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THE PASSENGER PIGEON
Vol. 51 No. 2
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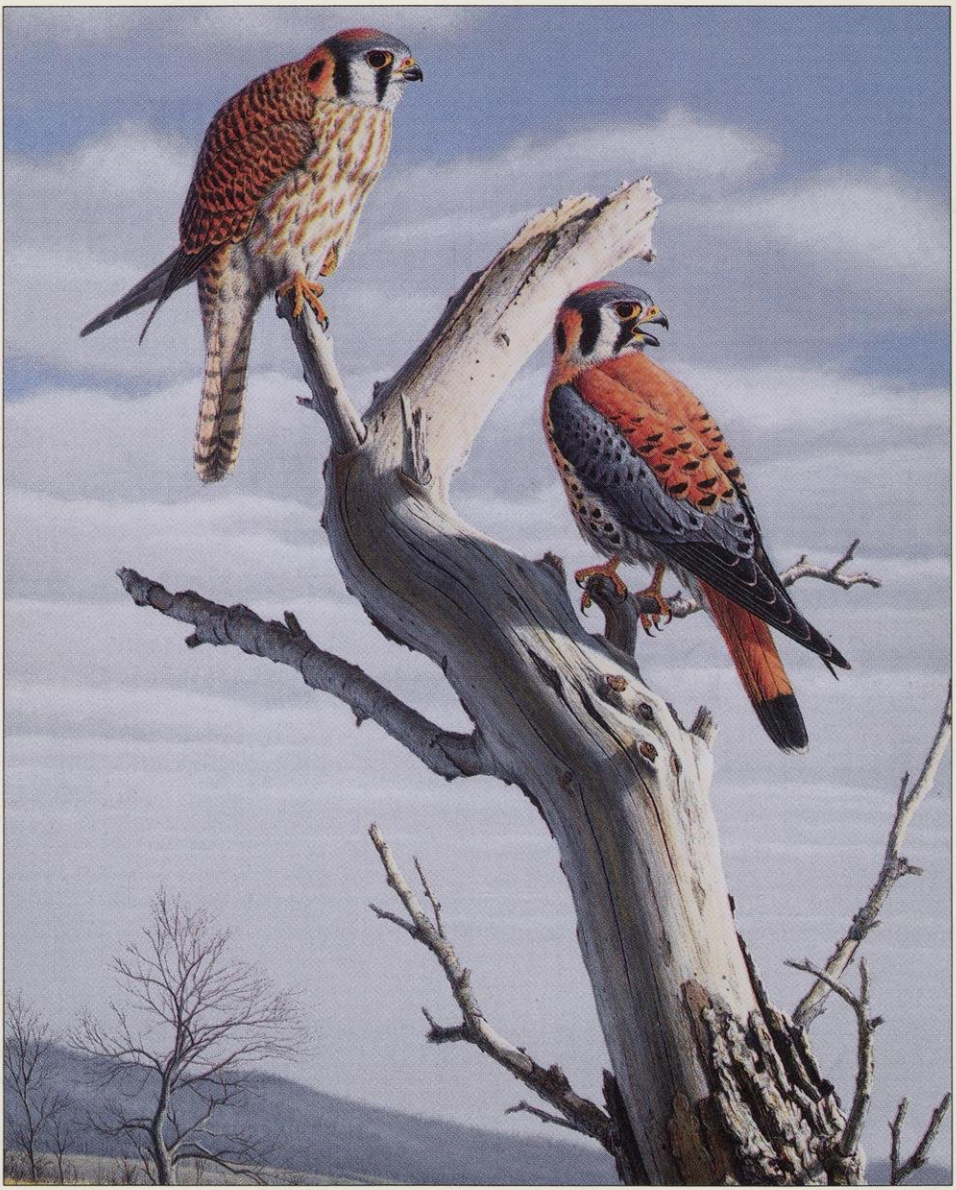

1939 -- 50th ANNIVERSARY -- 1989

THE PASSENGER PIGEON
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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.

Changing of the Guard: Out with the Old . . .

As we continue celebrating our 50th Anniversary, *The Passenger Pigeon* again has a full-color cover featuring the WSO-commissioned original painting of American Kestrels by Tom Schultz. If you have not already purchased one of the 400 limited-issue prints of this painting, you can purchase one from me for $30. This is a bargain price for a print of this quality by a renown Wisconsin wildlife artist; it is sure to increase in value. WSO is greatly indebted to Tom for allowing us to publish this impressive piece of art.

The 50th Anniversary Convention in Madison was a special event for all attending. The symposium on long-term studies, Paul Ehrlich's stimulating keynote address, and the enjoyable after-dinner comments by charter members were highlights of a memorable convention. We thank Stan Temple, the UW Department of Wildlife Ecology, Madison Audubon Society, and all of the volunteers who helped in this effort. Our next convention will be in LaCrosse where we will share our weekend with Minnesota and Iowa in the first ever Tri-State Convention.

