat[t]er bird. . . . They seem to be infested with vermin, perhaps Mallophaga [chewing lice], for while waiting for the parents to be fed, they pick their feathers continually and with great vigor. . . .

"Next came a family of Connecticut warblers; for several hours they remained within . . . sight of the shanty, part of the time not more than 2 to 3 yards away. . . .They and the others are very keen on raspberries which are ripening along the border of the swamp now. . . . And now for about 2 weeks we have [had] a number of palm warblers around. They must have been just out of the nest, for there was an endless calling, a flutter back and forth and steady going of the tails. . . . The young resemble the myrtle warbler of the same age, but are considerably darker and much more heavily spotted and streaked. There can be no mistake, however; young or old; their tails move steadily. Last year our friend Gromme promised to come and have a look at them. He certainly is missing something! Even for myself I had never dreamed of ever seeing all these birds, and many more— warblers and others— from our windows. It will be all over shortly, for when the birds begin to move one does not know which were locally bred. If it were not so late already and the distance so far I should like to say: Come up over the week-end or for a few days, and convince yourself!"

Zirrer was also lucky enough to document a rare occurrence of the western race of Yellow-rumped Warbler, known as "Audubon's" Warbler. He described the sighting in a 10 June 1943 letter to Schorger:

"May 3 at 7 in the morning I was in the nearby bog. It was cold; temperature was 26 above and the sphagnum cracked like glass under my feet. Coming to a small pond, no larger than a 6-room house, I noticed a small grayish-looking bird with much white on the wing walking on the half submerged logs and on the mud along the pond. . . . When . . . the bird turned displaying a yellow rump I thought that it was perhaps an abnormally colored Myrtle Warbler but with more white on the wings than usual. . . . Finally, after many attempts to obtain a good view of it, the bird turned toward me, the sun shone brightly on its breast—and then I almost collapsed: there was a yellow throat and I could also see the yellow on the upper flanks, larger and rounder than in the Myrtle it had seemed to me. Still I did not believe it; I watched for another opportunity but when I saw it again and again I could doubt no longer: It was the Audubon Warbler."

Much of this letter appeared as a note titled "An Audubon Warbler in Wisconsin" in the October 1943 issue of the *Passenger Pigeon*.

Zirrer's findings for "Myrtle" Warbler, Palm Warbler, Connecticut Warbler, and "Audubon's" Warbler are noted in Schorger's (1951) revisions to Kumlien and Hollister's book.

Zirrer delighted in learning the identity of nocturnal birds. In a 24 August 1941 letter to Schorger he wrote:

"Last spring I heard another call that puzzled me for a number of weeks. Snow was still plentiful and bogs were flooded. For a number of evenings I stood at the edge of the bog and listened to a call resembling a distant, subdued barking of a heavy dog. One evening, in order to bring the mysterious caller closer if possible, I started to imitate it. Doing this for a while the calling ceased, but I kept on calling. Everything remained quiet, however, and I was just about ready to quit and go home, when all of a sudden something—not over 30 feet away—burst into a weird, maniacal laugh 'heh, heh, heh.' This was followed by a sound very much like teeth chattering, and finally like a violent shaking of a heavy, wet garment. The whole performance was repeated several times in succession, and then everything remained quiet. It was pitch dark among the conifers and I could not see a thing. Several weeks later, however, I learned to know the actor—the long-eared owl. . . ."

Zirrer took equal delight in investigating the flora of the conifer bog adjacent to his cabin. Orchids were exquisite finds for him and he became immersed in identifying each species as if each was a new personal discovery:

"Our neighborhood is also very interesting botanically. Orchids are extremely plentiful and so far I have observed 17 species, among them such choice beauties as 3 species of *Cypripedium* [lady-slippers], *Arethusa* [*bulbosa* dragon's mouth], *Calopogon* [*pulchellus* grass pink], and *Pogonia* [*ophioglossoides* rose pogonia]. [On] June 12 I was lucky enough to find the *Orchis rotundifolia* [small round-leaved orchis], so far known only from the Ozaukee, Sheboygan and Door counties. When orchids bloom the whole bog is transformed into a most wonderful wild garden, and these choice varieties bloom literally by the thousands." (Letter to Schorger, 24 August 1941)

Forty summers later, botanist Steve Solheim (1981) visited the Kissick Alkaline Bog Lake. He compiled an impressive list of plant species, including 16 orchids. About *Orchis rotundifolia*, although he was unaware of Zirrer's report, he said: "This bog may well be the historical site for the threatened *Orchis rotundifolia* collected in 'a bog near Hayward' in 1941. This appears to be the only suitable site in the area,

but the plant has not been observed, and is thus extirpated if this was the collection site."

Zirrer made no mention of actually collecting this rare orchid in his letters to Schorger. But files in the WDNR's Bureau of Endangered Resources show that Zirrer collected the plant on 10 June 1941 and sent it to the Milwaukee Public Museum. It is difficult to speculate whether Zirrer's collection activities or a specific environmental condition or event imperiled this particular species in the 40 years between Zirrer's observation and Solheim's visit. A clue may be found in Zirrer's 5 August 1945 correspondence to Schorger in which he writes: "The bog, not being protected with snow as usual, froze to a depth of many inches. This in turn had had a bad effect on the orchids: those with shallow root horizon froze out, and some species though plentiful before, were quite rare last spring. Much of the other vegetation was also affected, some of it very badly."

The bog and surrounding land do not appear to have changed significantly in the past 50 years, mainly because the state acquired 941 acres (today known as the Kissick Swamp Wildlife Area), including the bog, during 1946–1951 (WDNR 1983). Earlier, in the 1920s, mature stands of white cedar, white and black spruce, and balsam fir had been logged uniformly. Zirrer observed in 1944 that the bog was "mostly overgrown with small conifers up to about 6 inches [in] diameter, [with] some larger trees, esp. cedars and enough fire wood to last forever." (Letter to Schorger, 7 July 1944) Today, there is an even-aged monotypic stand of dense conifers over much of the wildlife area. But has the bog lake itself changed? Zirrer (1945) put the size of the bog lake (he actually referred to it as a pond) at 30 acres, and yet in 1983 the WDNR described it as only 10 acres in size. Zirrer may have included the adjoining sedge mat in his estimate because it is not likely that the size of the lake has changed significantly during the past 50 years (Eric Epstein personal communication).

Bogs were not exactly the favorite haunts of local townspeople in Zirrer's day. And the "pond" itself had quite a reputation. Zirrer (1945) commented:

> "To the casual observer the pond appears very shallow, but underneath there is an enormous layer of soft, black mud, which also reaches for a considerable distance under the adjoining bog. A sixteen foot pole forced through the top layer of matted vegetation or pushed into the water next to the shore does not reach the bottom. In the opinion of the neighbors the pond is bottomless; which belief was strengthened a few years previously by the fact that a cow, venturing too far, broke through the floating sphagnum and disappeared into the mud beneath."

Recent breeding bird surveys conducted by myself and BER biologist Randy Hoffman at Kissick Bog suggest a change in the avifauna recorded by Zirrer. We have found no Soras, Virginia Rails, American Bitterns, Redwinged Blackbirds, Palm or Connecticut Warblers, only 1 Chimney Swift, and no Black Terns (although the rails and terns observed by Zirrer may have been migrants).

While at the bog site, Zirrer also took a considerable interest in mammals as well. On 12 March 1942, he wrote Schorger: "I find mammals, esp.

small mammals, just as interesting, and sometimes more so than birds. One can hardly go along with just one branch of nature study; it is advisable, almost essential, to be posted as much as possible on everything else." Zirrer observed the behavior of porcupines, mink, red and gray squirrels, muskrats, and young deer mice. His observations of the muskrat resulted in a 4-page, single-spaced, type-written paper that is now among mammalogist H.H.T. Jackson's papers at the State Historical Society. This paper describes the winter behavior of a muskrat at an ice hole on the bog lake.

About mink on the bog lake, Zirrer (letter to Schorger, 12 March 1942) wrote:

> "In summer a mink visits the pond to prey on water birds and other animals. Since it is not easy to negotiate the rim of the floating sphagnum bog from the side of the water in order to go on land, and as the mink does not deposit its droppings into the water, it burrows a tunnel through the matted vegetation starting at the water level and emerging at the top 4 or 5 feet from the rim. There it deposits its droppings daily, and returns, not the same way, however; another similar tunnel, a few feet further, leads back to the water. The piles of droppings are cone-shaped, about 2 inches high and wide, and [are] composed of slate-colored dirt, hair, feathers and bones. The animal uses this for weeks at a time, for some of these piles are fresh, others appear older, and some are washed out so that nothing but hair, feathers and bones remain. The most remarkable item[s] are the bones, some of them an inch and a half long, and so sharp that one cannot understand how they can pass through the intestine of such [a] comparatively small animal. [The] Milwaukee Public Museum was unable to give me much information on the subject: they never heard of anything like it!"

Zirrer's observations of mink and other mammals in northwestern Wisconsin were passed on by Schorger to Jackson, who corresponded with Zirrer to seek additional information for his book *Mammals of Wisconsin*. Almost the identical wording about the mink appeared in Jackson's book (1961:355). Zirrer apparently sent Jackson nearly the same letter he sent Schorger.

In the early 1940s Zirrer was honing his skills as a naturalist. While his knowledge of the natural world increased, so too did his desire to learn more about what he was seeing. Although his personal collection contained many European and regional (U.S.) publications, as well as several publications on Wisconsin's flora and fauna, Zirrer's appetite for natural history periodicals had grown insatiable. How could he obtain more publications, he asked Schorger, more books? He had exhausted the local library as a source. Besides, he didn't want to *borrow* books. He wanted to buy them and mark them up with notes as he saw fit. Schorger, besides providing him copies of articles, encouraged Zirrer to contact the Smithsonian Institution. He did so and included "a few of my observations" he thought might interest Alexander Wetmore. Secretary Wetmore forwarded two of the publications he wanted and to Zirrer's delight "confirmed some of my observations." (Letter to Schorger, 12 March 1942)

Keenly aware of Zirrer's promise as a naturalist, Schorger took steps to bring him in closer contact with the scientific community. He submitted Zirrer's name for membership to the

Wisconsin Society for Ornithology in 1942 and recommended that he become a member of the Wisconsin Academy of Science, Arts and Letters. It was with great delight that Zirrer later learned of his acceptance by the Wisconsin Academy. He felt indebted to Schorger and profusely thanked him for this and much more in a 10 June 1943 letter:

> "I have received recently the certificate of membership in the Academy . . . which I certainly appreciate and treasure . . . greatly. Through your friendly interest and kind recommendation I was introduced to the Wisc. Soc. [for] Ornithology, have become a member of the Academy, the supreme court of Wisconsin science and other intellectual activity, and now have joined the Wilson Ornithological Club.
>
> "Through your friendly advice . . . to apply for the technical bulletins on food and food habits of ducks and Bent's Life Histories I have not only acquired several valuable, extremely interesting and readable books, but also learned of a source of fine scientific literature largely unknown to me before. . . . In fact I am taking the monthly catalog of the government publications so as not to miss anything of interest. Not that I have any superfluous money but I would rather skimp on eats than miss a good book if it is within my means.
>
> "I cannot emphasize sufficiently how sincerely I appreciate all this, and wish to thank you. You are not only a scientist and as an ornithologist the best in Wisconsin but also a fine fellow in every other way. How could have you otherwise bothered with such a poor shanty dweller who is really nothing to you."

As Zirrer's mentor, Schorger urged him to publish his observations. But Zirrer was evasive. In a 5 August 1942 letter to Schorger he wrote: "Although not just so very dumb, and somewhat of a linguist, I am still at war with the English language. I wish sincerely to be able to master English as perfectly as you do. Then perhaps I should not fear to write something for publication, although even then my knowledge of various scientific disciplines could not compare with yours." Zirrer (1941) did publish his local records of several species in a short piece titled "Some November notes on Sawyer County birds," but he apparently considered this compilation not of the same caliber as an in-depth article on a particular species. It wasn't long, however, before his first feature article appeared in the *Passenger Pigeon*. It was titled "Bittern" and was published in April 1944. It is a relatively short but captivating piece; here are some excerpts to conclude Part II on Zirrer's work and life:

> "Our dwelling is situated at an extensive tamarack-cedar-black spruce bog, so close that the branches of tamaracks reach almost to our windows; and only a few feet above the high water mark. Bitterns are very common with us, so common that occasionally one is seen sitting on one or another of our woodpiles, often not more than a few feet from the house. . . .
>
> "On my trips into the bog evenings and nights I have, upon several occasions, heard a croaking sound, moving back and forth, coming sometimes from a considerable height, then again low over the bog, but always moving. At times dark, ghostly forms passed with great speed within 10 to 20 feet of me. . . . May 18 last year I was in the bog just a little before dark. Migration of warblers was at its height and the birds were actually swarming everywhere. While standing thus on a slightly drier spot and partly concealed by the dense growth of evergreens, I heard that familiar croaking sound again. Two large

birds appeared in the distance, chasing one another with unbelievable speed just above and between the treetops, which at that particular place are about 8 to 12 feet high, both birds croaking angrily, excitedly. It was already too dark to place them; aside from that the birds flew with such speed above and among the trees that I could only now and then catch a glimpse of them. This went on for a number of seconds. Suddenly the birds started straight toward me and coming to the small opening, on the edge of which I was standing, dropped right in and started to fight jumping at one another like two roosters, using beaks, wings and feet at the same time. Then I saw that the birds were bitterns and very probably two males.

"I stood like a statue, and at first the birds did not pay the slightest attention to me, if they saw me at all. Before long, however, the larger bird cornered the smaller one which began to back toward me. In this manner, the smaller bird, with its back turned, came so close that I could have touched it. Now the larger bird became suspicious; facing me only a few feet away, it apparently began to realize that the dark form standing in front of it was not just a tree stump. The bird froze in its track assuming the well known pose, and the other bird, without turning, followed suit. For quite some time not one of us moved. Before long, however, the weight of my body began to tell. I was sinking deeper and deeper, water started to gurgle under my feet and I was forced to move. This of course put life into the birds; with much flapping of the wings, but without a croak, they rose and disappeared in the distance."

Acknowledgments

I would like to thank John Bielefeldt and Mike Mossman for their careful review and editing of this manuscript. Their comments and suggestions were insightful and instructive. Thanks also to Eric Epstein for his helpful comments and review and to June Dobberpuhl and Randy Hoffman for their review.

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"Misty Morning Ruff" *by Jerry Gadamus* (A limited edition print reprinted with permission of the artist and the publisher, Northwoods Craftsman, Menomonee Falls, WI 53051)

Birds of Wisconsin Boreal Forests

by Michael J. Mossman, Eric Epstein, and Randy M. Hoffman

Boreas was the ancient Greek personification of the north wind, and today the term "boreal" refers generally to the north or far north. Ecologically, it also describes a more specific biogeographic region, the boreal forest biome, which in North America occupies a broad zone from Alaska south and east through Canada to the Atlantic Ocean. These are the extensive tracts of spruce, fir, birch and poplar, which—to those who have visited the region in summer—may be associated with long summer days, cool nights, northern lights, the antics of campside Gray Jays, and the songs of spruce-woods warblers, Swainson's Thrushes and White-throated Sparrows.

Although Wisconsin lies well outside the boreal forest biome, it has some very "boreal-like" tracts, as well as a number of boreal breeding-bird species. Of the 20 species whose breeding distribution is virtually limited to the boreal forest region of Canada, all but 2 have been known to occur in Wisconsin during the breeding season (Table 1). However, none are common anywhere in the state, and 11 are considered of rare and irregular occurrence during summer. Fifteen are known to have nested in Wisconsin, although for most of these, records are extremely rare.

In this, the tenth article in the Wisconsin bird habitat series, we describe Wisconsin "boreal" forest and its breeding-bird community, and compare this with other bird communities, especially those of Canada's true, boreal forests and other Wisconsin habitat types. This leads us to identify special characteristics of Wisconsin boreal forest bird communities as well as suggest some protection and management considerations, and high-quality sites worth visiting.

What is "true" Canadian boreal forest? On uplands, white spruce (*Picea glauca*) and balsam fir (*Abies balsamea*) are the usual canopy dominants, but hardwoods such as paper birch (*Betula papyrifera*), trembling aspen (*Populus tremuloides*) and balsam poplar (*P. balsamifera*) reach high levels of importance in some stands. Black spruce (*Picea mariana*) usually prevails in the canopy of lowland forests, and sometimes in uplands as well. Aspen, pop-

Table 1. Wisconsin breeding-season abundance and status of species occurring primarily in the boreal forest biome.

Species	Breeding-Season Status[1]
Spruce Grouse	Uncommon*
Northern Hawk-Owl	Rare, irregular*
Great Grey Owl	Rare, irregular*
Boreal Owl	Rare, irregular
Three-Toed Woodpecker	Rare, irregular
Black-backed Woodpecker	Rare, regular*
Gray Jay	Rare, irregular*
Boreal Chickadee	Rare, irregular*
Ruby-crowned Kinglet	Uncommon*
Philadelphia Vireo	Absent
Tennessee Warbler	Rare, regular*
Orange-crowned Warbler	Absent
Cape May Warbler	Uncommon*
Palm Warbler	Uncommon
Bay-breasted Warbler	Rare, irregular*
Blackpoll Warbler	Rare, irregular
Wilson's Warbler	Rare, regular*
Rusty Blackbird	Rare, irregular*
Pine Grosbeak	Rare, irregular*
White-winged Crossbill	Rare, irregular*

[1]Data from Barger et al. 1988. * = verified nesting in state.

lar, birch and (on xeric sites) jack pine (*Pinus banksiana*) tend to pioneer upland sites cleared by logging, fire, or windthrow, eventually farming a light canopy under which the more shade-tolerant fir and spruce develop and ultimately succeed the hardwoods and pine. Individual birches may persist in spruce-fir stands long after aspens have died off. The understory of spruce-fir forests generally includes only more spruce and fir, along with a dense ground layer of low ericaceous shrubs (e.g., *Vaccinium, Ledum*), and mosses. The understory of hardwood stands is better developed, particularly under canopy gaps, and may include alder (*Alnus crispa*), willows (*Salix* spp.), mountain maple (*Acer spicatum*) and other broadleaf shrubs and saplings, as well as spruce or fir. Erskine (1977) further describes true boreal forest.

Northward, the boreal forest thins gradually into treeless tundra. To the south it grades into the mixed hardwood-coniferous forest biome of the Great Lakes and St. Lawrence region, which includes the various northern Wisconsin forests described by Curtis (1959) and our present series of articles (Mossman and Matthiae 1988, Hoffman 1989). This mixed "northern hardwoods" region is typically dominated by combinations of hemlock (*Tsuga canadensis*), sugar maple (*Acer saccharum*), red maple (*A. rubrum*), pines (*Pinus* spp.) yellow birch (*Betula lutea*), and white cedar (*Thuja occidentalis*). Southward, mixed forest is replaced by the eastern deciduous forest biome of southern Wisconsin and much of the eastern United States.

Within the mixed hardwood-coniferous forest of northern Wisconsin, "outliers" of boreal forest occur near Lake Superior and in other areas characterized by cool, humid, equable climate, short growing season, deep snow, and often, heavy wet soils with at least seasonally poor internal drainage. These outliers are distinctive in that they contain species and characteristics of both boreal and mixed hardwood-coniferous forests. Although their transitional nature may best be described as "boreal coniferous-hardwood," we will refer to them simply as boreal.

Finley (1951) mapped the presettlement vegetation cover of Wisconsin from data contained in the notes of surveyors who conducted the statewide land survey in the mid-1800s. At that

time the boreal forest was best developed in the Lake Superior region, vegetating the northern quarter of Douglas County, northwestern Bayfield County, and the northern third of Ashland County. Scattered outliers were mapped in Iron, Vilas, Forest and Florence County, with a very disjunct area along Lake Michigan in northeastern Door County. The original surveyors' notes document the transitional nature of these forests, particularly with regard to the occurrence of hemlock, white cedar, yellow birch, and white pine (*P. strobus*).

The most extensive study of boreal forest in Wisconsin was that of John Curtis and his associates at the University of Wisconsin in the 1950s (Maycock 1957, Curtis 1959). Overall, they found the leading canopy dominants to be balsam fir, white pine, white cedar, paper birch and white spruce. Prevalent ground layer and understory species are not obligate to boreal forests, but are widespread in northern Wisconsin forests: Canada mayflower (*Maianthemum canadense*), bunchberry (*Cornus canadensis*), fly honeysuckle (*Lonicera canadensis*) starflower (*Trientalis borealis*), large-leaved aster (*Aster macrophyllus*), bluebead lily (*Clintonia borealis*), beaked hazel (*Corylus cornuta*) and swollen sedge (*Carex intumescens*).

Because of the limited presence of boreal forest in Wisconsin, Curtis did not differentiate stands along a dry/mesic/wet moisture gradient as he had for the major northern and southern Wisconsin forest types. However, soil moisture does affect boreal stand composition, structure and function; thus pines are often among canopy dominants on xeric sites, while white cedar, white spruce, yellow birch and hemlock occur more commonly in the mesic to wet portion of the moisture spectrum. Mesic boreal stands appear to have been largely successional, and quite ephemeral in nature. Although black spruce is typically restricted to bogs in Wisconsin, its ecological amplitude increases northward in the true and transitional boreal forests. Thus, at several sites near Lake Superior, black spruce is well represented in uplands, even in xeric stands of pine-fir. It is important to note that northern Wisconsin's typical bogs of black spruce and tamarack (*Larix laricina*) are not considered boreal; rather, they represent Curtis' northern wet forest type, which has yet to be featured in this series.

Curtis distinguished 3 "partially distinct," structural types of boreal forest in Wisconsin:

> "the first, the old stands of relatively pure conifers with balsam fir and white spruce as the major dominants, associated with large quantities of white pine, red pine (*Pinus resinosa*), or white cedar as found especially along Lake Superior; the second, the mixed conifer-hardwood stands, particularly on inland mesic sites, with the shade-tolerant hardwoods [e.g., sugar maple, yellow birch] gradually replacing the spruce and fir; and the third, the young stands of dense balsam fir and white spruce under an aging and decadent canopy of trembling aspen or white birch, as found throughout the range. [Many] hardwood species . . . are found in the second type. The hardwoods associated with the first type are white birch, mountain-ash (*Sorbus americana*), red maple (*Acer rubrum*), and mountain maple (*A. spicatum*), while the third type usually has only white birch or one of the aspens or poplars, with balsam poplar (*Populus balsamifera*) occasionally reaching significant levels of importance. Obviously, the last two types do not represent distinct and stable entities

but reflect successional recovery from recent disturbances."

These "recent disturbances" include logging and, often, subsequent fire. The UW researchers were able to locate very few stands for their study that had escaped gross disturbances due to human activity.

Curtis estimated that boreal forest covered approximately 672,300 acres, or slightly less than 2% of Wisconsin's land surface, at the time of European settlement. WDNR's statewide Natural Area Inventory, conducted between 1969 and 1983, located only about 750 acres of boreal forest presumably resembling the presettlement condition—a loss of 99%. By this time many of the successional stands described by Curtis for inland mesic sites had lost their boreal character due to senescence, blowdown, spruce budworm infestation, and succession to shade-tolerant hardwoods. Today these stands more closely resemble the second-growth mesic or dry-mesic forests (Curtis 1959, Hoffman 1989) so characteristic of northern Wisconsin. However, balsam fir still often occurs in the understory of these forest tracts; it is a vigorous colonizer of clearcuts, blowdowns, and burns, and is relatively unpalatable to browsing herbivores such as deer. Thus, it can achieve high stem densities and frequencies in young forests, but where stands have matured, particularly at inland sites, it is seldom an important canopy species.

Boreal forest has persisted mostly near Lake Superior, as stands of paper birch, trembling aspen, and balsam fir. These often occur on wet clay soils that may continue to favor the shallow-rooted boreal species over more mesic hardwoods such as sugar maple and basswood (*Tilia americana*). It would not be surprising, however, if other non-boreal species such as red maple, hemlock, yellow birch and white cedar eventually assumed codominance in these stands.

At present the best developed, least disturbed, and most protected boreal stands often occur on anomalous sites; on old beach ridges or sand spits, in narrow strips on flat dolomite bedrock along Lake Michigan, or on islands in Lake Superior. These stands have a strong boreal flavor, but all include components of the more typical regional forests and also express each site's unique conditions of microclimate, soils, exposure, remoteness, and natural disturbance regime. For example, some boreal forest stands on the Apostle Islands exhibit an incredible structural complexity in the shrub and subcancopy layers, due to lake- and island-related influences: frequent canopy openings from blowdown; mild, moist microclimate; and on some of the islands, the absence of deer. The abundant, often lush stands of Canada yew (*Taxus canadensis*), mountain maple, mountain ashes, and sapling white cedar, fir, spruce and hemlock present an aspect unlike anything encountered on the mainland. It also presents a tremendous challenge to those attempting to observe birds or sample vegetation.

To describe the breeding-bird community of Wisconsin's boreal forest we will focus on 7 stands, which represent most of the high quality, mature boreal forest remaining in the state, and include a wide range of structures, composition, and geographic settings. Kimball's Bay Boreal Forest is underlain by clay, along the Wisconsin-Minnesota border in far northwestern Wisconsin near Lake Superior. It is a

dry-mesic site dominated by white pine, white birch, and balsam fir, with frequent white spruce, and broadleaf shrubs, scattered white cedar, pockets of red pine (*Pinus resinosa*) and aspens, and little or no oak (*Quercus* spp.) or maple. It is recovering from severe logging and possibly burning, which occurred a century ago.

Port Wing Boreal Forest Natural Area also includes a dry-mesic boreal forest, with white spruce, fir and lesser amounts of hardwoods and white cedar growing beneath a taller canopy of white and red pines. The forest grows on an old beach ridge beside Lake Superior and the tract includes some adjacent, associated conifer bog and alder thicket.

High Lake Spruce-Balsam Forest Natural Area represents the inland, mesic, boreal forest described by Curtis (1959) as successional, and it was included in his studies. It is recovering from logging, windthrow, and fire, which probably spanned the period 1880–1915. Most white spruce and many firs have apparently succumbed to disease, senescence, and windthrow since Curtis' work. The canopy is mostly white birch, white and red pine, balsam fir, and white spruce, with fir and spruce scattered in the understory along with sugar maple seedlings.

Ridges Sanctuary Natural Area is the best remaining example of the boreal forest isolated on Door Peninsula. Unlike the 3 previous tracts, it is not set in an extensively forested region. It includes a series of Lake Michigan beach ridges forested primarily with black and white spruces, fir, and white pine, interdigitating with swales in which are white cedar and black spruce woods and open bog.

We have included surveys from 3 of the Apostle Islands, located at the northern tip of Wisconsin in Lake Superior (Temple and Harris 1985, Temple unpubl. data). All have good stands of mixed and boreal coniferous-hardwood forest. Devils and North Twin have an especially boreal aspect, and North Twin and Raspberry Islands have exceptional understory stands of Canada yew. The interior of Raspberry Island is generally dense yew 6–10 ft. tall, under mature white cedar, paper birch, yellow birch, and fir. Fir is abundant on the island's windswept edges. On much of Devils and North Twin are large, gnarly, open-grown yellow birch with paper birch, cedar, white pine, and—especially in gaps and edges—fir (Figure 1); the dense tall shrub layer

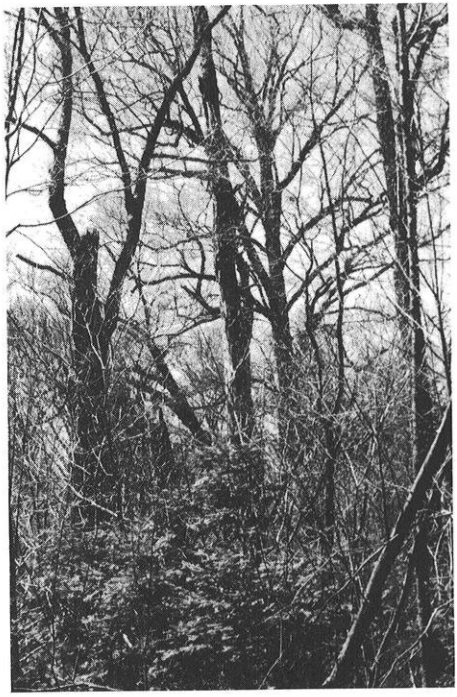

Figure 1. Old-growth yellow birch, with fir, white cedar, and a dense layer of yew. Devil's Island, Bayfield County.

consists of mountain maple and mountain ash, and—on North Twin—yew. Devils Island also has a substantial stand of black spruce, tamarack, and fir.

Standardized, breeding-bird survey data from these 7 stands are presented in Table 2. The table also characterizes each species on the basis of its breeding range, as determined by standard maps and texts (Erskine 1977, Peterson 1980, Godfrey 1986, Cadman et al. 1987) and our own experience in Wisconsin. For example, a "boreal" species is one that breeds primarily within the boreal forest biome while a "southern" species breeds primarily in the eastern deciduous forest biome; the breeding range of a "boreal-mixed forest" species spans both the boreal and mixed coniferous-hardwood forest biomes, but little or none of the eastern deciduous forest biome; and the range of a "widespread" species includes significant segments of all 3 biomes.

To help evaluate the nature and significance of Wisconsin's boreal forest breeding-bird community, we will first describe the primary bird communities of true boreal forests. Erskine (1977) gives an excellent overview of the latter. To allow comparisons with Wisconsin surveys, we computed mean relative abundance values from Erskine's census data collected in those eastern and central boreal stands dominated, respectively, by spruce, fir, and birch-aspen.

True boreal spruce forest has a relatively simple structure. It is typically dominated by a few needle-leaved conifer species with little or no broadleaf component except for heath. Its breeding-bird community is correspondingly rather simple, but with a very large proportion of species whose breeding ranges are primarily boreal or span both boreal and mixed coniferous-hardwood forest biomes. Boreal species constitute approximately 24% of all individuals and 36% of all species, while boreal-mixed forest species are represented by 71% of individuals and 54% of species. In total, boreal and boreal-mixed forest species constitute the vast majority of individuals (95%) and species (89%) breeding in boreal spruce forest. The most common species in these stands were White-throated Sparrow, Nashville Warbler, Yellow-rumped Warbler, and Golden-crowned Kinglet, although Erskine considered the Swainson's Thrush, Yellow-rump, and Dark-eyed Junco to be especially "ubiquitous and dominant."

Fir-dominated boreal forests are typically more diverse than spruce forests, with a greater mixture of tree and understory species and ages, including some birch or aspen. They generally have a more diverse bird community than do spruce stands, partly because of the addition or increased densities of several species such as Ovenbird, Red-eyed Vireo, and American Redstart, which have more southern, widespread breeding ranges. Besides these 3 "hardwoods" species, Erskine considered the following to be characteristic: Red-breasted Nuthatch, Solitary Vireo, Tennessee Warbler, Purple Finch, and most distinctively the Black-throated Green Warbler, Blackburnian Warbler, and Bay-breasted Warbler. Altogether, approximately 75% of individuals and 64% of species belong to boreal and boreal-mixed forest categories. His census data showed the most abundant species to be Bay-breasted Warbler (especially in mature

stands), Magnolia Warbler (especially in young stands), White-throated Sparrow, and Ovenbird.

Spruce, and especially fir-dominated forests are subject to periodic outbreaks of spruce budworm (*Choristoneura fumiferana*). These infestations are exploited by boreal warblers such as the Cape May Warbler, Bay-breasted Warbler, and Tennessee Warbler, whose populations may increase in response many fold. Even populations of more generalized species such as Red-breasted Nuthatch, Purple Finch, and Evening Grosbeak may increase substantially at these times.

Another species group that exhibits irruptive population changes is the cardueline finches, especially the Evening Grosbeak, Purple Finch, Pine Grosbeak, Pine Siskin, Red Crossbill, and White-winged Crossbill. These are primarily seed-eaters that range widely and sometimes nest in great numbers or in areas outside their normal range, when these sites happen to produce heavy cone crops. Of these species, the Evening Grosbeak, Pine Siskin, and White-winged Crossbill are known to be especially responsive to spruces.

The third type of the boreal forest pertinent to our discussion includes those early successional stands dominated by birch and aspen. In Erskine's censuses of this type, 50% of species and only 25% of individuals were primarily of boreal or boreal and mixed forest affinity. The 4 most abundant species (Ovenbird, Red-eyed Vireo, Least Flycatcher, and American Redstart) are distributed widely across eastern North America, and they comprised over half of all individuals in the type. Erskine also considered the following to characterize aspen-birch woods: Ruffed Grouse, Yellow-bellied Sapsucker, Black-capped Chickadee, American Robin, Swainson's Thrush, Veery, Black-and-White Warbler, Canada Warbler, and Rose-breasted Grosbeak.

The breeding-bird community of Wisconsin boreal forest (Table 2) has many species in common with those of the true boreal forest types, but differs considerably in the relative abundances of species. It is actually fairly typical of mixed coniferous-hardwood forest and edge (i.e., Curtis' northern Wisconsin forest types), but with an especially high prevalence of the more northern and conifer-loving species, including the addition of some that are truly boreal. It is characterized overall by having a few boreal species that occur in very low numbers, relatively high numbers of several "boreal and mixed forest" species, and a predominence of fairly widespread species (Tables 2, 3).

Birds with widespread breeding ranges comprise over one-third of the species and nearly half of the individuals in Wisconsin boreal forest. Although most of the widespread species are uncommon or rare, 8 are fairly common (e.g., Least Flycatcher), 2 are common (Cedar Waxwing, Black-and-White Warbler), and 3 are abundant (Black-capped Chickadee, Red-eyed Vireo, Ovenbird). Several of the widespread species, such as Swamp Sparrow, Red-winged Blackbird, Common Grackle, Song Sparrow, and American Goldfinch, are generalized species of edges and damp shrubby areas. Others, including the abundant species, are generalized breeders of deciduous and mixed forests, even in boreal regions of Canada.

Our sample of 7 stands includes only 2 species that can be considered pri-

Table 2. Breeding range and relative abundance[1] of birds occurring in 7 boreal forest stands in Wisconsin.

Species	Breeding Range[2]	Overall Abundance[3]	Relative abundance in indicated stands[4]						
			KB	PW	HL	RS	RI	DI	NT
Bald Eagle	W	U					+		+
Broad-winged Hawk	W	U					0.2	0.4	
Merlin	BM	R						+	
Ruffed Grouse	W	R	1.4						
Spotted Sandpiper	W	U					+	0.7	+
American Woodcock	SM	U					0.2		1.5
Mourning Dove	S	R	2.0						
Black-billed Cuckoo	SM	U	2.0	0.9					
Northern Saw-whet Owl	W	R					+		
Chimney Swift	W	FC		0.4		1.9	4.0	2.0	3.1
Ruby-throated Hummingbird	SM	U		0.1		0.4			
Belted Kingfisher	W	U					+	+	0.5
Red-headed Woodpecker	SM	R				0.7			
Yellow-bellied Sapsucker	BM	FC			4.9	0.4	0.3	0.7	+
Downy Woodpecker	W	U	0.1			1.2			0.5
Hairy Woodpecker	W	U	0.1			0.7	0.5	+	1.5
Northern Flicker	W	U		0.1		2.3	0.2		
Pileated Woodpecker	W	R				0.4			
Olive-sided Flycatcher	BM	R						1.4	
Eastern Wood-Pewee	SM	U	0.1	0.6		0.4		0.7	0.5
Yellow-bellied Flycatcher	BM	U		0.1					1.0
Alder Flycatcher	BM	U		2.0		0.7			
Least Flycatcher	W	FC	4.1	1.1			0.2	+	1.5
Eastern Phoebe	SM	R					0.3		
Great Crested Flycatcher	SM	U	0.1	0.9		1.5	0.3		0.5
Eastern Kingbird	W	R		0.6					
Purple Martin	SM	R				1.2			
Tree Swallow	W	FC		3.2		1.5	+	2.7	3.1
Cliff Swallow	W	U					1.5	+	+
Barn Swallow	W	U					+	1.4	
Gray Jay	B	R						0.7	
Blue Jay	SM	C	3.4	2.0	2.4	6.2	1.2	0.7	3.6
American Crow	W	FC		2.0		3.9	0.7	+	1.0
Common Raven	BM	U			2.4		0.7	+	0.5
Black-capped Chickadee	W	A	4.7	1.4	4.9	7.4	6.9	8.1	3.1
Red-breasted Nuthatch	BM	FC	2.0	0.3	2.4	2.3	0.3	0.7	2.6
White-breasted Nuthatch	SM	U	0.1	0.6			0.5		
Brown Creeper	BM	U	1.4			0.4			1.0
Winter Wren	BM	C			4.9	1.9	3.9	0.7	2.6
Golden-crowned Kinglet	BM	U		0.3		2.7	0.3	0.7	
Veery	M	C	12.2	3.3		0.7	4.1	+	2.6
Swainson's Thrush	BM	FC					+	0.7	5.2
Hermit Thrush	BM	FC		0.4	9.8	0.4	0.2		
American Robin	W	FC	4.7	3.4		3.5	0.8	+	+
Gray Catbird	SM	U		0.3		0.7	0.2		
Brown Thrasher	SM	R		0.1					
Cedar Waxwing	W	C	0.1	4.5		1.9	1.3	24.9	
Solitary Vireo	BM	R		1.0					
Warbling Vireo	SM	R					0.2		
Red-eyed Vireo	W	A	8.8	2.4	19.5	1.2	12.8	2.0	5.7
Golden-winged Warbler	M	R					+		
Tennessee Warbler	B	R	0.1						

continued

Table 2. (*Continued*)

Species	Breeding Range[2]	Overall Abundance[3]	Relative abundance in indicated stands[4] KB	PW	HL	RS	RI	DI	NT
Nashville Warbler	BM	C	4.7	8.6	2.4	2.7	1.7	2.7	+
Northern Parula Warbler	M	C		4.6	2.4	1.9	3.4	2.0	8.3
Yellow Warbler	W	U		1.3		0.4	0.3		
Chestnut-sided Warbler	M	FC		0.9			2.7	2.0	1.0
Magnolia Warbler	BM	FC		0.7		0.4	1.0		10.7
Cape May Warbler	B	R		1.0					
Black-throated Blue Warbler	M	U		0.3			2.4		
Yellow-rumped Warbler	BM	C	4.7	3.9	2.4	2.7	1.3	2.0	2.1
Black-throated Green Warbler	BM	A	4.1	4.2	9.8	4.7	12.2	2.7	5.7
Blackburnian Warbler	BM	C	2.7	6.2	7.3	0.7	3.0	2.7	2.1
Pine Warbler	M	U	0.1	2.9		0.7		0.7	
Palm Warbler	B	R		0.7					
Bay-breasted Warbler	B	R		0.1					
Blackpoll Warbler	B	R		0.1					
Black-and-White Warbler	W	C		4.5	2.4	3.0	7.1	0.7	4.1
American Redstart	W	FC		2.4		2.3	4.2	0.7	1.3
Ovenbird	W	A	10.8	2.0	22.0	3.5	7.9	3.4	0.5
Connecticut Warbler	BM	U					1.0	2.0	
Mourning Warbler	BM	FC	6.1	0.6		1.2	2.0		0.5
Common Yellowthroat	W	FC	2.0	3.4		7.0	0.4		0.5
Wilson's Warbler	B	U					+	0.7	
Canada Warbler	BM	C	1.4	0.1			1.7	2.7	9.7
Scarlet Tanager	SM	U		0.3		0.4			0.5
Northern Cardinal	S	R				1.2			
Rose-breasted Grosbeak	SM	U	2.7	0.7		0.4	0.3		0.5
Chipping Sparrow	W	U		1.3		2.7	0.2		1.0
Song Sparrow	W	FC	0.1	2.2		5.4	0.8	0.7	4.1
Swamp Sparrow	W	R		3.3					
White-throated Sparrow	BM	C	5.4	2.3		4.7	2.5	10.1	5.2
Dark-eyed Junco	BM	U		0.1				3.4	
Red-winged Blackbird	W	R		4.9					
Common Grackle	W	R				4.7			
Brown-headed Cowbird	SM	U	2.7	0.7		0.7			
Pine Grosbeak	B	R						0.7	
Purple Finch	BM	FC		0.4		0.7		4.7	
White-winged Crossbill	B	U						6.8	
Pine Siskin	BM	R		0.3					
American Goldfinch	W	U		0.9		2.3			
Evening Grosbeak	M	R		0.3					
Acreage			290	188	40	860	296	318	175
Years surveyed			1	4	1	3	1	1	1
Hours/year			3	2	1	2	13	6	6

[1]Numbers refer to the percentage of individual birds counted in a given stand that belong to a particular species (e.g., Ruffed Grouse comprised 1.4% of all birds counted at Kimballs Bay). A "+" means the bird was detected only once, but not while censusing.

[2]Primary breeding range: B = Boreal (boreal forest biome), S = Southern (eastern deciduous forest biome), M = Mixed (mixed hardwood-coniferous forest biome), W = Widespread.

[3]A = Abundant (occurred in all 7 Wisconsin stands, with total mean relative abundance $\geq$ 5%). C = Common (occurred in at least 5 stands, with mean abundance $\geq$ 2%). FC = Fairly Common (occurred in at least 3 stands, with mean abundance $\geq$ 0.8%). U = Uncommon (occurred in at least 2 stands, or in just 1 stand but with mean abundance $\geq$ 1%). R = Rare (occurred on only 1 stand, with mean abundance $<$ 1%).

[4]KB = Kimball's Bay. PW = Port Wing. HL = High Lake. RS = Ridges Sanctuary. RI =

Table 3. Composition of Wisconsin's boreal forest breeding-bird community according to species' primary breeding ranges.

	Community Composition[2]		
Breeding range[1]	Number of species	% of species	% of individuals
Widespread	32	35	45
Boreal	9	10	2
Boreal-Mixed	25	27	37
Mixed	7	8	9
Southern-Mixed	16	18	7
Southern	2	2	1
TOTAL	91	100	100

[1]Range categories defined in Table 2.
[2]Values represent totals in Table 2.

marily "southern" birds of the eastern deciduous forest biome, and they are both rare in Wisconsin boreal stands. One is the Northern Cardinal, which has expanded its range northward in recent decades with the rising popularity of winter bird feeding, and although generally a southern bird, it often selects northern, coniferous habitat when available (Mossman and Lange 1982).

Wisconsin boreal forest includes several species of birds whose primary range spans both the deciduous and mixed forest biomes. Except for the habitat generalist Blue Jay, these species are all uncommon or rare in the community, and they constituted a total of only 7% of the individuals encountered on surveys.

Most of these species, especially the Scarlet Tanager, White-breasted Nuthatch, Warbling Vireo, Black-billed Cuckoo, Eastern Wood-Pewee, and Rose-breasted Grosbeak, are known to select hardwood microhabitats when in mixed forest; however, the Blue Jay, and to some extent the pewee, may also use pines (e.g., Mossman and Lange 1982). This also appears to be their distribution in Wisconsin boreal forest.

There are a few Wisconsin birds whose ranges are centered on the mixed coniferous-hardwood forest biome, and 7 of these occurred in the boreal forest surveys. These include species that are rare in the community (Golden-winged Warbler and Evening Grosbeak), uncommon (Pine and Black-throated Blue Warblers), fairly common (Chestnut-sided Warbler), and common (Veery and Northern Parula). Four of these are birds of dense broadleaf understory.

In Wisconsin boreal forest, as elsewhere, the Veery and the Golden-winged Warbler, Chestnut-sided Warbler, and Black-throated Blue Warbler are birds of dense broadleaf understory, such as beneath canopy gaps or edges; however the Black-throated Blue occurs in these situations primarily in large, mature stands, and perhaps occasionally in dense coniferous understory. The Pine Warbler occurs in medium to large pines within Wisconsin boreal forest, for example at Kimball's Bay, where it occurred only in a grove of tall red pines. It is restricted to pine stands in the Apostles (Temple and Harris 1985). The Northern Parula breeds among both pines and spruce-fir, generally in the

presence of *Usnea* lichens. The Evening Grosbeak is a rare Wisconsin breeder. Although it was rare in our sample, and although Temple and Harris (1985) did not find it breeding in the Apostles, Robbins (in press) feels it probably breeds regularly in the boreal forests south of Lake Superior and near the Upper Peninsula border, where it feeds on maple seeds and spruce budworms.

Many species, and over one-third of the individuals recorded on Wisconsin boreal surveys, are birds of both boreal and mixed forest biomes. Of the 15 species that are common or abundant in Wisconsin boreal forest, nearly half (7) belong to this range category. These include the abundant Black-Throated Green Warbler, and 6 common species: Winter Wren, White-throated Sparrow, and the Yellow-rumped, Nashville, Blackburnian, and Canada Warblers.

These species are fairly well distributed within both the boreal and mixed forest regions, and in Wisconsin they occur in a variety of northern community types, often as far south as central and southern Wisconsin in mixed-forest upland relics and conifer bogs (Mossman and Lange 1982). In upland Wisconsin boreal forests, their habitat preferences, described below, are similar to their preferences described for other boreal forests.