By late this year Associate Editor Daryl Tessen hopes to have the new version of *Wisconsin's Favorite Bird Haunts* completed. This monumental effort will have 120 articles covering at least some part of every county in Wisconsin. This third edition of the popular book will be among the most extensive bird-finding guides of any state. The price should be in the twenty dollar range—quite a bargain for a 500-page book. Daryl is to be thanked deeply for the long hours, headaches, and sleepless nights he has invested in this effort.

As new President Randy Hoffman takes over, I would like to thank the Board Members, the Editorial Staff of *The Passenger Pigeon*, and other helpers who continue to keep WSO a leader in research, publication, education and conservation in Wisconsin. Two long-time board members will retire this year. Howard Young, professor, ornithologist, and past President has, as Award Committee Chair, helped WSO identify those special members who have contributed greatly to our Society and to Wisconsin ornithology so that we can give them proper recognition. His wisdom and guidance on other issues have been invaluable to the Board over the years. Fran Hamerstrom is also retiring from her position as Chair of the Scholarship and Grant Committee; she promises that should she see anything amiss with WSO or with issues pertaining to Wisconsin birds she will be back to air her views to the Board. I sincerely hope that she keeps her promise, but in the meantime I know that she will remain active in the ornithological work that she and Fred so love.

One of my many end-of-term projects was the questionnaire which was sent out to all members in April. So far the response has been good; please return your questionnaire if you have not yet done so. A brief summary of this poll of our members will be included in a later President's Statement.

And now allow me to introduce our new President, Randy Hoffman. Randy is one of Wisconsin's most active field ornithologists and a member of the team at the DNR's Bureau of Endangered Resources. He has helped us greatly over the past two years by drafting a management plan for our Honey Creek property. His relationship with the DNR can only help to strengthen the traditional co-operation between the DNR and WSO to the future benefit of Wisconsin's birds.

Out-going President

. . . And in With the New

I consider it an outstanding honor to be President of an organization that has withstood the test of time. Many organizations are formed to address a current need by a group of persons who share common interests and pursue common goals. In many instances, either interests change gradually or when goals are achieved the organization ceases to exist. Our organization has survived and prospered over the years because there has been a commitment by those serving WSO. Countless people have given their time and energy to the WSO. This effort was not for personal gain or wealth, but for the birdlife of Wisconsin and the world.

Over the next two years in these pages I will try to keep you informed about the functions of WSO and its board. I also hope to advise you where appropriate, of current trends in ornithology and its implications for you, the members. And finally, I hope to do some reflecting on our past 50 years and speculate a bit about the next 50. I want to be accessible to all members; therefore, if anyone has a suggestion, a complaint, or even praise of WSO, I would like to hear it. Please feel free to call or write me at any time.

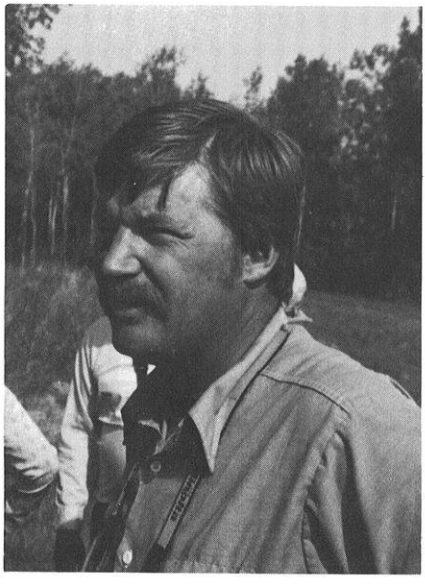
Because many of you may not know anything about me, here is a brief biographical sketch, focusing mostly on my interests in birds. I live in Waunakee, a small village directly north of Madison, with my wife JoAnn, son, Eric, and daughter, Laura. I am employed by The Nature Conservancy as a natural areas management specialist, working under contract with the Natural Areas Section of the Bureau of Endangered Resources. My work is primarily the management of 225 State Natural Areas statewide. These areas are the best remaining examples of presettlement biotic communities. The primary purpose of these areas is research, education and the protection of the state's biodiversity. My interest in birding began during my youth, although I didn't buy my first binoculars until I was in my twenties. My early enthusiasm was for everything in nature,

which, of course, included birds. After I purchased my first pair of binoculars, a whole new world appeared and enthralled me. Thousands of hours were spent over the next several years gathering more and more knowledge of birdlife.

My birding hours have declined in recent years. This happened because of my professional focus being on ecosystems and communities, along with my family responsibilities. These reasons for spending less time birding are also reasons why I am so anxious to serve WSO. I hope that, in some small way, I can do something to insure that birds are part of the future lives of my children.

Randy Hoffman

In-coming President



Randy Hoffman, our new President.