The Black-throated Green Warbler prefers fairly mature, mixed coniferous hardwood forest with a well-developed canopy structure. The relatively high importance of species such as sugar maple, yellow birch, and hemlock in Wisconsin boreal forest make this species more prevalent here than in true boreal forest. The Winter Wren occurs mostly in moist sites, often with fallen logs and a moderately dense understory. The White-throated Sparrow has a very generalized habitat distribution, breeding in most coniferous and mixed forests and edges, adjacent bogs and cutovers. The Yellow-rumped Warbler is also fairly generalized among conifer woods and edges, and like the previous species, is a very common bird of true boreal forest. Nashvilles occur mostly in aspen-birch, often at the forest edge, and sometimes in jack pines. Blackburnians are in mature spruce, fir, pines, and hemlock. Canada Warblers are found in moist sites, often on slopes, with a rich understory of mixed hardwood shrubs.

Although the surveys recorded 9 of the 20 Canadian species (Table 1) that are indicative of true boreal forest, they were all rare or uncommon, constituting only 2% of all individuals. Of these, the Pine Grosbeak, White-winged Crossbill, Gray Jay, and the Cape May, Palm, Bay-Breasted, and Blackpoll Warblers, are, to varying degrees, considered birds of spruce-fir, while the Tennessee and Wilson's Warblers are not. In the 7 Wisconsin survey areas, the most numerous of these were the crossbill, which occurred only on Devils Island but in relatively large numbers; and Wilson's Warbler, which occurred in low numbers on 2 of the Apostles, but also on 4 other of the islands (Temple and Harris 1985).

Because boreal bird species and their habitats are so uncommon in Wisconsin, we know little about their ecology here. Information on breeding status and distribution is sorely needed for most species. However, a few generalizations can be drawn from our limited knowledge and published information from other regions (e.g., Er-

skine 1977, Peck and James 1987, Cadman et al. 1987).

The White-winged Crossbill feeds almost exclusively on conifer seeds, and is especially fond of spruce-fir. It wanders extensively and is irruptive according to seed crops, and may breed at any time of the year. It is not necessarily nesting when here during the summer.

Cape May Warblers live mostly in the upper sections of spruce and fir trees. They and Bay-breasted Warblers are spruce-fir insectivores that are known to increase their numbers dramatically during budworm outbreaks, but it is unclear the extent to which this happens during Wisconsin's relatively mild budworm infestations.

The Blackpoll Warbler is considered "the most exclusively northern breeding warbler" in Ontario (Cadman et al. 1987), where its habitat is open, conifer and mixed scrub. It probably does not nest in Wisconsin, despite breeding-season records.

In the boreal forest biome, Tennessee Warblers breed in conifer, hardwood, and mixed stands, alder and willow swales, and cutovers. Temple and Harris (1985) found them in openings of mixed coniferous-hardwood forest on the boreal-like Apostle Islands, especially near conifers. We have also found them in aspens of boreal forest edges and of northern jack pine barrens.

The Wilson's Warbler is a bird of shrubby broadleaf thickets and edges in the boreal forest biome, and it inhabits the same sort of site on the Apostle Islands. Temple and associates documented the first known breeding of this species in Wisconsin, on Devil's Island in 1977.

In Wisconsin, boreal forest is not the only breeding habitat for boreal bird species. Many of these species occur more or less often in black spruce bogs—classified by Curtis (1959) as northern wet forest. Because of the greater extent of lowland black spruce, this community may be equally or more important for some boreal bird species than is the upland boreal forest described in this article. For example, the Spruce Grouse, Boreal Chickadee, Ruby-crowned Kinglet, and Palm Warbler occur primarily in these lowlands. The Gray Jay is found most often in areas with fairly widespread spruce or cedar swamps or boreal uplands.

In summary, Wisconsin's boreal forest is a distinctive mixture of components from both boreal and mixed coniferous-hardwood forest biomes. The bird communities are dominated by species of widespread distribution and others that breed in both boreal and mixed forest regions. Several distinctly boreal bird species also occur in this forest community, as well as in lowland spruce forest. Little is known about the Wisconsin breeding status and distribution of most of these uncommon species.

Compared to the true, Canadian boreal forest, Wisconsin's has a depauperate component of boreal bird species. In part, this is probably the result of the transitional nature of these tracts, with their dominant complement of nonboreal species such as sugar maple, hemlock, and white cedar. This is suggested by the fact that several boreal bird species appear to be more common in Wisconsin black spruce bogs, which closely resemble the structure of truly boreal spruce forests, in which boreal birds are most prevalent. Other factors contributing to this relative dearth of boreal birds

may relate to disturbance such as logging, or browsing by high deer populations, as indicated by differences in the understory of Apostle Islands that do or do not have deer.

Probably, a critical factor limiting populations of boreal birds in these Wisconsin outliers is tract size and isolation. This is apparent in the lack of distinctly boreal species in the isolated Ridges Sanctuary and in Temple and Harris' (1985) data from the Apostle Islands. For example, the number of boreal bird species increases from 0 on North Twin Island (175 acres), to 1 on Raspberry (296 acres), 5 on Devil's (318 acres, with especially good boreal forest), and 7 on Outer (7999 acres).

Wisconsin's boreal bird community is a unique aspect of our natural heritage, and worthy of protection. It is important to maintain boreal and northern wet forest communities on the Apostle Islands and present State Natural Areas. Yet these may not provide sufficient habitat for the full complement of species that once probably occurred regularly in these community types, or even, in the long run, for those few species that now occur fairly regularly, considering the possible local impacts of disturbances such as fire, disease, and fragmentation of surrounding, unprotected forest.

Several boreal species, for example the Spruce Grouse, Boreal Chickadee, and Ruby-crowned Kinglet, are not known to breed on any of the sites reported here, nor on any of the Apostles. We suggest the creation of a large, landscape-scale management and protection project within Wisconsin's boreal forest region—preferably along Lake Superior, which would incorporate a range of boreal forest successional types as well as lowland conifer communities. At the very least, in investigating the possibilities of such a project we would gain needed knowledge of the distribution, status, and habitat needs of these northern birds.

Description of Sites

We have selected four of the boreal forest tracts from Table 1 for detailed descriptions:

Devil's Island

Size.—318 acres.

Location.—This Lake Superior island is within the Apostle Islands National Lakeshore, and is the northernmost point of land in Wisconsin.

Access.—By private boat only. Interior access can be acquired at a public dock on the island's southern end; or by small craft (canoe, kayak or dingy) launched during favorable conditions from a larger boat offshore, onto the rocky shore just east of the lighthouse.

Site Description.—This is one of the smaller and outermost of the Apostles. Most of the island is forested, except for a narrow lane that connects the lighthouse/radio tower on the north end with the docking area on the south end. The island is up to sixty feet above Lake Superior and ringed with a scenic rocky shore. Spectacular, wave-cut cliffs, caverns, and pillars occur on the northwest shore. The forest is approximately 69% boreal and mixed conifer-hardwoods, and 28% lowland conifer. Dominants are yellow birch, white cedar and balsam fir, with lesser numbers of white pine, white spruce, paper

birch, balsam poplar, trembling aspen, red maple, and mountain ash. The very dense shrub layer is dominated by mountain maple and yew. There is a pronounced krumholz effect near the north and west shores, where the constant battering of trees by wind has produced a gnarled, stunted, and open aspect to the forest. Common herbs in the ground layer include bluebead lily, goldthread (*Coptis trifolia*), and star flower. Mosses are particularly common.

Birds.—Temple and Harris (1985) recorded 56 breeding species in 1977, including several with distinctly boreal affinities (Table 1), and a few (e.g., Spotted Sandpiper) that are not true forest birds. The most frequently observed species were Cedar Waxwing, White-throated Sparrow, Black-capped Chickadee, White-winged Crossbill, Purple Finch, Dark-eyed Junco, and Ovenbird. Whereas the crossbill is fairly indicative of true boreal forest, the other species are more often associated with mixed hardwood-coniferous forests. Other boreal species found here are the Gray Jay and Pine Grosbeak.

Raspberry Island

Size.—296 acres.

Location.—This island is just off the northern tip of the Bayfield Peninsula, within the Apostle Islands National Lakeshore.

Access.—By private or commercial boat. To explore the island for its natural values, it is necessary to have a private launch. Commercial boats stop only at the historic lighthouse, and allow little time for exploration.

Site Description.—This island has a 100-foot topographic relief. Shoreline features include sandstone cliffs, clay bluffs, sand beach, and a short spit that encloses a bog. On the southwest shore is an historic lighthouse. The area around the lighthouse has been cleared so as not to obstruct the beacon. The remainder of the island's interior is virtually undisturbed forest, and includes an apparently virgin stand of white cedar and yellow birch with a tall, lush shrub layer of yew and mountain maple. The forest around the island's edge is dominated by balsam fir, white cedar, and paper birch. A high spot in the interior supports a small stand of mesic hardwoods dominated by sugar maple and basswood. In total, the island consists of approximately 56% boreal and mixed hardwood-coniferous forest, 32% aspen-birch, 8% open areas, and 4% lowland conifers.

Birds.—Bird life is less boreal here than on Devil's Island, but it illustrates the influence of understory on boreal and mixed forest avifaunas. Temple and Harris (1985) recorded 61 breeding species, 6 of which are not true forest breeders. The most frequently observed were Red-eyed Vireo, Black-throated Green Warbler, Ovenbird, Black-and-White Warbler, Black-capped Chickadee, American Redstart, and Veery. Bird species of the lush understory and brushy edges include Veery, Black-throated Blue Warbler, Magnolia Warbler, Canada Warbler, Mourning Warbler, Chestnut-sided Warbler, Golden-winged Warbler, and Wilson's Warbler.

Port Wing Boreal Forest

Size.—188 acres, consisting of 2 distinct units of approximately equal size.

Location.—Northern Bayfield County, along Lake Superior.

Access.—The eastern unit is one mile northeast of the Village of Port Wing, on the northwest side of State Highway 13, bisected by Big Pete Road. The western unit is reached by taking Quarry Road from the village of Port Wing, west one mile to the southwestern corner of the tract.

Description.—The Port Wing project encompasses 2 forested tracts on sand spits inland from present Lake Superior beaches. Both units have dry-mesic, boreal-like forest that is separated by wetlands from the sandy lake beach. The total area of boreal forest on the Natural Area is 100 acres. White and red pines dominate, forming a canopy over white spruce and balsam fir. Also present are red maple, white birch, mountain maple, yellow birch, and white cedar. Many mosses and lichens are found on twigs, downed trunks, and the forest floor. North of the forest is an open water and sedge bog complex with many typical bog species such as pitcher plant (*Sarracenia purpurea*), sundews (*Drosera* spp.), bladderworts (*Utricularia* spp.), and sedges (*Carex* spp.). The beach is dominated by native grasses, beach pea (*Lathyrus maritimus*) and sand cherry (*Prunus pumila*).

Birds.—Birds (Table 1) were counted throughout the Natural Area, but primarily in boreal forest. The most common species are, in order of decreasing abundance: Nashville Warbler, Blackburnian Warbler, Red-winged Blackbird, Northern Parula, Black-and-White Warbler, Cedar Waxwing and Black-throated Green Warbler. There are intriguing summer observations for Bay-breasted and Blackpoll Warblers, which suggest that at least the Bay-breasted may breed here.

Ridges Sanctuary

Size.—860 acres.

Location.—The Natural Area is within the Ridges Sanctuary, just north of Bailey's Harbor, Door County.

Access.—From Hwy. 57 north of Bailey's Harbor, turn east on County Hwy. Q. Follow the signs to the nature center, and then hike the marked trails through the tract; or, enter the site from the south via a parking area near the range light on Harbor Drive.

Description.—The Ridges Sanctuary consists of a series of Lake Michigan beach ridges forested with black spruce, white spruce, balsam fir, and white pine, with wet swales between the ridges. Swamp conifers occupy some of the swales; others are filled with marsh and bog flora. Portions of the ridges are open, wet, and calcareous and support an outstanding assemblage of rare and endangered plants. Eighty acres of the forest is classified as boreal, far disjunct from the main areas of Wisconsin boreal forest near Lake Superior. However, the 700 acres of northern wet and wet-mesic forest on the tract also have boreal components, which are favored by the climatic influence of Lake Michigan.

Birds.—Breeding-bird surveys here covered the entire Natural Area, including open and semi-open swales. In order of decreasing abundance, the most common species (Table 1) are Black-capped Chickadee, Blue Jay, Song Sparrow, White-throated Sparrow, American Crow, American Robin, and Black-and-White Warbler. The Ridges supports many species that are typically associated with the conifers of mixed forest, but none of those species that characterize true boreal forest.

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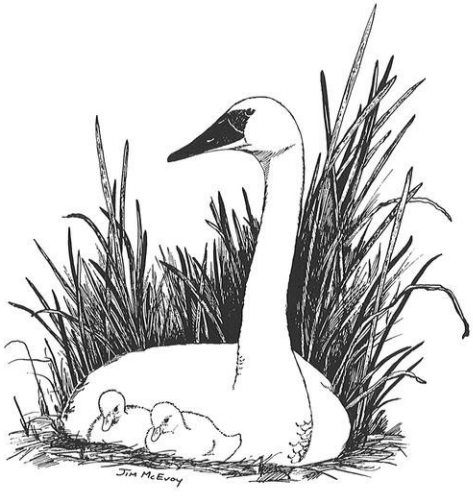


Trumpeter Swan *by Jim McEvoy*

Building Houses and Feeders for Backyard Birds: A New Publication is Available

by Scott R. Craven

Since it was first written over 20 years ago by Agricultural Engineer Glenn Barquest and Wildlife Ecologist Bob Ellarson, University of Wisconsin Extension publication G2091—"Shelves, Houses and Feeders for Birds and Squirrels"—has been UW Extension's most popular wildlife bulletin. Revised by Scott Craven in 1980 and given a new look with an Owen Gromme painting as a cover illustration, it remained popular during the 1980s. Now in 1990 it has undergone another, more significant revision. Numerous new house designs have been added, and the name has been changed slightly to "Shelves, Houses and Feeders for Birds and Mammals" to reflect the inclusion of new mammal housing. It has also been adopted as an Extension "regional publication," so it will be available in a number of North Central states. Of course, it's available anywhere in the world by mail order.

Building and erecting wildlife housing is a quick way to improve wildlife habitat, especially if natural cavities or other nest sites are in short supply. For some species such as Purple Martins, housing construction is the only way to attract them to your property on a regular basis. When I was a kid pounding boards together in my dad's workshop, a "bird house" was nothing more than a wooden box with a roof and floor and a hole of whatever dimension a handy drill bit or circular template would yield. Now there are a multitude of designs and modifications targeted to specific birds and the exclusion of unwanted tenants. It is certainly possible to modify and even improve existing plans. New house designs or a novel use of materials can contribute to our knowledge of wildlife housing. However, the designs presented in "Shelves, Houses, and Feeders" are "tried and true."

Beyond the satisfaction of providing housing for birds, house building offers a chance for off-season activity and improvement or exercise of woodworking skills. Bird houses or feeders make excellent gifts and fund-raising or community service projects for conservation clubs, school classes, or youth groups such as 4-H or scouts.

"Shelves, Houses, and Feeders" begins with an introduction to wildlife housing and construction techniques

WREN HOUSE

MATERIALS

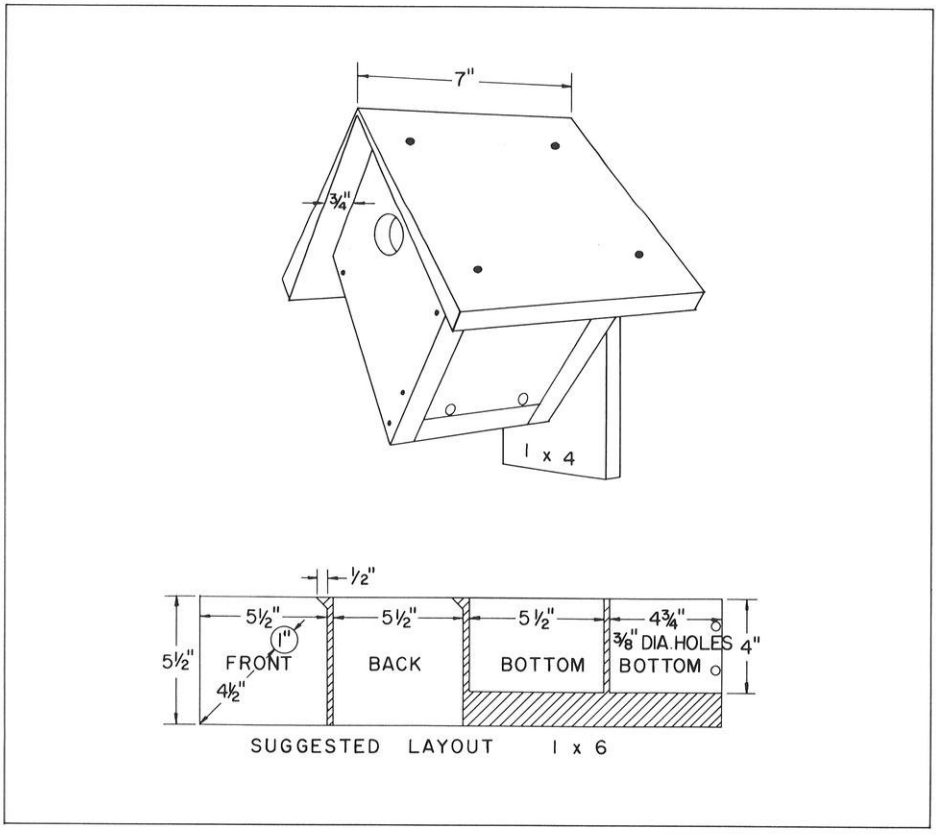
1 piece 1 x 6 (about 3/4" x 5 1/2") x 24"
1 piece 1 x 4 (about 3/4" x 3 1/2") x 12"
Use box lumber, bevel siding, exterior plywood, heavy asphalt roofing or tin for roof.
4 roundhead wood screws to attach one side of roof
9 1 3/4"-2 1/4" nails
8 1 1/4" nails

CONSTRUCTION

Attach one side of roof with wood screws, so it can be removed for annual house cleaning.

MOUNTING

Attach to a tree or post 5-6'above ground with roundhead or lag screws.



NEST SHELF FOR ROBINS AND PHOEBES

MATERIALS

1 piece 1 x 6 (about 3/4" x 5 1/2") x 18"
1 piece 1 x 2 (about 3/4" x 1 1/2") x 10"
8 1 3/4"-2 1/4" nails

MOUNTING

Attach to the side of a building at least 10-12' above the ground in the shelter of the eaves or on the main branch of a tree in a shaded area.

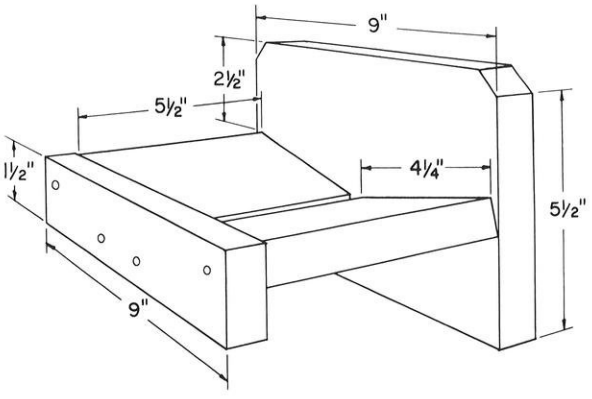
ROOFED SHELF FOR ROBINS AND PHOEBES

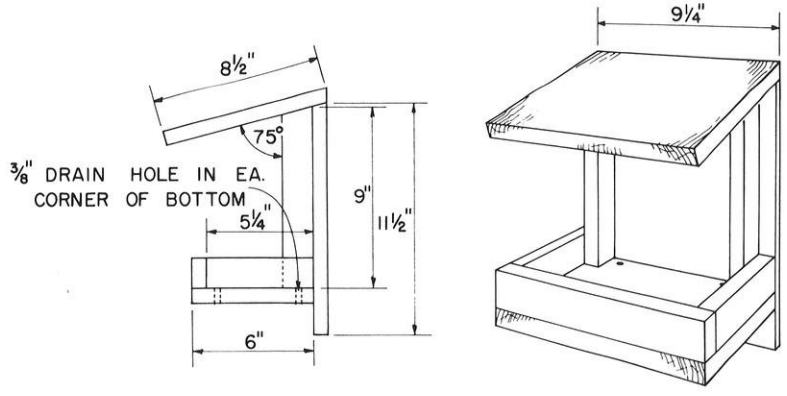
MATERIALS

1 piece 1 x 10 (about 3/4" x 9 1/4") x 30"
1 piece 1 x 2 (about 3/4" x 1 1/2") x 36"
1 3/4"-2 1/4" nails
1 1/4" nails

MOUNTING

Use round head or lag screws to mount on the south or east side of a building or in a tree at least 10-12' above the ground.





WOOD DUCK HOUSE

MATERIALS

1 piece 1 x 12 (about 3/4" x 11 1/4") x 5'
1 piece 1 x 10 (about 3/4" x 9 1/4") x 6'
1 piece 1 x 2 (about 3/4" x 1 1/2") x 1' for cleat
1 3/4"-2 1/4" nails
1 1/4" nails for roof section
1 1 1/4" round head wood screw
1 piece 3" x 12", 1/4" or 3/8" mesh hardware cloth (see construction notes)
poultry netting staples (galvanized)

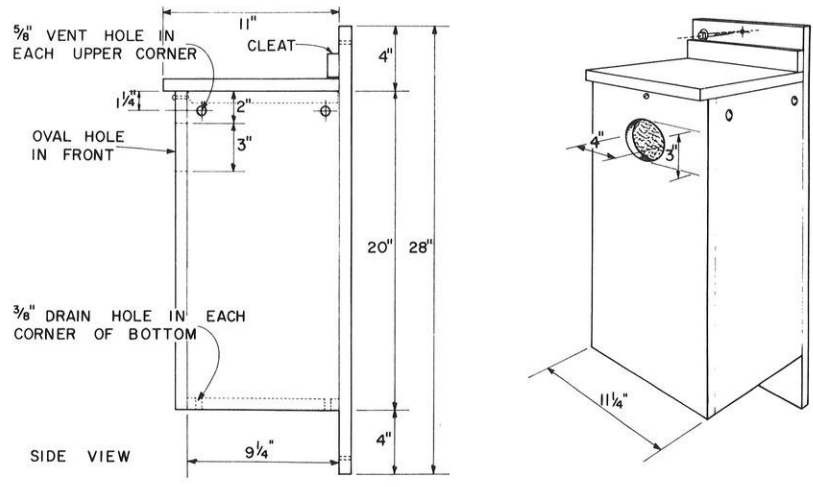
CONSTRUCTION

If inside surface of front board is smooth, attach a 3" x 12" strip of hardware cloth on the inside. Have it extend from the bottom of the hole down 12 inches. Saw cuts 1/8" deep and 1/2" apart in the same area are suitable.

Use a piece 1 x 12, with the grain direction front to back, for roof. To reduce warping and to keep the roof piece in position, attach a piece 1 x 10, with the grain direction side to side, on the underside. Reduce in size and slightly bevel the front edge of the 1 x 10 piece so it can be raised when the screw is removed. The 1 x 2 permanently attached cleat in the back and the screw in front keep the roof in place.

MOUNTING

Attach to tree trunk 8-30' above the ground where no branches shield the entrance. It may also be attached to a sturdy pole in shallow water just a few feet above the water. Use a lag screw and washer at both top and bottom of back piece.



and materials. Then, for each selected species or group of animals, one or more house designs, materials lists, construction guidelines, and tips on house placement and species ecology are presented. The new revision includes almost 40 blueprints for housing for House Wrens, Purple Martins, Eastern Screech-Owls, American Kestrels, Common Barn Owls, Eastern Bluebirds, Tree Swallows. Wood Ducks, Black-capped Chickadees, and other birds, as well as squirrels and bats. Several samples are included in this article. All 4 designs for bluebird houses recommended by the Bluebird Restoration Society of Wisconsin are presented, as well as the Ohio DNR plans for a barn-owl box. Bat Conservation International graciously gave us permission to reproduce BCI's plans for a bat roost. Granted, bats are not birds, but I now receive more calls for bat house plans than any other type of wildlife housing.

The new revision also contains a section devoted to recycling 2-liter pop bottles, milk cartons, old tires, and other potential landfill into useful and inexpensive feeders and houses. These designs are especially useful for children.

In Wisconsin, about 45 birds utilize tree cavities. Eliminating the woodpeckers, which are quite capable of excavating their own cavities, that means almost 40 secondary cavity nesters are potential tenants for your housing. To maximize your occupancy rates, pay careful attention to placement recommendations. Be patient; a martin house, for example, may go unused for several years. To minimize house use by House Sparrows and starlings, don't put houses in place until the desired species are due to arrive in spring (e.g., Purple Martins) and remove House Sparrow or starling nests if and when they are built.

The revised version of "Shelves, Houses, and Feeders for Birds and Mammals" is due in stock about 1 June. It will be available at all county UWEX offices or by mail from: Agricultural Bulletins, Room 245, 30 North Murray Street, Madison, WI 53715, (608) 262–3346.

If you like birds and can use a saw and drive a nail, I believe you will find this publication very enjoyable and useful. It is not, however, the only publication of its kind. Other states and resource management agencies also provide housing plans. In fact, as noted, some of the designs presented originated with other sources. My goal is to promote wildlife conservation and bird houses are one way the public can make a contribution.

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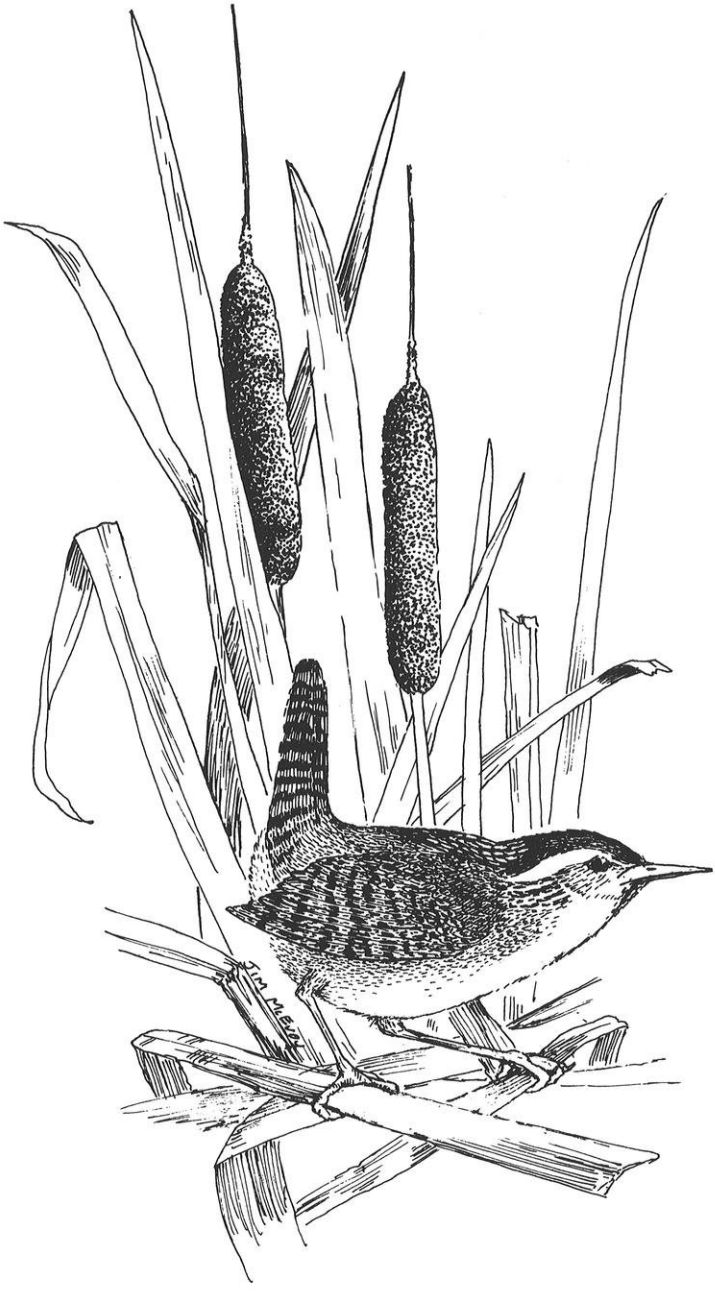

Marsh Wren *by Jim McEvoy*

Statistics are for the Birds

by Stanley A. Temple

About one third of the papers that have appeared in *The Passenger Pigeon* over the past 2 years have included some sort of statistical analysis of the observations that the authors made of birds. The use of statistics is a necessary part of ornithology that should be understood, appreciated and accepted by all ornithologists, amateurs and professionals. As editor of *The Passenger Pigeon* I have occasionally received conflicting comments about too much or too little use of statistical analyses in published articles. The fact that readers seem interested and concerned about the subject prompts this essay in which I shall try to explain what we mean by statistics, why statistics are necessary, and how statistics are commonly used in articles in ornithological journals. I hope it will help lift the fog of "statistical phobia" that keeps some readers from fully appreciating why we use statistics in ornithology.

Whether they know it or not most amateur ornithologists actually use statistics. One common use of statistics is the collection of quantitative information about birds. We use numbers to describe various characteristics of the birds we observe. We count their clutch size, we know whether they are common or rare, we know when they migrate, and we generally keep records of at least some of these observations. These may be simple checklists or more detailed records, but they are data. These data are statistics about birds: a collection of quantitative information.

Merely collecting data or statistics about birds and reporting on them is as far as some ornithologists are willing to go. As long as the amount of data is small, a simple report, such as the contributions to "By the Wayside," will suffice. But, when the amount of data that has been collected is large there is a need to summarize it. Statistical analysis provides a way to handle large amounts of data and produce summary statistics. One of the most common types of summary statistics is the average or mean value for a large number of observations. In the last issue, Ziebell (1990), for example, reported an average clutch size of 4.6 eggs for 35 Least Bittern nests at Rush Lake.

Other observations may be summa-

rized as a percentage that reveals the proportion of a group of observations that fall into a particular category. Recently, Gieck (1989) reported that in 1989 77% of the 336 Bald Eagle nests in Wisconsin fledged at least one young. Temple (1989) reported that 95% of the 109 participants in Project Feederwatch in Wisconsin reported seeing Blue Jays at their feeders.

Sometimes ratios are used to express certain types of proportions. Temple (1989), for example, reported that the ratio of sexually active males to females among Sharp-tailed Grouse is 1:10.

When collecting the data that will be used to generate summary statistics, it is often important to know exactly what group of birds is being described. In some cases all of the birds in a group may be measured, but in other cases it is clear that not all of the birds in a group have been measured, only a sample of the whole has been studied. When we sample a large population to produce summary statistics it is frequently important that the sample be randomly selected to insure that no bias exists. If you wanted to know the percentage of households in Wisconsin that feed birds you would not want to sample only WSO members, that would lead to a biased statistic. Brittingham and Temple (1989) reported that at least 54% of WSO households fed birds whereas only 34% of randomly selected households statewide did.

Sometimes it is important to know how variable the data used to generate summary statistics may have been. Measurements used to calculate an average might have been clustered tightly near the average value or they might have been widely variable. In cases where it is important to know the magnitude of this variability, several additional statistics are used. One is the range, the high and low values in the sample. Ziebell (1990), for example, reported that mean egg length for Least Bitterns on Rush Lake was 31.2 mm with a range from 28.4 to 34.5 mm. He also reported on another study in which the mean was 32.1 mm but the range was smaller (31.5 to 33.0 mm), indicating less variation in the sample. Sometimes variation in the average is expressed as a standard deviation (often abbreviated S.D.) or a standard error (often abbreviated S.E.). These two values are calculated using standard equations and again convey information on how variable the sample is. Ziebell (1990) reported that 47 Least Bittern eggs averaged 9.8 g in weight with a standard deviation of 0.62 g.

There are many important uses of statistics beyond producing these summary statistics. Many of these are inferential statistics that allow some inference about the numbers being analyzed. It is often important to know whether or not two averages or proportions are really different from one another. Because of the variability in most measurements, some slight differences in means or proportions may be due to nothing more important than chance, not real differences between the two groups being compared. This is especially true of small samples. Proper statistical analyses can indicate whether the differences have a high probability of being due to chance or real differences. Often the results of these various statistical tests are expressed as a probability (usually abbreviate p). The p value indicates the probability that the reported difference is due to chance. It is customary

in the sciences to accept as real (often termed "significant") only differences that have a p value of less than 5% (or $p < 0.05$). This means that there is less than a 5% probability (1 chance in 20) that the difference is due to chance alone. Brittingham and Temple (1989) reported that the proportion of feeders with Red-breasted Nuthatches was 34% in southern Wisconsin and 63% in northern Wisconsin. A statistical test revealed that there was less than one chance in a thousand ($p < 0.001$) of this difference being due to chance. It is safe to conclude that it is a real difference. In contrast, 96% of feeders in northern Wisconsin reported Blue Jays while only 93% did so in southern Wisconsin. The statistical test revealed that this slight difference was not significant ($p > 0.5$); there was more than a 50% likelihood of the difference being due to chance.

The statistical tests used to reveal differences between summary statistics are varied, but two of the most frequently encountered are the t-test, which analyzes differences in means, and the Chi-square (or χ^2) test that analyzes differences in proportions. Brittingham and Temple (1989) used χ^2 tests to analyze differences in percentages of feeders reporting certain birds; Eichhorst (1989) used t-tests to analyze differences in the diet of American Coots.

Sometimes a researcher is interested in knowing whether two measurements are correlated with one another. If one measured the wing length and bill length of birds of one species there would be a strong positive correlation, as one increased or decreased so would the other, a negative correlation exists when one value goes up as the other goes down. A statistical analysis known as correlation analysis is used in these cases. Correlation analysis produces a value identified as a correlation coefficient (r) that has a probability (p) associated with it. The value of r ranges from -1.0 to $+1.0$. A value of $+1.0$ indicates a perfect positive correlation; a value of -1.0 a perfect negative correlation; a value close to zero indicates no correlation at all. The value of p indicates, again, whether the correlation is real or due to chance alone. Temple and Cary (1987) showed that there was a significant negative correlation ($r = -0.959$, $p < 0.05$) between spring arrival dates for Eastern Bluebirds and spring temperatures. When temperatures were low bluebirds were late, and vice versa.

Another common statistical analysis deals with trends. Is some measurement increasing or decreasing over time? Such trends are often expressed as an average % change per year. Mossman and Hoffman (1989) reported the average annual change in population estimates for birds of upland forests in Wisconsin between 1966 and 1987. Turkey Vultures had been increasing by 6.5% per year whereas Golden-winged Warblers had been declining by 4.4% per year. To know whether such changes are significant, scientists sometimes use a regression analysis which produces a p value, revealing whether the trend is real or due to chance.

Table 1 summarizes some of these more commonly encountered statistics and how they are abbreviated in text. Use this list as a field guide to statistics in *The Passenger Pigeon*.

The next time you encounter a statistic or the result of a statistical analysis, pause for a moment to reflect on its meaning and importance. It was not

Table 1. A summary of some statistics and statistical tests commonly encountered in the pages of *The Passenger Pigeon*.

Statistic	Symbol	Explanation
Mean or average	$\bar{x}$	The average value of a sample of measurements
Sample size	n	The number of observations used to produce a statistic
Standard error or standard deviation	S.E. or S.D.	Indicates variability in the sample used to produce a mean
t-test statistic	t	Used to determine whether or not two means are significantly different
Chi-square statistic	χ^2	Used to determine whether or not two or more proportions are significantly different
Correlation coefficient	r	Used to determine how two variables are related to one another

included to annoy you, confuse you, or make the paper seem more important than it is. It was included to let you, the reader, better appreciate the quantitative aspects of a study.

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"Vanishing Red Gathering White" *by Jerry Gadamus* (A limited edition print reprinted with permission of the artist and the publisher, Northwoods Craftsman, Menomonee Falls, WI 53051)

The Fall Season: 1989

by Mark S. Peterson

Each year as August 1st rolls around the fall migration is usually well underway. Many of the shorebirds have already passed through, and the passerines are either beginning to head south or are gathering in flocks for their journey south. As the days continue to become shorter and cooler, and the migration increases, the realization soon sinks in that another winter is rapidly approaching.

From late August until about mid–September each year, for those who have learned how to predict when to pursue the warbler waves of fall with the passage of the frequent cold fronts, the variety and numbers of warblers and other small songbirds can, at times, be very impressive. On at least 4 occasions, on August 30, and September 2, 5, and 13 significant warbler movements were noted in Shawano County. These were noted on August 11 in Oneida County, on August 27 in Dane and St. Croix County, on September 8–9 in St. Croix County, and from September 9–12 in Portage County.

Warblers and other small songbirds are usually mixed with or near flocks of Black-capped Chickadees, which are usually very noisy. For those who are adept at calling in birds, the location of a flock of chickadees during the fall migration, especially with many leaves on the trees, usually means success in finding and bringing into view many species of warblers and other small songbirds in the fall.

August was a warm and wet month. A high of 96 was reached on the 4th in La Crosse, and a low of 35 was recorded in Lake Thompson on the 16th. Rainfall was above normal in most of the state for the month.

September began as a moist month, but was much drier in the second half of the month. Scattered frost was reported in the north and central areas of the state on the 14th, with a widespread frost on the morning of the 24th. A high of 86 was reported at several localities during the month. A low of 18 was reported at Lake Thompson on the 24th.

October had wide fluctuations in the temperatures and varying amounts of precipitation. A high of 86 was reported in Port Edwards on the 1st. It was also 81 in La Crosse on the 25th

and at Juneau on the 24th. A low of 12 was reached in Harrison on the 4th. On the 19th 3–6 inches of snow fell in the southeastern part of the state.

November again had wide fluctuations in temperature. It was cold at the beginning of the month, warmed up briefly near the middle of the month, and became much colder in the latter half of the month. Hurley had 40 inches of snow on the 2nd and 3rd. It was below zero several times during the last week of the month in Douglas County.

Winter finches invaded the state in good numbers. White-winged Crossbills by the hundreds had arrived in the northern areas by the end of August. Hundreds of Pine Siskins could be found by mid–October. Most feeders in the state seemed to be invaded by them by the end of the period. Pine Grosbeaks, Purple Finches, Common Redpolls, and Evening Grosbeaks were present in good numbers in at least the northern half of the state. Only Red Crossbills were scarce at the end of the period.

Eighty-eight contributors found 290 species during the fall season of 1989. This would have been increased by several species if more complete documentation had been supplied. This is unfortunate, because the addition of as few as one or two key details can make the difference between acceptance and rejection of a sighting. Others, including some that are very common during their peak migrations, are deleted because they seem too early or too late. Some of these include late flycatchers, late thrush sightings, very early or very late warbler sightings, especially Orange-Crowned Warbler, and American Tree Sparrow and Rusty Blackbird sightings at the beginning of the period. Some of these may be the result of carelessness, but others could be included if even a brief description of the encounter was included with the field note form.

Numerous rarities were seen during the season, although many of these were only brief encounters and included the following: Western Grebes in Chippewa and Douglas Counties, American White Pelicans in La Crosse County, Snowy Egrets in Brown County, Little Blue Herons in Brown and Marathon County, Tricolored Herons in Brown County, a Yellow-crowned Night-heron in Ozaukee County, a Glossy Ibis in Trempealeau County, Greater White-fronted Geese in Burnett and Wood Counties, Harlequin Ducks in Milwaukee and Sheboygan Counties, a Black Vulture in Sauk County, a Black-shouldered Kite in Burnett County, Swainson's Hawks in Oconto, St. Croix, and Sheboygan Counties, Golden Eagles in Burnett, Milwaukee, Oconto, and Ozaukee Counties, a Prairie Falcon in Portage County, a Gyrfalcon in Sheboygan County, Spruce Grouse in Ashland, Bayfield, and Oneida Counties, a Piping Plover in Sheboygan County, Whimbrels in Douglas, Manitowoc, and Milwaukee Counties, Western Sandpipers in Clark, Dane, Manitowoc, and Milwaukee Counties, Buff-breasted Sandpipers in Clark, Dane, Douglas, Eau Claire, Milwaukee, Racine, and Winnebago Counties, Red-necked Phalaropes in Clark, Dane, and Eau Claire Counties, Parasitic Jaegers in Milwaukee and Ozaukee Counties, Little Gulls in Milwaukee County, Lesser Black-backed Gulls in Sauk and Sheboygan Counties, a Rufous Hummingbird in Milwaukee County, Black-backed Woodpeckers in Forest,

Oneida, and Sawyer Counties, Western Kingbirds in Dane and Marathon Counties, Scissor-tailed Flycatchers in Bayfield and Shawano Counties, Carolina Wrens in Dane and Manitowoc Counties, a Varied Thrush in Outagamie County, Northern Mockingbirds in Door and Waupaca Counties, a Loggerhead Shrike in Winnebago County, a Black-throated Gray Warbler in Dodge County, a Yellow-breasted Chat in Price County, and a Sharp-tailed Sparrow in Milwaukee County.

Reports (August 1–November 30, 1989)

Red-throated Loon.—Reported by Johnson in Douglas County on October 29 and by Robbins in Dane County on November 4 and 7.

Common Loon.—Found at the beginning of the period south to Chippewa, Taylor, Oneida, and Forest Counties. Belter found 47 in Marathon County on October 30. Reported at the end of the period in Dane and Walworth Counties.

Pied-billed Grebe.—Reported at the beginning of the period south to Eau Claire, Dane, and Winnebago Counties. Robinson found 94 in Burnett County on September 2. Reported at the end of the period in Dane County by Ashman.

Horned Grebe.—First reported by Ziebell in Winnebago County on September 8. Verch found 58 in Ashland and Bayfield Counties on November 4. Last reported by Robinson in Ashland County on November 26.

Red-necked Grebe.—Reported by Hoefler in Burnett County on September 21 and by Robbins in Dane County on November 7.

Western Grebe.—Reported by Castelein and Lauten in Douglas County on November 4 and by Polk in Chippewa County on November 20.

American White Pelican.—Soulen found 2 on Lake Onalaska in La Crosse County on November 4.

Double-crested Cormorant.—Found at the beginning of the period south to Barron, Clark, Winnebago, and Brown Counties. The Lukes found 1000 in Door County on August 30. Last reported by Ashman in Dane County on November 26.

American Bittern.—Reported at the beginning of the period in Ashland, Barron, Bayfield, Burnett, Door, Dunn, Marinette, Milwaukee, and Price Counties. Last reported by Robinson in Washburn County on November 23.

Least Bittern.—Found at the beginning of the period in Ashland, Bayfield, and Shawano Counties. Last reported by Berger in Sheboygan County on September 5.

Great Blue Heron.—Found throughout the state at the beginning of the period. Tessen found 38 in Manitowoc County on August 13. Last reported by Polk in Chippewa County on November 28.

Great Egret.—Reported at the beginning of the period in Burnett, Dodge, and Dunn Counties. Robinson found 28 in Burnett County on September 2. Last reported by Hoefler in Burnett County on October 17.

Snowy Egret.—Reported by Woodmansee in Brown County on August 3, Sunby found 5 in Brown County on September 10, and Korducki found 5 in Brown County on September 16.

Little Blue Heron.—Reported by Frank in Brown County on August 3, by Hoeft in Marathon County on August 16, 2 immatures by Korducki in Brown County on September 16, and by Tessen in Brown County on September 17.

Tricolored Heron.—Reported by Frank and Woodmansee in Brown County on August 3, by Sunby in Brown County on September 10, and by Korducki in Brown County on September 16.

Cattle Egret.—Reported by Frank and

Woodmansee in Brown County on August 3, by Sunby in Brown County on September 10 and Korducki found 23 in Brown County on September 16.

Green-backed Heron.—Found throughout the state at the beginning of the period. Belter found 14 in Marathon County on August 11. Last reported by the Smiths in St. Croix County on October 15.

Black-crowned Night-Heron.—Reported at the beginning of the period in Brown, Clark, Dodge, Door, Shawano, and Winnebago Counties. Sontag found 14 in Manitowoc County on August 30. Last reported by Williams in Kenosha County on November 18.

Yellow-crowned Night-Heron.—The Sheas found an immature in Ozaukee County on November 4.

Glossy Ibis.—One was found by Kemper and Polk at the Trempealeau National Wildlife Refuge in Trempealeau County on November 19. This record was accepted by the Records Committee. See By the Wayside.

Trumpeter Swan.—Tessen found one in Brown County on August 8 and 22. Lead shot from many years of hunting will be a major obstacle to the successful reintroduction of this species in Wisconsin.

Tundra Swan.—Reported at the beginning of the period in Burnett County by Hoefler. Soulen reported 1000 in Buffalo County on November 4. Found at the end of the period in Dane, Milwaukee, and Winnebago Counties.

Mute Swan.—Found at the beginning of the period in Ashland, Bayfield, and Dane Counties. Berner found 6 in Portage County on November 4. Reported at the end of the period in Ashland, Bayfield, Dane, Portage, and Shawano Counties.

Greater White-fronted Goose.—Reported by Hoefler in Burnett County on September 18 and by the Gangers in Wood County on October 7.

Snow Goose.—First reported by Lehman in Racine County on September 13. Hoefler found 300 in Burnett County on October 16. Last reported by Mead in Brown County on November 26.

Canada Goose.—Reported throughout the state at the beginning of the period. 228,000 were reported at Horicon National Wildlife Refuge on November 2 and 567,800 were reported in East-Central Wisconsin on November 9. Reported at the end of the period north to Burnett, Bayfield, Ashland, and Door Counties.

Wood Duck.—Found throughout the state at the beginning of the period. Ziebell found 150 in Winnebago County on October 7. Reported at the end of the period in Chippewa and Shawano Counties.

Green-winged Teal.—Reported at the beginning of the period in Ashland, Barron, Bayfield, Burnett, Chippewa, Clark, Dane, and Dodge Counties. The Smiths found 112 in St. Croix County on October 1. Last reported by the Smiths in St. Croix County on November 13.

American Black Duck.—Found at the beginning of the period in Ashland, Bayfield, Dodge, Door, Manitowoc, Oneida, and Sawyer Counties. Ziebell found 85 in Winnebago County on November 30. Reported in scattered areas throughout the state at the end of the period.

Mallard.—Found throughout the state during the period. Martin reported 6000 in Columbia County on November 12.

Northern Pintail.—Reported in Ashland, Bayfield, Burnett, Marinette, and Shawano Counties at the beginning of the period. Martin found 125 in Columbia County on October 28. Reported at the end of the period in Dane and Shawano Counties.

Blue-winged Teal.—Found throughout the state at the beginning of the period. Robinson found 200 in Burnett County on August 26. Last reported by Bontly in Milwaukee County on November 20.

Northern Shoveler.—Reported at the beginning of the period in Ashland, Bayfield, Burnett, Chippewa, Dodge, and Marinette Counties. Ashman found 115 in Dane County on November 15. Reported at the end of the period in Dane County by Ashman, Hansen, and Robbins.

Gadwall.—Reported at the beginning of the period in Burnett County by Hoefler. Polk found 150 in Chippewa County on October 13. Found at the end of the period in Dane and Green Lake Counties.

American Wigeon.—Reported at the beginning of the period in Burnett County by Hoefler. Ziebell found 600 in Winnebago County on October 27. Reported at the end of the period in Dane County by Ashman, Cederstrom, Hansen, and Robbins.

Canvasback.—First reported by Tessen in Ozaukee County on September 30. Volkert reported a mid–October to November peak of over 900 in the Horicon National Wildlife Refuge. Reported at the end of the period in Dane, Jefferson, and Walworth Counties.

Redhead.—Reported at the beginning of the period in Ashland, Bayfield, Dodge, and Winnebago Counties. Belter found 7 in Marathon County on November 8 and Hale found 7 in Jefferson County on November 21. Found at the end of the period in Dane and Jefferson Counties.

Ring-necked Duck.—Reported at the beginning of the period in Burnett County by Hoefler. Belter found 100 in Marathon County on October 29. Reported at the end of the period in Bayfield, Jefferson, and Shawano Counties.

Greater Scaup.—First reported by Semo in Douglas County on August 6. Woodmansee found 2000 in Milwaukee County on October 12. Found at the end of the period in Door, Milwaukee, Sheboygan, and Winnebago Counties.

Lesser Scaup.—Reported at the beginning of the period in Ashland, Bayfield, Chippewa, Dunn, and Manitowoc Counties. Tessen found 1000 in Ozaukee County on November 4. Reported at the end of the period in Chippewa, Dane, Eau Claire, Green Lake, Jefferson, Manitowoc, Walworth, and Winnebago Counties.

Harlequin Duck.—Reported by Sunby in Milwaukee County on October 28 and November 5 and 14, by Soulen in Milwaukee County on November 3, by Tessen in Milwaukee County on November 4, by Williams in Milwaukee County on November 18, and by Schultz in Sheboygan County on November 25.

Oldsquaw.—First reported by Verch in Ashland/Bayfield Counties on October 16. Williams found 8 in Milwaukee County on October 22. Reported at the end of the period in Manitowoc County by Sontag.

Black Scoter.—First reported by Tessen in Ozaukee County on September 30. Tessen found 102 in Ozaukee County on October 21. Last reported by Sunby in Milwaukee County on November 23.

Surf Scoter.—First reported by Tessen in Ozaukee County on September 23. Tessen found 25 in Ozaukee County on October 21. Last reported by Sunby in Milwaukee County on November 15.

White-winged Scoter.—First reported by Hale in Jefferson County on October 4. Tessen found 45 in Ozaukee County on October 21. Last reported by Robinson in Sawyer County on November 19.

Common Goldeneye.—Robinson reported 3 young at Round Lake in Sawyer County at the beginning of the period. Ashman found 500 in Dane County on November 23. Reported at the end of the period in scattered areas throughout the state.

Bufflehead.—Reported at the beginning of the period in Ashland/Bayfield Counties by Verch. Verch reported over 1000 in Ashland and Bayfield Counties on November 4. Found at the end of the period in Chippewa, Dane, Jefferson, Manitowoc, Milwaukee, Sheboygan, Walworth, and Winnebago Counties.

Hooded Merganser.—Reported at the beginning of the period in Ashland, Barron, Bayfield, and Clark Counties. The Smiths found 148 in St. Croix County on October 22. Reported at the end of the period in Dane and Portage Counties.

Common Merganser.—Reported at the beginning of the period in Ashland/Bayfield Counties by Verch. Ziebell found 220 in Winnebago County on November 21. Found in scattered areas throughout the state at the end of the period.

Red-breasted Merganser.—Found at the beginning of the period in Ashland, Bayfield, Door, and Oneida Counties. Bontly found 1000

in Milwaukee County on October 30. Reported at the end of the period in Bayfield, Dane, Door, Manitowoc, and Milwaukee Counties.

Ruddy Duck.—Reported at the beginning of the period in Burnett, Chippewa, Columbia, Dodge, Dunn, Manitowoc, and Winnebago Counties. Sunby found 88 in Milwaukee County on October 25. Found at the end of the period in Dane, Walworth, and Winnebago Counties.

Black Vulture.—Hartman found one at Devils Lake State Park in Sauk County on October 7 and 15. These sightings were accepted by the Records Committee. See By the Wayside.

Turkey Vulture.—Reported throughout the state at the beginning of the period. Martin found 50 in Columbia County on September 14. Last reported by P. Risch in Taylor County on November 19.

Osprey.—Reported at the beginning of the period south to Barron, Taylor, and Shawano County. Tessen found 12 in Oneida County on August 17. Last reported on November 11 in Sheboygan County by Berger and the Brassers.

Black-shouldered Kite.—Savage found one in Burnett County on September 9. This sighting was accepted by the Records Committee. See By the Wayside.

Bald Eagle.—Reported at the beginning of the period south to Dunn, Eau Claire, Clark, and Marinette Counties. Tessen found 5 in Oneida County on August 17. Found at the end of the period south to Jackson, Dane, and Green Lake Counties.

Northern Harrier.—Found at the beginning of the period south to Eau Claire, Green Lake, and Dodge Counties. The Smiths found 11 in St. Croix County on September 17. Reported at the end of the period in Burnett, Clark, Dodge, Green lake, Portage, and Richland Counties.

Sharp-shinned Hawk.—Reported in scattered areas throughout the state at the beginning of the period. Robinson found 12 in Grant County on September 28. Found at the end of the period in Clark, Door, Green Lake, Marathon, and Walworth Counties.

Cooper's Hawk.—Found at the beginning of the period in scattered areas throughout the state. Erdman found 7 in Oconto County on October 2. Found at the end of the period in Clark, Green Lake, and Portage Counties.

Northern Goshawk.—Reported at the beginning of the period in Door and Marathon Counties. Reported at the end of the period in Door and Langlade Counties.

Red-shouldered Hawk.—Reported at the beginning of the period in Outagamie and Polk Counties. Berger found 9 in Sheboygan County on November 10. Last reported by Tessen in Ozaukee County on November 11.

Broad-winged Hawk.—Found at the beginning of the period south to Dunn, Eau Claire, Shawano, and Door Counties. Erdman reported 1210 in Oconto County on September 26. Last reported by Erdman in Oconto County on October 12.

Swainson's Hawk.—Reported by the Smiths in St. Croix County on August 13, by Erdman in Oconto County on August 20, and by Berger in Sheboygan County on September 30.

Red-tailed Hawk.—Found throughout the state at the beginning of the period. Erdman found 195 in Oconto County on November 11. Reported at the end of the period north to Burnett, Barron, Chippewa, Taylor, Outagamie, and Brown Counties.

Rough-legged Hawk.—First reported by Ziebell in Winnebago County on October 7. Erdman found 20 in Oconto County on November 10. Reported at the end of the period in scattered areas throughout the state.

Golden Eagle.—Reported by Woodmansee in Ozaukee County on September 23, by Robinson in Burnett County on October 13, by Erdman in Oconto County on October 17 and November 12, by Bontly and Woodmansee in Milwaukee County on November 6, by Hanbury in Ozaukee County on November 8, and by the Sheas in Ozaukee County on November 10.

American Kestrel.—Found throughout the state at the beginning of the period. The Smiths found 20 in St. Croix County on September 10. Reported at the end of the period

north to Burnett, Barron, Chippewa, Taylor, Portage, and Brown Counties.

Merlin.—Reported at the beginning of the period in Ashland/Bayfield Counties by Verch. Berger found 69 in Sheboygan County on October 2. Last reported by Johnson in Douglas County on November 27.

Peregrine Falcon.—First reported by Hansen in Dane County on August 25. Berger found 10 in Sheboygan County on September 25. Last reported by Bontly in Milwaukee County on November 26.

Prairie Falcon.—Hoppa and Semo found one in Portage County on November 30. This sighting was accepted by the Records Committee. See By the Wayside.

Gyrfalcon.—Berger reported that one was trapped, telemetered, and photographed at Cedar Grove Ornithological Station in Sheboygan County on November 11.

Gray Partridge.—Reported during the period in Marinette, St. Croix, and Shawano Counties. The Smiths found 21 in St. Croix County on October 22.

Ring-necked Pheasant.—Reported during the period north to Burnett, Douglas, Sawyer, Taylor, Marinette, and Door Counties. The Smiths found 10 in St. Croix County on October 22.

Spruce Grouse.—Reported by Tessen in Oneida County on August 17, 3 by Polk in Oneida County on September 2, by Sunby in Oneida County on September 9, by Robinson in Bayfield County on October 15 and November 25, and by Verch in Ashland/Bayfield Counties on October 18.

Ruffed Grouse.—Found during the period south to Vernon, Lafayette, Dane, and Sheboygan Counties. Merkel found 18 in Sawyer County on September 17.

Greater Prairie-Chicken.—Reported during the period in Burnett, Clark, Marathon, and Portage Counties. Belter found 32 in Marathon County on October 29.

Sharp-tailed Grouse.—Found during the period in Burnett, Douglas, and Taylor Counties. Robinson found 11 in Burnett County on November 4.

Wild Turkey.—Reported during the period in Grant, Jackson, Juneau, La Crosse, Marinette, Monroe, Richland, and Vernon Counties. Duerksen found 19 in Richland County on October 26.

Northern Bobwhite.—Reported during the period in Dunn, Eau Claire, Marathon, Monroe, Portage, and Richland Counties. Duerksen found 17 in Richland County on November 26.

Virginia Rail.—Found at the beginning of the period in Ashland, Bayfield, and Dane Counties. P. Risch found 3 in Taylor County on September 14. Diehl reported an injured individual in Milwaukee County on November 1.

Sora.—Reported at the beginning of the period in scattered areas throughout the state. Ashman found 8 in Dane County on August 13. Last reported by Sontag in Manitowoc County on October 25.

Common Moorhen.—Found at the beginning of the period in Columbia, Dane, and Marinette Counties. Ashman found 7 in Dane County on September 16. Last reported by Robbins in Dane County on October 3.

American Coot.—Found at the beginning of the period in scattered areas throughout the state. Peterson found 2000 in Shawano County on November 1 and Ashman found 2000 in Dane County on November 5. Reported at the end of the period in Dane, Eau Claire, Jefferson, Milwaukee, Walworth, and Winnebago Counties.

Sandhill Crane.—Reported at the beginning of the period north to Burnett, Price, Langlade, Marinette, and Door Counties. Belter found 100 in Marathon County on August 20. Last reported by Parsons in Walworth County on November 25.

Black-bellied Plover.—First reported by Henning and Mueller in Milwaukee County on August 7. Belter found 23 in Marathon County on October 29. Last reported by Belter in Marathon County on November 12.

Lesser Golden-Plover.—First reported by P. Risch in Clark County on August 18. Ashman found 82 in Dane County on September 10. Last reported by Polk in Dunn and Eau Claire Counties on November 1.

Semipalmated Plover.—Found at the beginning of the period in Clark, Dane, Eau Claire, and Manitowoc Counties. Robinson found 12 in Douglas County on September 2. Last reported by Sontag in Manitowoc County on October 25.

Piping Plover.—Belter found one at Sheboygan Point in Sheboygan County on October 22.

Killdeer.—Found throughout the state at the beginning of the period. P. Risch found a leucistic individual in Clark County on August 27. Tessen found 100 in Winnebago County on August 14. Last reported by Polk in Chippewa County on November 20.

Greater Yellowlegs.—Reported at the beginning of the period in Brown, Chippewa, Clark, Door, Dunn, Eau Claire, Manitowoc, and Milwaukee Counties. Robinson found 26 in Douglas County on October 29. Last reported on November 12 in Clark County by L. Risch and in Marathon County by Belter.

Lesser Yellowlegs.—Found at the beginning of the period in scattered areas throughout the state. Belter found 40 in Marathon County on August 20 and Tessen found 40 in Brown County on August 22. Last reported by Verch in Ashland/Bayfield Counties on November 13.

Solitary Sandpiper.—Reported at the beginning of the period in scattered areas throughout the state. Belter found 21 in Marathon County on August 27. Last reported by Robinson in Sawyer County on October 25.

Spotted Sandpiper.—Found throughout the state at the beginning of the period. The Smiths found 7 in St. Croix County on August 20 and Belter found 7 in Marathon County on September 4. Last reported by Sontag in Manitowoc County on November 2.

Upland Sandpiper.—Reported at the beginning of the period in Ashland, Bayfield, and Milwaukee Counties. Robinson found 20 in Milwaukee County on August 4. Last reported by Polk in Eau Claire County on August 7.

Whimbrel.—Reported by Johnson in Douglas County on August 26, by Sontag in Manitowoc County on September 11, and by Lehman in Milwaukee County on September 13.

Marbled Godwit.—Reported by P. Risch in Clark County on August 28.

Hudsonian Godwit.—Reported by P. Risch in Clark County on August 28, by Tessen in Milwaukee County on September 30, and by Ashman in Columbia County on October 15.

Ruddy Turnstone.—First reported by Sontag in Manitowoc County on August 16. Last reported by Sontag in Manitowoc County on September 16.

Red Knot.—Reported by Tessen in Milwaukee County on August 15 and in Brown County on August 22.

Sanderling.—Reported at the beginning of the period in Douglas County by Johnson. Robinson found 34 in Douglas County on September 2. Last reported on November 4 in Milwaukee County by Tessen and in Sheboygan County by the Brassers.

Semipalmated Sandpiper.—Found at the beginning of the period in Brown, Chippewa, Clark, Dane, Dunn, Eau Claire, Manitowoc, Shawano, and Taylor Counties. Sontag found 25 in Manitowoc County on September 15. Last reported by Tessen in Sheboygan County on November 4.

Western Sandpiper.—Reported by Robbins in Dane County on August 16, by Tessen in Manitowoc County on August 22, by Williams in Milwaukee County on August 26, and by P. Risch in Clark County on August 27.

Least Sandpiper.—Found at the beginning of the period in scattered areas throughout the state. Belter found 50 in Manitowoc County on August 27. Last reported by Hansen in Dane County on October 12.

White-rumped Sandpiper.—Reported at the beginning of the period in Clark and Taylor Counties by P. Risch. Last reported by Polk in Chippewa County on November 9.

Baird's Sandpiper.—Found at the begin-

ning of the period in Chippewa, Clark, Douglas, Dunn, and Eau Claire Counties. Polk found 12 in Dunn County on November 1. Polk reported a very late individual in Eau Claire County at the end of the period.

Pectoral Sandpiper.—Reported in scattered areas throughout the state at the beginning of the period. Sunby found 27 in Milwaukee County on September 23. Last reported by Verch in Ashland/Bayfield Counties on November 7.

Dunlin.—First reported by Sunby and Tessen in Milwaukee County on September 23. Sontag found 43 in Manitowoc County on October 28. Last reported on November 18 in Manitowoc County by Sontag and in Milwaukee County by Sunby.

Stilt Sandpiper.—Reported at the beginning of the period in Dane County by Hansen. Sontag found 5 in Manitowoc County on August 31. Last reported by Hansen in Dane County on September 30.

Buff-breasted Sandpiper.—First reported on August 4 in Milwaukee County by Robinson. Semo found 4 in Douglas County on August 5 and Polk found 4 in Eau Claire County on August 5. Last reported on September 17 in Douglas County by Bontly and Johnson. Also reported in Clark, Dane, Racine, and Winnebago Counties.

Short-billed Dowitcher.—Found at the beginning of the period in Ashland, Bayfield, Clark, Dunn, and Milwaukee Counties. Tessen found 20 in Brown County on August 8 and 20 in Milwaukee County on August 15.

Long-billed Dowitcher.—Reported at the beginning of the period in Clark County by P. Risch. Berner found 8 in Portage County on September 29. Last reported by Berner in Portage County on October 26.

Common Snipe.—Reported at the beginning of the period south to Dunn, Eau Claire, Winnebago, and Manitowoc Counties. The Smiths found 45 in St. Croix County on October 29. Found at the end of the period in Ashland, Bayfield, Manitowoc, and Polk Counties.

American Woodcock.—Found at the beginning of the period south to Barron, Clark, Marathon, and Door Counties. Berner found 6 in Portage County on October 6. Last reported by Semo in Douglas County on November 3.

Wilson's Phalarope.—Reported at the beginning of the period in Brown, Burnett, Clark, and Dunn Counties. Tessen found 5 in Brown County on August 22. Last reported by Hoefler in Burnett County on September 20.

Red-necked Phalarope.—First reported by Hansen in Dane County on August 24. Last reported by Robbins in Dane County on September 13. Also reported in Clark and Eau Claire Counties.

Parasitic Jaeger.—Lehman found an immature in Milwaukee County on September 13 and Tessen found an adult in Ozaukee County on October 21.

Franklin's Gull.—Reported by Henning and Mueller in Milwaukee County on August 7 and by Polk in Chippewa County on October 4.

Little Gull.—Reported by Hanbury in Milwaukee County on August 1, 2 by Tessen in Manitowoc County on August 13, and by Lehman in Milwaukee County on September 13.

Bonaparte's Gull.—Found at the beginning of the period in Ashland, Bayfield, Burnett, Door, Manitowoc, and Sheboygan Counties. Sontag found 230 in Manitowoc County on August 3. Reported at the end of the period in Milwaukee County by Sunby.

Ring-billed Gull.—Found throughout the state during the period. Hale found 2000 in Jefferson County on November 12.

Herring Gull.—Reported throughout the state during the period. Ziebell found 1200 in Winnebago County on November 30.

Lesser Black-backed Gull.—Robbins found one in Sauk County on November 6 and the Brassers and Harriman found one in Sheboygan County on November 11. These sightings were accepted by the Records Committee. See By the Wayside.

Glaucous Gull.—Reported from November 4 to the end of the period in Douglas County

by Johnson, on November 6 in Sauk County by Robbins, on November 13 in Columbia County by Ashman, and on November 23 in Milwaukee County by Sunby.

Caspian Tern.—Reported at the beginning of the period in Ashland, Bayfield, Door, Manitowoc, and Sheboygan Counties. Tessen found 50 in Manitowoc County on August 13. Last reported by Belter in Marathon County on November 2.

Common Tern.—Found at the beginning of the period in Ashland, Bayfield, Douglas, Manitowoc, and Winnebago Counties. Hoefler found 20 in Burnett County on September 20. Last reported by Tessen in Milwaukee County on November 11.

Forster's Tern.—Reported at the beginning of the period in Brown, Dodge, Manitowoc, Shawano, and Winnebago Counties. Johnson found 30 in Douglas County on September 16. Last reported on September 30 in Crawford County by Robbins and in Douglas County by Johnson.

Black Tern.—Reported at the beginning of the period in Ashland, Bayfield, Columbia, Dane, Dodge, Douglas, Jefferson, Manitowoc, and Winnebago Counties. Ashman found 23 in Columbia County on August 5. Last reported by Verch in Ashland/Bayfield Counties on September 26.

Rock Dove.—Found throughout the state during the period. Diehl found 300 in Milwaukee County on November 3.

Mourning Dove.—Reported throughout the state during the period. Ziebell found 376 in Winnebago County on September 11.

Black-billed Cuckoo.—Reported at the beginning of the period in Barron, Burnett, Chippewa, Columbia, and Douglas Counties. Last reported by Diehl in Milwaukee County on September 22.

Yellow-billed Cuckoo.—Reported at the beginning of the period in Taylor County by Offord. Last reported by Woodmansee in Milwaukee County on September 7.

Eastern Screech-Owl.—Found during the period in Dane, Green Lake, Jefferson, Milwaukee, Monroe, Portage, Richland, Sheboygan, Walworth, Washington, and Winnebago Counties. Diehl found 3 in Milwaukee County on October 20.

Great Horned Owl.—Reported throughout the state during the period. Hale found 3 in Jefferson County on September 7 and Mead found 3 in Brown County on November 12.

Snowy Owl.—Reported by Verch in Ashland/Bayfield Counties on October 24 and by Ziebell in Winnebago County on November 30.

Barred Owl.—Reported during the period south to Crawford, Richland, Green Lake, and Sheboygan Counties. Merkel found 8 in Sawyer County on September 16.

Long-eared Owl.—Reported throughout the period in Clark County by L. Risch, on September 26, October 24, and November 1 in Oconto County by Erdman, on October 7 and November 20 in Sheboygan County by Berger, on October 29 in Taylor County by P. Risch, and on November 2 in Manitowoc County by Sontag.

Short-eared Owl.—Reported by Hanbury in Milwaukee County on August 24, by Robinson in Sawyer County on September 25, by the Smiths in St. Croix County on October 14, by Sunby in Milwaukee County on October 28, by P. Risch in Taylor County on November 22, and by L. Risch in Clark County at the end of the period.

Northern Saw-whet Owl.—First reported on September 23 at the Little Suamico Banding Station in Oconto County and at the Linwood Springs Banding Station in Portage County. 35 were seen at the Cedar Grove Ornithological Station in Sheboygan County on November 2, 48 were seen at the Linwood Springs Banding Station in Portage County on October 7, and 80 were seen at the Little Suamico Banding Station in Oconto County on November 2. Reported at the end of the period at the Little Suamico Banding Station.

Common Nighthawk.—Found throughout the state at the beginning of the period. Berger reported 2300 in Sheboygan County on August 29. Last reported by Diehl in Milwaukee County on October 15.

Whip-poor-will.—Reported at the beginning of the period in Burnett, Door, Price, and Shawano Counties. Last reported by Sontag in Manitowoc County on October 4.

Chimney Swift.—Reported throughout the state at the beginning of the period. Hardy found 300 in Price County on August 16. Last reported by Bontly in Milwaukee County on October 9.

Ruby-throated Hummingbird.—Found at the beginning of the period south to Richland, Dane, Walworth, and Milwaukee Counties. Erdman found 25 in Oconto County on August 29. Last reported by Bontly in Milwaukee County on November 3.

Rufous Hummingbird.—Schmitz saw one in Milwaukee County on August 8. This sighting was accepted by the Records Committee. See By the Wayside.

Belted Kingfishers.—Reported at the beginning of the period throughout the state. The Smiths found 6 in St. Croix County on September 10. Reported at the end of the period in Chippewa, Columbia, Richland, and St. Croix Counties.

Red-headed Woodpecker.—Found throughout the state at the beginning of the period. Robinson found 18 in Grant County on September 28. Reported at the end of the period in Barron, Chippewa, Clark, Dane, and Portage Counties.

Red-bellied Woodpecker.—Reported during the period north to Burnett, Bayfield, Ashland, Langlade, Marinette, and Door Counties. Ziebell found 4 in Winnebago County on August 31, Berner found 4 in Portage County on October 24, and the Smiths found 4 in St. Croix County on October 29.

Yellow-bellied Sapsucker.—Reported at the beginning of the period south to St. Croix, Dunn, Eau Claire, Clark, Shawano, and Door Counties. Sontag found 8 in Manitowoc County on September 28 and Tessen found 8 in Milwaukee County on September 30. Reported at the end of the period in Dunn County by Raile.

Downy Woodpecker.—Found throughout the state during the period. The Smiths found 18 in St. Croix County on October 15.

Hairy Woodpecker.—Reported throughout the state during the period. The Smiths found 9 in St. Croix County on October 15.

Black-backed Woodpecker.—Reported by Tessen in Forest County on August 17, by Korducki in Oneida County on September 10, and by Merkel in Sawyer County on November 19.

Northern Flicker.—Found throughout the state at the beginning of the period. Richter found 24 in Monroe County on September 11. Reported at the end of the period in Clark, Dane, Dunn, and Outagamie Counties.

Pileated Woodpecker.—Reported during the period south to Crawford, Richland, Sauk, Dane, and Sheboygan Counties. Berner found 7 in St. Croix County on August 27.

Olive-sided Flycatcher.—Reported by Tessen in Forest County on August 1. Last reported by Polk in Dunn County on September 15.

Eastern Wood-Pewee.—Found throughout the state at the beginning of the period. Ashman found 10 in Dane County on August 26. Last reported by Ashman in Dane County on October 2.

Yellow-bellied Flycatcher.—Reported at the beginning of the period in Douglas County by Johnson. Woodmansee found 4 in Milwaukee County on September 29, which was also the latest report.

Alder Flycatcher.—Found at the beginning of the period in Ashland, Bayfield, Columbia, Door, Douglas, Forest, Langlade, and Shawano Counties. Last reported by Kemper in Chippewa County on September 22.

Willow Flycatcher.—Reported at the beginning of the period in Brown, Dane, and Shawano Counties. Ashman found 3 in Dane County on August 6. Last reported by Hardy in Price County on September 11.

Least Flycatcher.—Found at the beginning of the period south to Monroe, Shawano, and Door Counties. Merkel found 6 in Sawyer County on August 27. Last reported by Kemper in Chippewa County on September 22.

Eastern Phoebe.—Reported in scattered areas throughout the state at the beginning of the period. Berner found 12 in Portage County on September 23. Last reported by Ashman in Dane County on November 13.

Great Crested Flycatcher.—Found throughout the state at the beginning of the period. The Smiths found 4 in St. Croix County on August 13 and Ashman found 4 in Dane County on August 18. Last reported on September 17 in Door County by the Lukes and in Douglas County by Johnson and Bontly.

Western Kingbird.—Reported by Ashman in Dane County on August 27 and by Merkel in Marathon County on September 15.

Eastern Kingbird.—Found throughout the state at the beginning of the period. The Smiths found 43 in St. Croix County on August 20. Last reported by Ziebell in Winnebago County on September 20.

Scissor-tailed Flycatcher.—Reported by Kersten and Peterson in Shawano County on October 1 and by Hanson and Verch in Bayfield County on October 14. These sightings were accepted by the Records Committee. See By the Wayside.

Horned Lark.—Found at the beginning of the period in scattered areas throughout the state. Belter found 17 in Marathon County on October 1. Reported at the end of the period north to Burnett, Taylor, Marathon, and Door Counties.

Purple Martin.—Reported throughout the state at the beginning of the period. Woodmansee found 2000 in Milwaukee County on August 29. Last reported by Ziebell in Winnebago County on September 25.

Tree Swallow.—Found throughout the state at the beginning of the period. Robbins reported over 10,000 in Crawford County on September 30. Last reported by Ashman in Columbia County on October 15.

Northern Rough-winged Swallow.—Reported at the beginning of the period in scattered areas throughout the state. Hale reported over 20 in Jefferson County on August 6. Last reported by Robinson in Grant County on September 28.

Bank Swallow.—Found at the beginning of the period north to Polk, Barron, Taylor, Langlade, and Marinette Counties. Belter found 125 in Marathon County on August 13. Last reported by Tessen in Ozaukee County on September 23.

Cliff Swallow.—Reported at the beginning of the period south to Sauk, Columbia, and Sheboygan Counties. Merkel found 250 in Wood County on August 28. Last reported by Frank in Milwaukee County on September 24.

Barn Swallow.—Found throughout the state at the beginning of the period. Belter found 150 in Marathon County on August 20. Last reported by Henning and Mueller in Ozaukee County on November 5.

Gray Jay.—Reported during the period in Forest, Oneida, Price, Sawyer, and Vilas Counties. Hardy reported a maximum of 11 in Price County during the period. Polk found 8 in Oneida County on September 2.

Blue Jay.—Found throughout the state during the period. The Smiths found 64 in St. Croix County on September 17.

American Crow.—Reported throughout the state during the period. The Lukes found 500 in Door County on October 17.

Common Raven.—Found during the period in its usual range south to Polk, Eau Claire, Clark, Portage, Shawano, and Door Counties. Also reported in November in Sheboygan County by Berger and the Kuhns. Merkel found 12 in Sawyer County on November 21.

Black-capped Chickadee.—Found throughout the state during the period. Belter found 62 in Marathon County on November 26.

Boreal Chickadee.—Reported during the period in Bayfield, Forest, and Oneida Counties. Polk found 12 in Oneida County on September 2.

Tufted Titmouse.—Found during the period in Chippewa, Dane, Dunn, Eau Claire, Richland, and St. Croix Counties. The Smiths found 3 in St. Croix County on November 13.

Red-breasted Nuthatch.—Reported at

the beginning of the period south to Dane and Milwaukee Counties. Robinson found 21 in Sawyer County on September 10. Found throughout the state at the end of the period.

White-breasted Nuthatch.—Found throughout the state at the beginning of the period. The Smiths found 26 in St. Croix County on October 9.

Brown Creeper.—Reported at the beginning of the period south to Dunn, Eau Claire, and Green Lake Counties. Tessen found 10 in Ozaukee County on September 30. Found in scattered areas throughout the state at the end of the period.

Carolina Wren.—Reported by Robbins in Dane County on August 31 and September 4, by Hansen in Dane County on September 1, October 3 and 12, by Sontag in Manitowoc County on September 6 and November 2, and by Ashman in Dane County on November 12.

House Wren.—Found throughout the state at the beginning of the period. Ashman found 9 in Dane County on August 18. Last reported by Cederstrom in Dane County on October 21.

Winter Wren.—Reported at the beginning of the period south to Taylor, Marathon, Shawano, and Door Counties. Sontag found 5 in Manitowoc County on October 17. Reported at the end of the period in Dane County by Ashman.

Sedge Wren.—Found at the beginning of the period south to Columbia and Dane Counties. The Smiths found 7 in St. Croix County on August 13. Last reported by L. Risch in Clark County on September 24.

Marsh Wren.—Reported in scattered areas throughout the state at the beginning of the period. Ziebell found 6 in Winnebago County on November 4, which was also the latest report.

Golden-crowned Kinglet.—Found at the beginning of the period in Douglas and Sawyer Counties. Tessen found 40 in Ozaukee County on October 21. Reported at the end of the period north to Sawyer, Taylor, and Marathon Counties.

Ruby-crowned Kinglet.—Reported at the beginning of the period in Ashland, Bayfield, and Taylor Counties. The Smiths found 50 in St. Croix County on October 9. Reported at the end of the period in Milwaukee County by Zehner.

Blue-gray Gnatcatcher.—Found at the beginning of the period in Dane, Outagamie, Polk, and Richland Counties. Last reported by Zehner in Milwaukee County on September 4.

Eastern Bluebird.—Reported at the beginning of the period south to Richland, Sauk, Dane, and Walworth Counties. Erdman reported 150 in Oconto County on November 1, and 86 in Oconto County on September 26. Reported at the end of the period in Chippewa and Green Lake Counties.

Veery.—Reported at the beginning of the period south to Dane County. Last reported on October 7 in Milwaukee County by Woodmansee.

Gray-cheeked Thrush.—First reported by Wierzbicki in Brown County on August 31. Sontag found 4 in Manitowoc County on September 29. Last reported by Woodmansee in Ozaukee County on October 22.

Swainson's Thrush.—Reported at the beginning of the period in Langlade and Taylor Counties. Sontag found 28 in Manitowoc County on September 8. Last reported by Anderson and Petznick in Outagamie County on October 12.

Hermit Thrush.—Reported at the beginning of the period south to Eau Claire and Sheboygan Counties. Tessen found 40 in Ozaukee County on September 30. Last reported by Woodmansee in Milwaukee County on November 27.

Wood Thrush.—Found at the beginning of the period north to Price, Langlade, Marinette, and Door Counties. Belter found 5 in Marathon County on August 27. Last reported by Bontly in Milwaukee County on October 18.

American Robin.—Found throughout the state at the beginning of the period. Diehl found 300 in Milwaukee County on October 15. Found in scattered areas throughout the state at the end of the period.

Varied Thrush.—Krause reported a male at her feeder near New London in Outagamie County on November 29.

Gray Catbird.—Found throughout the state at the beginning of the period. Berner found 20 in Portage County on September 16. Last reported by Ashman in Dane County on November 25.

Northern Mockingbird.—Reported by the Lukes in Door County on August 31 and by Anderson in Waupaca County on November 17.

Brown Thrasher.—Found throughout the state at the beginning of the period. Ashman found 25 in Dane County on September 25. Last reported by Sontag in Manitowoc County on October 30.

Water Pipit.—First reported by Johnson and Bontly in Douglas County on September 17. Robinson found 31 in Burnett County on October 13. Last reported by Polk in Chippewa County on October 30.

Bohemian Waxwing.—First reported by Verch in Ashland/Bayfield Counties on October 19. Hardy found 300 in Price County on October 24. Reported at the end of the period in Ashland, Bayfield, Price, and Sawyer Counties.

Cedar Waxwing.—Found throughout the state at the beginning of the period. Ashman found 300 in Dane County on October 7. Found in scattered areas throughout the state at the end of the period.

Northern Shrike.—First reported by Robinson in Burnett County on October 13. Erdman reported 3 in Oconto County on October 31 and Pickering reported 3 in Langlade County on November 30. Reported at the end of the period south to Monroe and Green Lake Counties.

Loggerhead Shrike.—Reported by Ziebell in Winnebago County on August 15 and 16.

European Starling.—Found throughout the state during the period. Belter found 1000 in Marathon County on September 4.

Solitary Vireo.—Reported at the beginning of the period in Barron, Sawyer, Shawano, and Taylor Counties. The Smiths found 13 in St. Croix County on September 17. Last reported by the Smiths in St. Croix County on October 9.

Yellow-throated Vireo.—Reported at the beginning of the period in Chippewa, Dane, Dunn, Eau Claire, Monroe, Richland, and Shawano Counties. Peterson found 5 in Shawano County on September 13. Last reported by the Kuhns in Sheboygan County on October 1.

Warbling Vireo.—Found in scattered areas throughout the state at the beginning of the period. Belter found 5 in Marathon County on August 27. Last reported by Goff in Barron County on September 22.

Philadelphia Vireo.—First reported by Johnson in Douglas County on August 15. Last reported by Zehner in Milwaukee County on October 1.

Red-eyed Vireo.—Found throughout the state at the beginning of the period. The Smiths found 22 in St. Croix County on August 27. Last reported by Kemper in Chippewa County on October 7.

Blue-winged Warbler.—Reported at the beginning of the period in Dane, Dunn, Eau Claire, and Richland Counties. Last reported by Kemper in Chippewa County on September 8.

Golden-winged Warbler.—Found at the beginning of the period in Barron, Chippewa, Douglas, Dunn, Eau Claire, Price, and Sawyer Counties. Berner found 4 in St. Croix County on August 26 and Belter found 4 in Marathon County on September 5. Last reported by Kemper in Chippewa County on September 22.

Brewster's Warbler.—Berner saw 2 and possibly 3 along the Willow River in St. Croix County on August 26.

Tennessee Warbler.—Reported at the beginning of the period in Ashland, Bayfield, and Douglas Counties. Belter found 25 in Marathon County on September 13. Last reported by Tessen in Ozaukee County on October 21.

Orange-crowned Warbler.—First reported by Sontag in Manitowoc County on Sep-

tember 1. The Smiths found 3 in St. Croix County on October 1, Woodmansee found 3 in Milwaukee County on October 13, and Bontly found 3 in Milwaukee County on October 14. Last reported by Williams in Milwaukee County on November 18.

Nashville Warbler.—Reported at the beginning of the period south to Dunn, Eau Claire, Shawano, and Door Counties. Robinson found 14 in Sawyer County on August 27. Last reported by Robinson in Sawyer County on October 14.

Northern Parula Warbler.—Found at the beginning of the period in Door, Sawyer, and Douglas Counties. Last reported by Belter in Marathon County on October 4.

Yellow Warbler.—Reported at the beginning of the period south to Richland, Dane, and Sheboygan Counties. Ashman found 6 in Dane County on August 13. Last reported by Berner in Portage County on September 29.

Chestnut-sided Warbler.—Reported at the beginning of the period south to Dunn, Eau Claire, Shawano, and Door Counties. Ashman found 5 in Dane County on September 10. Last reported by Polk in Eau Claire County on October 6.

Magnolia Warbler.—Reported at the beginning of the period in Ashland, Bayfield, Douglas, Sawyer, and Taylor Counties. Sontag found 14 in Manitowoc County on September 7. Last reported on October 2 in Dane County by Ashman and Robbins.

Cape May Warbler.—First reported by Verch in Ashland/Bayfield Counties on August 16. Berner found 7 in Portage County on September 9. Diehl reported an injured individual in Milwaukee County on October 20.

Black-throated Blue Warbler.—Reported at the beginning of the period in Shawano County by Peterson. Peterson found 3 in Shawano County on September 13. Last reported by Kemper in Chippewa County on October 15.

Yellow-rumped Warbler.—Reported at the beginning of the period south to Eau Claire, Clark, and Door Counties. Robinson found 103 in Crawford County on September 29. Last reported on November 25 in Dane County by Ashman and in St. Croix County by Berner.

Black-throated Gray Warbler.—Balistrieri found on in Dodge County on September 10. This sighting was accepted as a hypothetical record by the Records Committee. See By the Wayside.

Black-throated Green Warbler.—Reported at the beginning of the period in Ashland, Bayfield, Door, Douglas, Forest, Sawyer, Shawano, and Taylor Counties. Merkel found 16 in Sawyer County on September 17. Last reported by Sontag in Manitowoc County on October 10.

Blackburnian Warbler.—Reported at the beginning of the period south to Taylor, Shawano, and Door Counties. The Smiths found 7 in St. Croix County on August 27. Last reported by Berner in Portage County on September 29.

Pine Warbler.—Reported at the beginning of the period in Ashland, Bayfield, Chippewa, Door, Dunn, Eau Claire, Sawyer, and Shawano Counties. Tessen found 15 in Menominee County on August 17. Last reported on September 17 in Brown County by Tessen and in Sawyer County by Robinson.

Palm Warbler.—First reported on August 23 in Langlade County by Pickering and in Price County by Hardy. Belter found 15 in Marathon County on September 10. Last reported by Sontag in Manitowoc County on October 23.

Bay-breasted Warbler.—First reported by Kemper in Chippewa County on August 3. Berner found 15 in Portage County on September 9. Last reported by the Kuhns in Sheboygan County on October 9.

Blackpoll Warbler.—First reported by Verch in Ashland/Bayfield Counties on August 16. Sontag found 23 in Manitowoc County on September 8. Last reported by Ashman in Dane County on October 2.

Cerulean Warbler.—Reported by Robbins in Dane County on September 2, by P. Risch in Taylor County on September 6, and by the Smiths in St. Croix County on September 9.

Black-and-White Warbler.—Reported at the beginning of the period south to Dunn,

Eau Claire, Shawano, and Door Counties. Sunby found 8 in Milwaukee County on September 23. Last reported by Kemper in Chippewa County on October 3.

American Redstart.—Found at the beginning of the period south to Dunn, Eau Claire, Dane, and Manitowoc Counties. Ashman found 28 in Dane County on September 10. Last reported by the Smiths in St. Croix County on October 17.

Prothonotary Warbler.—Berner found 2 along the Willow River in St. Croix County on August 27.

Ovenbird.—Reported at the beginning of the period south to Dane and Richland Counties. Belter found 9 in Marathon County on September 5. Last reported in Chippewa County on October 13 by Kemper.

Northern Waterthrush.—Found at the beginning of the period south to Chippewa, Shawano, and Door Counties. Sontag found 5 in Manitowoc County on September 8. Last reported by Bontly in Milwaukee County on October 15.

Louisiana Waterthrush.—Reported by Robbins in Sauk County on September 2 and by Sontag in Manitowoc County on September 29.

Connecticut Warbler.—Reported at the beginning of the period in Price County by Hardy. The Smiths found 4 in St. Croix County on September 25. Last reported by the Smiths in St. Croix County on October 7.

Mourning Warbler.—Reported at the beginning of the period in Chippewa, Douglas, Dunn, Eau Claire, Price, Shawano, and Taylor Counties. Merkel found 3 in Sawyer County on August 27. Last reported by Sontag in Manitowoc County on October 13.

Common Yellowthroat.—Found throughout the state at the beginning of the period. Berner found 15 in Portage County on September 17. Last reported by Belter in Marathon County on November 7.

Wilson's Warbler.—First reported by Sontag in Manitowoc County on August 23. Last reported by Bontly in Milwaukee County on October 5.

Canada Warbler.—Found at the beginning of the period in Ashland, Bayfield, and Shawano Counties. Last reported by Sunby in Milwaukee County on September 23.

Yellow-breasted Chat.—Hardy found one in Price County on August 4.

Scarlet Tanager.—Reported at the beginning of the period south to Richland, Dane, and Sheboygan Counties. Berner found 3 in Portage County on September 10. Last reported by Schultz in Green Lake County on October 6.

Northern Cardinal.—Reported during the period north to Burnett, Bayfield, Ashland, Marinette, and Door Counties. Ashman found 18 in Dane County on November 25.

Rose-breasted Grosbeak.—Found at the beginning of the period south to Richland, Dane, and Jefferson Counties. Williams found 14 in Dane County on August 26 and the Smiths found 14 in St. Croix County on September 3. Last reported by Goff in Barron County on October 13.

Indigo Bunting.—Found throughout the state at the beginning of the period. Peterson found 48 in Shawano County on August 2. Last reported on October 7 in Dane County by Robbins and in Milwaukee County by Sunby.

Dickcissel.—Reported at the beginning of the period in Chippewa, Columbia, Dane, Dunn, Eau Claire, and Ozaukee Counties. The Smiths found 3 in St. Croix County on August 17. Last reported by the Smiths in St. Croix County on August 20.

Rufous-sided Towhee.—Reported at the beginning of the period north to Chippewa, Price, Taylor, Marinette, and Door Counties. Zehner found 3 in Milwaukee County on September 30 and Duerksen found 3 in Richland County on October 15. Last reported by Tessen in Milwaukee County on November 11.

American Tree Sparrow.—First reported by Hudick in Polk County on September 26. Robinson found 1017 in Sawyer County on November 3. Reported at the end of the period

north to Burnett, Barron, Taylor, Langlade, and Door Counties.

Chipping Sparrow.—Found throughout the state at the beginning of the period. Parsons found 235 in Walworth County on September 21. Last reported by Roy in Bayfield County on November 7.

Clay-colored Sparrow.—Found at the beginning of the period south to Columbia County. Williams found 51 in Portage County on September 10. Last reported on October 10 in Barron County by Goff, in Portage County by Berner, and in St. Croix County by the Smiths.

Field Sparrow.—Reported at the beginning of the period north to Polk, Barron, Marinette, and Door Counties. Peterson found 3 in Shawano County on August 2 and Belter found 3 in Marathon County on October 15. Last reported by Bontly in Milwaukee County on November 8.

Vesper Sparrow.—Reported at the beginning of the period north to Burnett, Marathon, Marinette, and Door Counties. Robinson found 12 in Burnett County on September 22. Last reported by the Smiths in St. Croix County on October 22.

Lark Sparrow.—Reported from the beginning of the period to August 10 in Marathon County by Hoeft.

Savannah Sparrow.—Found throughout the state at the beginning of the period. Robinson found 30 in Burnett County on August 26. Last reported by Williams in Kenosha County on November 18.

Grasshopper Sparrow.—Reported at the beginning of the period in Chippewa, Door, Dunn, Eau Claire, and Shawano Counties. Last reported on August 13 in Milwaukee County by Henning and Mueller.

Henslow's Sparrow.—Reported from the beginning of the period to August 14 in Richland County by Duerksen.

LeConte's Sparrow.—Reported by Munson in Portage County on September 10, by Robbins in Dane County on September 20, and by Tessen in Milwaukee County on September 30.

Sharp-tailed Sparrow.—Reported by Tessen in Milwaukee County on September 30.

Fox Sparrow.—First reported by the Smiths in St. Croix County on September 10. The Smiths found 24 in St. Croix County on October 15. Reported at the end of the period in Eau Claire, Jackson, and Milwaukee Counties.

Song Sparrow.—Reported at the beginning of the period throughout the state. Belter found 47 in Marathon County on August 20 and the Smiths found 47 in St. Croix County on October 15. Reported at the end of the period in Chippewa, Dane, Jefferson, Manitowoc, and Marinette Counties.

Lincoln's Sparrow.—Reported at the beginning of the period in Douglas, Marathon, and Sawyer Counties. Tessen found 25 in Milwaukee County on September 30. Last reported by Sontag in Manitowoc County on November 3.

Swamp Sparrow.—Found in scattered areas throughout the state at the beginning of the period. Belter found 24 in Marathon County on September 17. Reported at the end of the period in Dane and Manitowoc Counties.

White-throated Sparrow.—Reported at the beginning of the period south to Eau Claire, Clark, Shawano, and Door Counties. Tessen found 150 in Milwaukee County on September 30. Reported at the end of the period in Barron, Dane, Milwaukee, Outagamie, and Sheboygan Counties.

White-crowned Sparrow.—First reported by Hardy in Price County on September 13. Berner found 20 in Portage County on October 12. Last reported by Sunby in Milwaukee County on November 26.

Harris' Sparrow.—First reported by Verch in Ashland/Bayfield Counties on September 20. The Smiths found 5 in St. Croix County on October 15. Last reported by Hardy in Price County on November 2.

Dark-eyed Junco.—Found at the beginning of the period in Ashland, Bayfield, Brown, and Dunn Counties. Robinson found 480 in

Sawyer County on November 3. Found throughout the state at the end of the period.

Lapland Longspur.—First reported by Polk in Eau Claire County on September 17. Pickering found 70 in Langlade County on November 1. Reported at the end of the period in Clark, Portage, Taylor, and Winnebago Counties.

Snow Bunting.—First reported on October 8 in Ashland/Bayfield Counties by Verch. Hoefler found 200 in Burnett County on October 30 and Hardy found 200 in Price County on November 2. Reported at the end of the period south to Dunn, Eau Claire, Clark, Portage, and Brown Counties.

Bobolink.—Found in scattered areas throughout the state at the beginning of the period. Belter found 19 in Marathon County on August 20. Last reported by Robbins in Dane County on September 22.

Red-winged Blackbird.—Found throughout the state at the beginning of the period. Ziebell found over 6000 in Winnebago County on October 22. Reported at the end of the period in Clark, Douglas, Dunn, and Eau Claire Counties.

Eastern Meadowlark.—Reported throughout the state at the beginning of the period. Duerksen found 15 in Richland County on August 12. Last reported by the Lukes in Door County on November 26.

Western Meadowlark.—Reported at the beginning of the period east to Dane, Shawano, and Door Counties. The Smiths found 8 in St. Croix County on October 22. Last reported by the Smiths in St. Croix County on October 27.

Yellow-headed Blackbird.—Reported at the beginning of the period in Ashland, Barron, Bayfield, Clark, Columbia, Dane, and Shawano Counties. Last reported by Ashman in Dane County on September 16.

Rusty Blackbird.—First reported on September 23 in Douglas County by Johnson and in Ozaukee County by Tessen. Berner found 175 in Portage County on October 22. Reported at the end of the period in Dunn County by Polk.

Brewer's Blackbird.—Reported at the beginning of the period south to Richland, Wood, Shawano, and Door Counties. The Smiths found 625 in St. Croix County on September 17. Last reported by Hansen in Dane County on November 18.

Common Grackle.—Found throughout the state at the beginning of the period. The Smiths found 6800 inSt. Croix County on October 1. Reported at the end of the period in Ashland, Bayfield, Chippewa, Door, Jefferson, and Ozaukee Counties.

Brown-headed Cowbird.—Found throughout the state at the beginning of the period. Ziebell found 48 in Winnebago County on September 19. Last reported on November 19 in Walworth County by Parsons and in Winnebago County by Ziebell.

Northern Oriole.—Reported throughout the state at the beginning of the period. Belter found 31 in Marathon County on August 10. Last reported by Robbins in Dane County on September 22.

Orchard Oriole.—Reported by Zehner in Washington County on August 15.

Pine Grosbeak.—First reported by Johnson in Douglas County on October 22. Merkel found 30 in Sawyer County on November 19. Found at the end of the period south to Dunn, Clark, and Marathon Counties.

Purple Finch.—Found at the beginning of the period south to Chippewa, Clark, Marathon, and Door Counties. Erdman found 135 in Oconto County on September 22. Reported throughout the state at the end of the period.

House Finch.—Reported during the period north to La Crosse, Marathon, Shawano, and Door Counties. Hansen found 35 in Dane County on October 1.

Red Crossbill.—First reported on August 1 in Forest County by Tessen. Munson found 28 in Clark County on November 13. Reported at the end of the period in Ashland, Barron, Bayfield, Langlade, and Taylor Counties.

White-winged Crossbill.—Reported at the beginning of the period in Bayfield, Douglas,

and Sawyer Counties. Robinson found 360 in Ashland County on August 25 and Merkel found 300 in Sawyer County on August 27. Reported at the end of the period in scattered areas throughout the state.

Common Redpoll.—First reported by Verch in Ashland/Bayfield Counties on October 19. Robinson found 30 in Sawyer County on November 19. Found at the end of the period south to Dunn, Eau Claire, Clark, Portage, and Manitowoc Counties.

Pine Siskin.—Reported at the beginning of the period south to Barron, Clark, and Door Counties. The Lukes found over 300 in Door County on October 17 and Sontag found over 300 in Manitowoc County on October 19. Found throughout the state at the end of the period.

American Goldfinch.—Found throughout the state during the period. The Smiths found 150 in St. Croix County on October 9.

Evening Grosbeak.—Reported at the beginning of the period south to Taylor, Langlade, and Menominee Counties. Hardy found 150 in Price County on November 15. Reported at the end of the period south to Monroe and Manitowoc Counties.

House Sparrow.—Found throughout the state during the period. Ashman found 300 in Dane County on September 9.

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"Familiar Places" *by Jerry Gadamus* (A limited edition print reprinted with permission of the artist and the publisher, Northwoods Craftsman, Menomonee Falls, WI 53051)

"By the Wayside"

Observations of Glossy Ibis, Black Vulture, Black-shouldered Kite, Prairie Falcon, winter raptors, Lesser Black-backed Gull, Rufous Hummingbird, Scissor-tailed Flycatcher, Purple Martin, American Crow, and Black-throated Gray Warbler are highlighted.

GLOSSY IBIS (*Plegadis falcinellus*)

19 November 1989, Trempealeau National Wildlife Refuge, Trempealeau County.—On Saturday, November 18, I got a call from the staff at the Trempealeau National Wildlife Refuge about an unidentified dark ibis that had been observed at the refuge that day. The next morning Dave Hanson and I headed down to see if the ibis could be refound and, we hoped, identified. We arrived at the refuge in the late morning and joined in the ongoing search along the marshy edge of the Mississippi River. According to the people who had seen the bird the day before, it had appeared weak, and there was concern that it might not have survived the night. After a long period of searching and just as we were beginning to get discouraged, the ibis flew in directly overhead and landed a short distance away in the marsh. In flight, the dark brown, almost crow-sized bird displayed broad, rounded wings, trailing legs and feet, and a long, decurved bill. It flew strongly, and as we followed it from place to place along the river edge, quickly demonstrated that it was in excellent health. Eventually we were able to position ourselves and set up our scopes for a leisurely view. The bird was quite cooperative, walking along the edge of the marsh on the ice (the river was almost completely frozen over), feeding in the open spots, and occasionally disappearing from view in the grass and cattails. At one point it flew in to approximately 50 feet and provided excellent, fully sunlit views as it walked along in a rather chicken-like manner. It was about the size of a small heron with moderately long, gray legs (blackish at the hocks and feet) and along, downcurved, slightly bluish gray bill. The body feathers were a rich, deep brown, slightly shiny and with a hint of green and purplish gloss, while the head and neck were fuller brown with pale streaks. The area of bare skin between eye and bill was dark bluish-slate; this was bordered above and below by striking light blue ridges of skin, running from just above the eye over the bill, and just below the eye to the chin, re-

spectively. These ridges of skin did *not* encircle the eyes. Occasionally the ibis would tilt its head into the sun, really showing off the vivid pastel blue of these ridges, and also allowing a good look at its eye color (dark gray-brown). Several times I heard a short, nasal call which I presume was produced by the ibis. We observed the bird for at least 15 minutes at about 50 feet, after which it flew into a spot that was even closer but out of view behind the reeds; after a few minutes here it flew to a more distant location along the river.—*Janine Polk, 1407 Frederic, Eau Claire, WI 54701.*

Black Vulture (*Coragyps atratus*)

7 and 15 October 1989, Devil's Lake State Park, Sauk County.—One Black Vulture was flying with a group of 30–40 Turkey Vultures on 2 different occasions. In both observations, the bird (possibly the same one) flew out of the traditional Turkey Vulture roost at Devil's Lake State Park, Sauk County, Wisconsin. I first noticed the distinct silhouette and flight pattern. In flight, the bird's head and neck extended beyond the shoulders and body about 1/4 of the bird's total length (head to feet). The tail extended beyond the body about 1/4 of the bird's total length. The wings were short and broad. The feet extended just beyond the tail. It flew with 4–5 quick wing beats followed by a short glide. This pattern was repeated throughout the duration of its flight. (flap-glide, flap-glide. . .) The wings were held level in flight. Coloration: The wings and body were black, except the undersides of the proximal 1/2 of the primaries were white (seen when the bird was in flight). The legs and feet were gray. The head was uniformly dark gray with a white beak tip.—*Lisa Hartman, 6573 Highway 113, Waunakee, WI 53597.*

Black-shouldered Kite (*Elanus caeruleus*)

9 September 1989, Burnett County.—When I first noted the bird, from a distance of 100 yards, I thought it was a Snowy Owl (which in itself would have been unusual at this time of year), but the body shape was more cylindrical and the angle of perch was also not owl-like. This bird appeared more hawk-like, but the white color puzzled me. I put my binoculars (9×35) on it as it roosted in the top of a dead oak. I could then see the black shoulder patches and what appeared to be a black mask. I still had no idea what this bird was (never having seen one before). My truck was parked in a fire break and I was looking south at the bird with full sunlight shining directly on it. I set up my 60× spotting scope on the door window and zeroed in at maximum magnification. Only then could I clearly see the black, teardrop configuration of feathers around the eyes, in addition to the shoulder patches, and slightly gray feathering on the back. With the aid of my Robbins field guide, I identified it. When I drove off 15–20 minutes later, it was still perched there preening itself. Even with a 300 mm lens, I couldn't get a decent picture at the great distance.—*Pat Savage, Wildlife Manager, DNR Ranger Station, Spooner, WI 54801.*

Prairie Falcon (*Falco mexicanus*)

30 November 1989, 2/3 mile south of highway W at the corner of Tower and Townline Roads, Portage County.—After observing a perched raptor 60 yards away, Larry Semo and I confirmed with

our binoculars that it was a falcon. The first characteristic noted was size. The falcon was large in length and body size compared to its two relatives, the American Kestrel and the Merlin.

When first observed, the sun was behind the bird making it difficult to see facial marking or other color patterns. However, after several minutes, the sun became entirely covered by clouds, thus affording us a better view. The distinct dark crown gave way to a contrastingly light-colored superciliary line. The dark, thin mustache and dark auriculars were also noted. The bird had a dorsal scale pattern; sandy brown feathers with lighter edges on the back and upper wing coverts.

A short flight from its original perch to one 10 feet closer allowed me to see white underwings with dark axillars. The dark on the underwing also extended into the underwing coverts.

After approximately 35 minutes, the falcon left its second perch, its flight was direct and determined. Relative to a kestrel or Merlin, it appeared much more "heavy" in flight. Its long, pointed wings did not extend above the horizontal plane formed by the back when flying. Again, I was able to see the dark axillars and underwing coverts. The bird flew with strong wingbeats and accelerated so quickly that I lunged out of the window of my vehicle to follow it. Thirty yards behind the car, the bird dove into the ditch on the north side of Tower Road flushing a small bird, barely missing its quarry. On the falcon's descent toward its target, I was able to see its yellow legs.

The bird then flew to a third perch approximately 90 yards to the southwest of our location. I turned the car around and raced to the bird's new perch, which was approximately 45 feet up at the top of another hardwood. This perch was 10 feet from Townline Road. Larry took two pictures with his camera at a distance of about 30 yards. Attempting to get on the other side of the bird for photos with the sun at our backs, I pulled forward. As I passed the bird, it flew directly away from us. Again, the swift flight and dark axillars were noted.

The bird flew approximately 200 yards away where, after a short time perched, it began to fly in wide circles. It gained altitude quickly and at a considerable distance above the ground, began to hover. Shortly thereafter, the bird was lost from sight.—*Thomas G. Hoppa, 932 Portage St., Stevens Point, WI 54481.*

30 November 1989, Buena Vista Marsh, Portage County.—On November 30, 1989, Tom Hoppa and I, while in the Buena Vista Marsh in Portage County, observed a medium-sized raptor perched in a snag approximately 60 yards away. Originally it proved difficult to determine size. The bird unfortunately was perched with its back toward us and faced directly into the sun. We proceeded further down the road a short distance to gain a better lighting. At this position, we noticed that this bird was definitely larger than a kestrel or Merlin, appearing Broad-winged Hawk sized, but thinner; with the falcon shape and behavior such as long, pointed wings (appeared longer than tail but this impression probably developed because the bird was in a bent-over position so that the wing tips protruded above the tail), and a small rounded head. The bird was apparently actively hunting as it continually pumped its head as all falcons do. From this position I could observe a partial view of the head and noticed a long, thin malar streak. The bird then took flight and landed in another tree a little closer to us. Immediately I noticed

dark axillars and underwing coverts. From this second position, we had a much better view. The head was composed of a brown cap with a striking white superciliary line. One thin, black mustache mark extending from the proximal edge of the eye and extending posteriorly (when perched, the malar streak extended almost to the shoulder). A second smudge drooped at the distal portion of the eye and a third streak arose from this same location and passed distally to the crown and dropped posteriorly. The rest of the face was basically white. The back of the head had two white eye spots observable when turned away from us.

The back was brown and had a scaled appearance. It seemed lighter in color than in an immature peregrine. The primaries, when folded, were darker and contrasted with the lighter brown of the back and upperwing coverts. The breast was basically white with short, vertical streaks, overall appearing lighter than in an immature peregrine. The tail was light brown with evenly-spaced darker horizontal bars. After documenting these perched characteristics, the bird then took flight. It was a swift powerful flier, more powerful than the quick snappy flight behaviors of kestrels and Merlins. Underwings were light throughout the primaries and secondaries and distally located underwing coverts except for the obvious black axillars and proximal portioned underwing coverts.

Apparently it was attempting to capture a bird (starling?), but failed and perched along the side of the road. We were then able to approach to within 30 yards or so and photographs were taken. The bird took to the air again and after perching a 4th time, began flying in circles, rising almost out of sight. Before losing sight, however, I observed the bird to hover in typical kestrel fashion. (This is a behavior I have observed with Prairie Falcons in the western U.S., also.)

Realizing the possibility that it might be an escaped falconry bird, I discussed this with Tom Doolittle of Washburn, a falconer who owns a Prairie Falcon, and Dr. Frances Hamerstrom. Neither of them knew of any Prairie Falcons in the area and Frances was going to seek information, but she found no one missing any birds. The wild behavior of this bird suggests a truly wild individual.—*Larry Semo, Rt. 2 Box 435, Superior, WI 54880.*

Winter Raptors

December 1988–January 1989, various roadsides around Wisconsin.—During late December, 1988 and early January, 1989, I travelled approximately seven hundred miles of Wisconsin freeways. On these occasions, I made particular note of raptors along the freeways as reported below. On all these trips there was one or more other observers in the vehicle who could point out but not necessarily identify the birds.

December 31, 1988, weather clear, 30° F, slight wind. From Tomah to Janesville observations were made of fourteen Red-tailed Hawks, one Rough-legged Hawk and five American Kestrels. All these birds were within one-hundred yards of the highway. The majority of red-tails were perched in trees. Four of these were in the median strip separating the north-south lanes.

January 3, 1989, cloudy, snow flurries, very windy 20°-25° F. No raptors were observed from Beloit to Portage with the exception of one Rough-legged

Hawk. One Bald Eagle was seen on the Wisconsin River ice just east of Highway 51 at Portage. Also seen were one Red-tailed Hawk and four Rough-legged Hawks, all in flight.

Two outstanding observations should be noted. Three Northern Goshawks were seen near Westfield. Two adults few across Highway 51 twenty yards in front of the van and joined a third near the tree line to the east. My passengers, six college biology students, were quite excited as none had ever seen goshawks before.

Just north of Stevens Point an Osprey was spotted flying west near the junction of 51 and Wis 66. Needless to say, this species is not to be expected in Central Wisconsin during the winter. This bird was identified by this author and several other observers using field marks described in several field guides. Researching recent literature reveals that Osprey has not been reported in Wisconsin after November in fall and winter accounts from *Passenger Pigeon*. Christmas Bird Counts do not report any Osprey at least in north-central Wisconsin.

January 10, 1989, sunny, calm, 15° F. The very different weather conditions from a week earlier changed the raptor activity considerably. Seen between Merril and Janesville were eight Red-tailed Hawks, four Rough-legged Hawks and two Kestrels. The majority of red-tails were perched and the rough-legged were in hunting (hovering) flight.

Considering the observers were travelling at high speeds, some untrained not always able to watch for birds, one wonders how many raptors in the two hundred yard wide band parallel to the freeway were not seen.—*John Bergstrom, Rock Valley College, 3301 North Mulford Rd., Rockford, IL 61101.*

Lesser Black-backed Gull (*Larus fuscus*)

6 November 1989, Sauk City, Sauk County.—Having looked at 100+ Herring Gulls and Ring-billed Gulls in an unsuccessful search for the Lesser Black-backed Gull previously seen by Scott Swengel, I discovered a likely-looking bird swimming just offshore, about 125 yards from my vantage point. I was looking down on the bird, with the sun behind my back. I was attracted to this gull (mostly brownish first year winter plumage) by the head color. Where on the first-year herrings the head was almost as dark as the mantle, on this bird the head seemed noticeably lighter. Next, I noted the bill. It was solid black, not as stout as that of a Herring Gull. It was the same thickness throughout, where a herring would show a slight enlargement near the tip.

Several times during the observation period, I switched my telescope back and forth between this bird and some of the first-year Herring Gulls. The body of the Lesser Black-backed Gull gave the appearance of looking slightly longer, because the folded wings extended farther beyond the tip of the tail.

I was zeroed in on the Lesser Black-backed Gull when it flew. At no time did I detect the leg color. But the upper wing surface was definitely darker than that of the similarly plumaged Herring Gulls. It was the back half of the wing that was particularly dark brown.

In flight the posterior half of the tail was covered by a well-marked band, contrasting with a more diffuse band on nearby Herring Gulls. Several Ring-billed Gulls were nearby, but these were noticeably smaller and lighter in body plumage.—*Samuel D. Robbins, 14 South Roby Road, Madison, WI 53705.*

11 November 1989, Sheboygan's North Point Park, Sheboygan County.—The first thing we noticed was that the mantle of this gull was darker than the mantles of the surrounding flock of Ring-billed Gulls and Herring Gulls. The second thing we noted was its size. It was larger than the Ring-billed Gulls and smaller than the Herring Gulls standing next to it. It had the same body shape as the Ring-billed and Herring Gulls.

We made note of the following marks (it stretched its wings occasionally): The tail was pure white; the breast and belly were also pure white; the head and nape were white with brown streaks. The bill was proportionately the size of the bill of the Ring-billed Gull, with a red spot toward the tip of the lower mandible, and a black mark on the bill just behind the red spot. It had a yellow eye. The legs were very pale.

As to behavior: It sat on the rocks among the Herring and Ring-billed Gulls, and after a while it hopped into the water and stood there. It did not interact with the other gulls. In flight it appeared to have longer wings than the other gulls. It did not vocalize.

After we had viewed the gull for 20 minutes, it stretched its wings and flew north. Then we noted: The upper surface of the wings was dark gray (much darker than the nearby Herring and Ring-billed Gulls), with black wingtips, and a narrow white trailing edge. The wings seemed considerably longer than those of the Ring-billed Gulls. The undersurface of the wings was also dark gray, blending into the black wingtips.—*David and Margaret Brasser, 813 Logan Avenue, Sheboygan, WI 53083.*

11 November 1989, along Lake Michigan shore, Sheboygan, County.—On Saturday morning, 11 November 1989, Anita Carpenter and I arrived in Sheboygan shortly after 10:00 A.M. intending to look for scoters and other waterfowl. As we drove north along the lake shore we noticed many gulls along the edge of the beach and on the rocks, and decided we should pay attention to gulls as well. About four or five blocks north of the YMCA, we noticed a gull standing at the water's edge which was much darker than the many nearby Ring-billed Gulls.

The most noticeable feature was a very dark gray mantle which extended into black wing tips. The black tips of the outer primaries showed very small white markings with, at most, two tiny white spots near the tip of the wing. The head was mostly white with brown flecking which reached down the neck to the upper breast. The breast and underparts were snowy white, as was the tail and rump. When the bird flew there was a conspicuous white trailing edge on the upper wings. The bill was yellowish with a subterminal red spot on the lower mandible and a dark smudged area behind the red spot. The legs were a pale fleshy-yellow color.

We determined the size of this gull by comparing it with the nearby Ring-billed and Herring Gulls since we could often see all three species in our binocular field of vision at the same time. The darker gull was about half way in size between the Ring-billed and the Herring Gulls. Based on the size, dark gray mantle, and yellowish legs, we decided that the gull we were watching was a Lesser Black-backed Gull. The other gulls in the proper size range are: Herrmann's Gull which has dark underparts and black legs; Iceland Gull and Thayer's Gull which are too light and have pink legs; and California which is the same size and has yellow legs, but a much lighter man-

tle (I have observed California Gulls in California).

As we looked at this bird we were not sure if it was in third or fourth winter plumage. When I returned home I checked *Gulls, a Guide to Identification*, edition 2, 1986, by P. J. Grant, and based on his comments about winter plumages, I believe we were watching a fourth winter bird. He states that a few fourth year birds show adult plumage, but have a dark area on the bill and fleshy legs, having not yet acquired the full adult coloration on the bare parts. This certainly fits the gull we were seeing.

We watched this gull from our car for about half an hour with Swift Audubon (8.5×44) and Bushnell (10×40) binoculars. It stood along the shore and in the water and occasionally flew up and then settled back down, usually at the edge of a flock of mostly Ring-billed Gulls. The bird was from 20 to 30 yards from us. The sky was overcast with occasional rays of sun, but the lighting was good.

While we were watching, another car pulled up behind us and the two people were also watching the gulls. When I went back to point the Lesser Black-backed Gull out to them, they had already found it and also decided it was a Lesser Black-backed Gull. These two birders were David and Margaret Brasser from Sheboygan.

This is the second Lesser Black-backed Gull I have seen. The first was in December 1987 in Virginia, and it was also in winter plumage.—*Bettie Harriman, 5188 Bittersweet Lane, Oshkosh, WI 54901.*

Rufous Hummingbird (*Selasphorus rufus*)

8 August 1989, Shorewood, Milwaukee County.—Our back yard, where I saw the Rufous Hummingbird on August 8, 1989, is enclosed on 3 sides by bushes and flowers. Much of this has been allowed to go to phlox—lavender, magenta, pink, and white. There is a large bed of lavender hosta plants around a big shagbark hickory tree where I have seen, in the 25 years we have lived here, Ruby-throated Hummingbirds at rare intervals, but often enough to know that a hummingbird is very unique and not like any other bird. On August 8, a sunny day, between 10:00 and 10:30 A.M., I was picking a small bouquet of phlox when suddenly I noticed the hovering of a tiny hummingbird, darting into a large clump of phlox, not more than 3½ feet in front of me. Immediately I realized I was not seeing the usual iridescent green back. What I was seeing was a general impression of a predominantly rusty, reddish-brown color. In every other category-size, flight pattern, type of long, slender bill, size of wings, it seemed identical to the Ruby-throated Hummingbird. My thoughts raced like this: "What am I seeing?, I'm seeing something different! What should I be looking for?" I stood there transfixed, absolutely immobile. To my indescribable amazement, the hummingbird darted out of those flowers and into the little bouquet clasped in both my hands. It must have instantly realized something was amiss, as it just barely alighted, then out again, off and away, out of sight. I hurried into the house to consult my copy of Roger Tory Peterson's *A Field Guide to the Birds* and saw the color illustration of the bird I had just seen, labeled: Rufous Hummingbird.—*Eleanor J. Schmitz, 2200 E. Newton Avenue, Shorewood, WI 53211.*

Scissor-tailed Flycatcher (*Tyrannus forficatus*)

14 October 1989, 3 miles north of Mason on Highway 63, Bayfield County.—

While driving south on U.S. Highway 63 approximately 15 miles south of Ashland in Bayfield County, I observed, at a distance of 1/4 mile, a pale, long-tailed bird fly from the ground to a high tension line up approximately 40 feet from the level of the road. My instant impression was "What a funny swallow is that?" I slowed immediately to about 20 mph. and at a distance of 1/10 mile, with the bird brightly lit by the afternoon sun, I saw it was a Scissor-tailed Flycatcher. Without stopping, but at a very low speed, I rolled past it, not wanting to cause it to fly. I lifted my binoculars to see it, but they gave me less information than my eyes provided alone. I observed a thrasher-sized bird with a solid white/gray head, black eye and lore, dark gray wing and tail which was as long as the bird itself. The breast was gray and the belly from side to side was a bright rosy color. This color extended back toward the under tail as far as I could see. The bird did not fly, so the tail feathers were closed. The tail feathers on this bird were medium in length as compared to some other scissor-tails I have seen. I would estimate their length at 6 1/2–7 inches and their width as 1/2" to 3/4". The bird cleaned its beak on the wire and made no other moves. I accelerated back up to highway speed. Total time on the bird was about 90 seconds. When I reached Grandview 8 minutes or so later I called David Bratley in Washburn who contacted Dr. Richard Verch. Dr. Verch subsequently came there and also saw the bird.—*David J. Hanson, 5317 Markgraf Road, Fall Creek, WI 54742.*

13 October 1989, nine miles south of Ashland on Highway 63, Bayfield County.—While driving south on Highway 63 I continued to watch the power lines along the road. There were only a few birds on the wires and most were starlings so when I sighted a slim, long-tailed bird I knew it was the flycatcher. I drove to within 50 feet of the area that the bird was in. It would sit on the wire for 10–15 seconds and then fly off in pursuit of an insect. Most times it appeared to be successful in catching one. As it sat on the wire I could see the outer tail feathers were at least 1 1/4 times as long as the body. The black tips on the white tail feathers were clearly seen, especially when the tail was spread as the bird maneuvered to catch an insect or when it landed on a wire. The head, neck, back, and upper breast were a uniform gray color. The lower breast and belly were whitish but the flanks, sides, and the undertail coverts were an obvious orange-pink color. When the bird was flying, it was clear that the wing linings were the same color also. I watched and attempted to photograph the bird for about 30 minutes.—*Richard L. Verch, Biology Dept., Northland College, Ashland, WI 54806.*

1 October 1989, Caroline, Shawano County.—The day was unseasonably warm and sunny with a strong southwest wind. It was around 1:30 in the afternoon when I decided to take a break from our potato digging and relax under our large weeping willow in the backyard. I happened to glance up at the sky in time to see a bird fly into the willow that I knew we did not have recorded in our backyard life list. In fact, I knew I had never seen the bird before. My first impressions were of the streamlined body about the length of a Mourning Dove, long narrow tail, and light-colored underparts. I immediately ran to the house for the binoculars while my wife stayed out to keep it in view. It

didn't seem to be in any hurry to leave. It repeatedly took flight, made a large circle, and returned to our willow or the top branches of our large spruce. We were able to view it well because it favored the same dead willow branch about 20 feet above us. The strong winds buffeted it in flight giving us repeated occasions to see the splitting of its tail feathers.

Through binoculars I noted its gray head, dark eye stripe, and dark beak. Its chest was white with a creamy, faintly pink abdomen and wing undersides. The underside of its tail was white and tipped with black. The upper part of the wings were dark with faint light wingbars. The legs and feet were dark,

After noting the bird's markings, my wife and I consulted our National Geographic *Field Guide to the Birds of North America*. The only illustration it resembled was the Scissor-tailed Flycatcher, but we also noted that its range wasn't anywhere near Wisconsin. We then called Mark Peterson, our neighbor, who came over and said it was a Scissor-tailed Flycatcher. Mark drove back home, picked up his camera, and he was able to get some fairly good shots of the bird with a telephoto lens.

As we continued to observe its circular flight patterns, we noticed that it was snatching large flying insects in mid-air and returning to the trees and eating them. The bird stayed in our yard feeding as such for about three hours. It didn't seem at all disturbed by our presence right below it.--*Ronald Kersten, Star Rt. Box 21A, Caroline, WI 54928.*

1 October 1989, Caroline, Shawano County.—On October 1 at about 1:20 P.M. I received a call from Ron Kersten, who lives on the west side of Caroline, to come and identify a long, skinny bird that had been feeding in his yard. I arrived at his house at about 1:30 P.M. and immediately saw a bird about the size of a Blue Jay, but much thinner, perched on a branch of a willow tree. The bird flew out to catch an insect and then returned to the branch. With its very buoyant flight and the way it spread its tail when it landed, left no doubt that I was seeing a Scissor-tailed Flycatcher. I quickly went home to get a camera and returned about 5 minutes later.

Every minute or so the bird would fly out, sometimes up to 50 yards, and return, usually to the same branch in the willow tree. It would occasionally land in a spruce tree nearby where the lighting was best to see the following: approximately 12″ long or about the length of a Blue Jay. The wings were dark gray. At times it appeared to have pale white wingbars. The upper side of the tail was dark gray. The underside was light gray, except that the distal approximately 2″ was almost black. The tail was approximately 1/2 of the body length. The crown and upper back were a pale silvery-gray. The bill was black, the eye was black, and a narrow strip between the eye and bill was black. The throat and breast were white. The belly had a pale pink cast to it. The area immediately bordering the wings on the flanks was a pale pink. The axillary area, which was only seen well once was an orangish-pink color. The tail was frequently split slightly when the bird was perched.

The bird remained for most of the afternoon, although I had to leave for work at 2:00 P.M. Although several people watched the bird from under the trees, it did not seem to be bothered by our presence.—*Mark Peterson, Box 53, Caroline, WI 54928.*

PURPLE MARTIN (*Progne subis*) feeds on Monarch Butterfly

20 July 1989, Manitowoc.—We observed a Purple Martin delivering a monarch butterfly to its young. The actual feeding was not seen because the adult entered the nest box with the monarch. Several moments later, a second martin was seen returning with a monarch to a neighboring "apartment" complex. The use of monarch butterflies for feeding the young had not been observed previously by us, and it is not usually expected, for the adult should have at sometime in its life experienced the effects of the cardiac glycosides associated with the monarch's tissues.

A much more "typical" response is for birds to regurgitate after eating monarch. The cardiac glycosides that the monarch larva accumulates as it feeds upon the milkweed, however, does not seem to be absolute and depends upon the quantity of the toxin produced by the species of milkweed.

Brower and Lanting (1988, *Animal Kingdom* 91) report that the common milkweed (*Asclepias syviaca*) plants have become more abundant in the midwest and eastern United States due to land use and are only mildly toxic compared to the western species. Because of this, the monarch butterfly from the midwest and eastern U.S. have been found to be much less toxic than the western monarch. To cause vomiting, the eastern monarch would need four times more poison than their western cousins.

Perhaps this was not an isolated feeding event; martins and other birds may "test" monarchs as a food source with greater frequency than has been previously suggested. The difficulty might be that it had not been looked for and that the feeding is not always in exposed or obvious places where observation is easy. The martins, with the exposed "apartment" provided that opportunity. Other attempts to record monarch feeding by the same martin colony on following days failed, however.—*Charles Sontag, 801 North 4th Street, Manitowoc, WI 54220 and James Steffen, P.O. Box 400, Glencoe, IL 60022.*

AMERICAN CROW (*Corvus brachyrhynchos*) KILLS COOPER'S HAWK (*Accipiter cooperii*)

5 May 1985, Stevens Point.—The Cooper's Hawk, so swift and agile in the air, is a common predator of birds. Occasionally American Crows will mob a Cooper's Hawk, but according to Bent (1937, *U.S. Nat. Mus. Bull. No. 167*) "sometimes the tables are turned and the hawk chases the crow, though I doubt if this often results fatally for the crow."

Bent also reports a surprising and successful attack of the smaller but similar Sharp-shinned Hawk on a crow on Mackinack Island, Michigan. He also cites Sutton's (1928, *Wilson Bull.* 40:84–95) find of a dead Cooper's Hawk, its crop packed with flesh and feathers of a crow. Dr. Sutton believed the hawk killed the crow.

The following observation relates how crows killed a Cooper's Hawk, very likely an uncommon occurrence. In a cursory review of available books on hawks and crows I found no other comparable incidents.

In 1985, I prepared a study skin (Museum of Natural History Bird Collection No. 1960) of an immature (yearling) male Cooper's Hawk killed 5 May 1985, by an American Crow. How this happened is not clearly understood. The hawk seemed clean, apparently healthy

and in good condition. The tips of the tail feathers, except two of them, were slightly worn. Gladys Shafransky of Stevens Point, Wisconsin, observed the attack at 1:45 P.M. in her residential yard (of lawn, maple and pines). Mobbed by some 6–8 American Robins, 10–15 Blue Jays and two crows, the hawk's head was struck by one crow flying from a maple tree about 8 feet above ground as the hawk was flying southward. A few feathers fell to earth. The wings flapped twice as the hawk died, knocked to earth, and a spot of blood was found on its breast. All the birds immediately quieted and flew away, none attempting to eat or even examine the dead hawk. Shafransky had observed the noisy birds mobbing the hawk about five hours earlier (8:30 A.M.), as it perched in a tree, but all the birds flew away, probably not returning until the fateful attack. It may have been a lucky strike by the crow, or the hawk may have been sick, somewhat disabled, and probably tired from the mobbing. Its immaturity may have been a factor. I thought it peculiar that the crows left the hawk's carcass untouched.—*Charles A. Long, Department of Biology and Museum of Natural History, U.W.-Stevens Point, Stevens Point, WI 54481.*

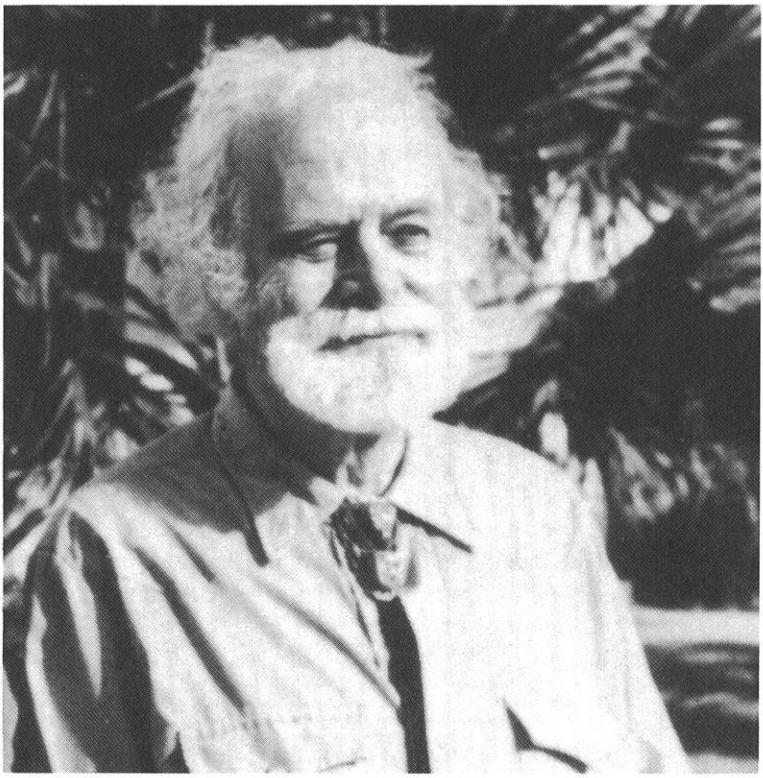
Black-throated Gray Warbler (*Dendroica nigrescens*)

10 September 1989, 10 miles north of Oconomowoc, Dodge County.—While watching a flock of mixed warblers (Redstarts, Black-and-White Warblers, Pine Warblers, Myrtle Warblers, and Golden-winged Warblers) and Black-capped Chickadees, I noticed a stunningly-marked black and white warbler about twenty feet away. It was about eight feet off the ground foraging in young growth. It had a full black or very dark gray crown, a black eyestripe/cheek patch and a large black bib giving way to black stripes along the flank. The entire underbody was white and the bird had white wing bars. Its back was a mottled gray.

Since chickadees and Black-and-White Warblers were present, they were easy to distinguish. Blackpoll Warblers lack the black bib and eye stripe/cheek patch. Several other warblers have similar black markings (crowns and bibs), but have yellow or gold faces and the Mountain Chickadee, although similarly marked, is easily distinguished by body shape, body markings and the fact that it is even less likely to appear in Wisconsin.

This bird was also distinguishable from the black and whites with which it travelled. The black and whites, as expected, foraged along the tree trunks and larger branches, while the subject preferred young growth and kept in the tangle of vines and small trees, never once landing on a trunk. I observed the bird in two locations during the hour for a minute and one-half each time.—*Carlo A. Balistrieri, N. 802 Franklin Road, Oconomowoc, WI 53066.*

FREDERICK N. HAMERSTROM
1909–1990



On April 28, 1990, Frederick N. Hamerstrom, age 80, died in Idleyld Park, Oregon, of pancreatic cancer. He is survived by his wife, Frances; a son, Alan, of Annapolis, MD; and a daughter, Elva H. Paulson, of Roseburg, OR. Fred (Hammy) was a Charter Member of WSO and its President in 1966. He and his wife, Fran, received the Society's Silver and Golden Passenger Pigeon Awards. Together they chaired the Research Committee from 1961–1977.

Fred was perhaps more comfortable (and doubtless enjoyed himself more) at WSO Conventions than at AOU meetings, where he was a Fellow. Academically, he received a BA from Harvard in 1931; MS from Iowa State University in 1935; and a PhD on the ecology of Greater Prairie-Chickens from the University of Wisconsin in 1941 under Aldo Leopold. He was a curator at the University of Michigan's Edwin S. George Reserve, before entering the military in 1943, where he spent over two years as a first lieutenant aviation physiologist. Fol-

lowing this stint, he and Fran became Project Leader and Assistant Leader, respectively, for the Wisconsin DNR, working on the Prairie Grouse Management Unit.

Their home near Plainfield, WI was the headquarters for Greater Prairie-Chicken work, which over the years drew thousands of professional and amateur volunteers in early spring to observe prairie chicken mating behavior. Fred and Fran often prepared a scrambled-egg breakfast for most of the participants; a substantial effort in its own right.

Here the soft-spoken, patient and considerate leader briefed team after team on what to record as meaningful data. Later, he listened with interest and enthusiasm as each novice detailed what had been seen and heard. Fred Hamerstrom made his helpers feel that what they had recorded was of utmost importance—and it was. Thus, he made his charges proud of their efforts. He shared his knowledge of field biology without fanfare and without making one feel inferior or beholding. Fred never attempted to speak above the chatter of a crowd, but in a quiet atmosphere he could be articulate and perceptive on matters biological or social.

The Hamerstrom home near Plainfield was an antebellum structure that did not suffer a coat of paint or indoor plumbing. No matter how spartan the field conditions, Fred never became "bushed" with cabin fever. He dressed neatly at all times, and his boyish face was always clean shaven. Eventually, he grew a beard and thus took on a distinguished demeanor befitting the man. He was the epitome of a gentleman in all aspects of his life and thus enjoyed the respect and admiration of all who knew him.

The Hamerstroms were the first of Aldo Leopold's graduate students that I met and knew, and a friendship of 50 years ensued. He was an extremely devoted husband, as well as a scientific partner with his wife, Fran. It is difficult to separate the accomplishment of Fred and Fran since their lives were completely in tandem. After retirement, winters were spent in Mexico doing research on raptors.

Regrettably, Fred did not seem to enjoy writing, despite the fact that he was an all-around naturalist and knew more about Greater Prairie-Chickens than anyone. His list of publications was adequate but not extensive; yet he had all the skills necessary to be a prolific contributor to the scientific and popular literature. Unfortunately, after the war Fred Hamerstrom did not enjoy robust health to go with his robust intellect, which may have accounted for his writing reticence.

Those whose lives he touched were enriched by this gentle scientist, and the organizations to which he was party were strengthened. That I will no longer be able to look across his unpolished, paper-cluttered table to listen, wine glass in hand, to my colleague and dear friend with his trimmed snow-white beard, is to be sad for all who share the loss of Frederick Nathan Hamerstrom.

In parting, Hammy—*Weidmans heil!*—Robert A. McCabe, Department of Wildlife Ecology, University of Wisconsin, Madison, WI 53706.

ABOUT THE AUTHORS AND ARTISTS

Robert B. Blair is a researcher at the University of Michigan Biological Station in Pellston, Michigan. His article about loons and water quality is one in a series he has written covering the states of Wisconsin, Michigan, New York, and New Hampshire.

Scott R. Craven is an Associate Professor and Extension Wildlife Specialist in the UW-Madison's Department of Wildlife Ecology. He is well known to naturalists around the state for his extension publications and radio shows. He is particularly interested in urban wildlife and wildlife damage problems.

Eric Epstein is one of Wisconsin's outstanding all-around naturalists. He uses his extensive knowledge of Wisconsin's biological diversity in his work with the Natural Heritage Inventory program of the DNR and The Nature Conservancy.

Jerry Gadamus has a B.S. degree from UW–Stevens Point where he has instructed wildlife carving classes. A pioneer in the technique of "free-hand" airbrush in wildlife art, he has received many awards for his art.

Randy M. Hoffman is our current president. He is a biologist with the Wisconsin DNR's Bureau of Endangered Resources and The Nature Conservancy where he is in charge of managing State Natural Areas.

Robert W. Howe is an Associate Professor in the Department of Natural and Applied Sciences at UW-Geen Bay. His Ph.D. is from the UW-Madison. He is the Chairman of WSO's Research Committee.

Robbye Johnson is an active birder in Northern Wisconsin who has a degree in Fine Art from UW–Superior. Between birding and teaching metalwork at UW–Superior, she finds time to produce a few bird drawings.

Robert A. McCabe is Professor Emeritus of Wildlife Ecology at UW–Madison and former President of WSO. He and Fred Hamerstrom were both graduate students of Aldo Leopold.

Jim McEvoy, a microbiologist by training, has been a graphic artist for the DNR for 13 years and an instructor in

drawing and watercolor at Madison Area Technical College.

Sumner W. Matteson is a Nongame Biologist in the Wisconsin DNR's Bureau of Endangered Resources. He is the statewide recovery coordinator for several endangered and threatened bird species.

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Mark S. Peterson, our Fall Field-note Compiler, is a professional nurse at the Homme Lutheran Home for the Aging in Wittenberg. He received his Bachelor's degree in Biology from the University of Wisconsin-Stevens Point.

John C. Robinson is a Wildlife Biologist with the U. S. Forest Service at the Hayward Ranger Station. He has B.S. degree in Fisheries and Wildlife Biology from Iowa State University. He authored a soon-to-be-published annotated checklist of the birds of Tennessee.

Thomas R. Schultz, Cochair of WSO's Field Trip Committee is one of Wisconsin's finest wildlife artists and a frequent contributor to *The Passenger Pigeon*. He illustrated gulls in The National Geographic Society's field guide to birds.

Stanley A. Temple is Editor of *The Passenger Pigeon* and a Professor of Wildlife Ecology at the UW-Madison. He has authored several WSO publications and has received WSO's Golden Passenger Pigeon Award.

Robin P. White recently received her Ph.D. in geography at UW-Madison; her thesis topic was the distribution of neotropical migrants. She works for the Office of Technology Assessment in Washington, D.C.

Amy T. Wolf is a student of Bob Howe's at UW-Green Bay. She is now working on her master's degree, but the Winter Wren study was an undergraduate research project. A native of Green Bay, she has worked on biological surveys in the Pacific northwest and Alaska.

NOTICES AND ADVERTISEMENTS

ERRATA

There are three errors in Table 8 of "The 1989 Wisconsin Christmas Bird Counts" (*Passenger Pigeon* 52:3–18). A Northern Saw-whet Owl was found at Owen and not reported in the table. The Yellow-bellied Sapsucker and Rose-breasted Grosbeak reported from Willard were from Owen.

THE WISCONSIN SOCIETY FOR ORNITHOLOGY

The Wisconsin Society for Ornithology is an educational and scientific non-profit organization founded in 1939 "to encourage the study of Wisconsin birds." The Society achieves this goal through programs in research, education, conservation, and publication.

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CONTENTS

Volume 52 Summer 1990 Number 2