Osprey *by William R. Stott, Jr.*

Wisconsin's First Documented Nesting of Great Gray Owls

After years of speculation and circumstantial evidence, it has been confirmed that Great Gray Owls do breed in Wisconsin. An active nest was studied near Clam Lake in 1988.

by Keith J. Merkel

In an exciting article in the Summer 1979 *Passenger Pigeon*, the late Don G. Follen, Sr. described his encounter with a family group of Great Gray Owls (*Strix nebulosa*) in August 1978 near Moose Junction, Douglas County, Wisconsin. This discovery was the first known evidence of possible nesting of this species in Wisconsin (Follen 1979). Encouraged by his find, Follen began a five-year study "to determine the distribution and range of the Great Gray Owl in Wisconsin and to determine whether it is a permanent resident or an occasional straggler into the state" (Follen 1980b).

Follen's primary methods of study were the statewide placement of descriptive Great Gray Owl posters and requests for reports of sightings through the news media, as well as in various bulletins and journals, and through contacts with Department of Natural Resources (DNR) field personnel. He also requested photographs, tape recordings, birds found injured or dead, and old mounted specimens (Follen 1980b, 1987). Some results of that study were summarized by Follen (1987).

Hoping to increase the chances of finding an active nest, Follen and colleagues began erecting artificial nesting platforms for Great Grays in 1979. By the end of 1980, 24 platforms had been placed in likely habitat in northwestern Wisconsin. A Great Gray was later flushed from one of those platforms, but no nesting resulted (Follen 1987). During the winter of 1984–85, 17 platforms were erected in north-central and northeastern Wisconsin. Most of these structures were of the "wire basket" type in which a piece of poultry netting is formed into a cone shape, lined with roofing paper, and then filled with twigs. The result is an acceptable alternative to the old or abandoned nests of hawks, crows, and ravens often used by the owls for nesting.

To help defray the considerable expenses incurred with field work, in late 1986 Follen organized the Wisconsin Foundation for Wildlife Research (WFWR), hoping to obtain additional funding through grants, bequests, and contributions from corporate and private donors. Goals of the organization

were to continue existing research projects and to implement new studies, mostly involving raptors. In January 1987, I became a member of his newly formed group.

Upon first meeting Follen in 1985 I was impressed with his energy and vision, especially concerning the Great Gray Owl study. Despite the fact I had never seen a Great Gray, but encouraged by Don's contagious enthusiasm, I decided to investigate several areas he had not previously visited. Thus, in January 1986 I also began erecting nesting platforms, mostly in Ashland and Sawyer counties, and by mid-March I had installed 31 platforms. All were of the "tire" type; that is, an old automobile tire is cut in half along the tread, producing two platforms. Each half is then turned "inside-out" and completed with the netting, paper, and twigs as in the "wire basket" type. No evidence of visitations by owls was found during the first two years after these "nests" were installed. On 2 April 1988, however, I found a female Great Gray Owl on one of these platforms near Clam Lake, Ashland County. Later observations showed four young were successfully fledged from this nest, providing the first verification of breeding by this species in Wisconsin.

Previous Breeding Evidence

Several possible Great Gray Owl nestings were revealed by Follen's study (Figure 1). These included reports from Marinette County (1978), Forest County (1979, 1980), and Douglas County (1982). Reports from Forest County (1984) and Taylor County (1985) were discarded because of lack of details or conflicting information.

Evidence of nesting included: an adult and one young bird seen, and possibly two other young birds heard calling for about one week in mid-summer 1978, near Peshtigo, Marinette County (D. Follen, unpubl. data; Robert Couvillion, pers. comm.); an adult bird seen hunting during the day and two (apparently young) birds heard calling for several weeks in late summer 1979 near Hiles, Forest County (Follen 1980a, William Cochrane, pers. comm.); an adult bird seen with two young on 3 August 1980, again near Hiles, Forest County (D. Follen unpubl. data; Roy Peters, pers. comm.); and apparently two pairs of owls northeast of Cloverland, Douglas County, in 1982. Individual (and sometimes two) birds were seen frequently from 1 May to 25 September and were heard hooting (territorial behavior). Nesting was suspected to have occurred, but no nest or young were found (D. Follen unpubl. data; Ronald Perala, pers. comm.).

Additionally, a female Great Gray, found dead 4 May 1984 in Marathon County, appeared to have a large brood patch; an internal examination revealed enlarged ova, indicating advanced breeding condition (Follen 1984, 1985a). A report of a Great Gray seen 18 December 1986 (*Passenger Pigeon* 49:194) only four miles from the location of the above specimen, if correctly identified, further suggests the possibility of a pair of owls in the area at that time.

The habitat at all these locations includes nearby stands of Tamarack (*Larix laricina*) and Black Spruce (*Picea mariana*). This habitat is considered to be of primary importance to breeding Great Gray Owls in southeastern Manitoba and northwestern Minnesota (Nero 1980).

The 1988 Clam Lake Nesting

Habitat.—The Clam Lake nest was located approximately 6 miles southeast of

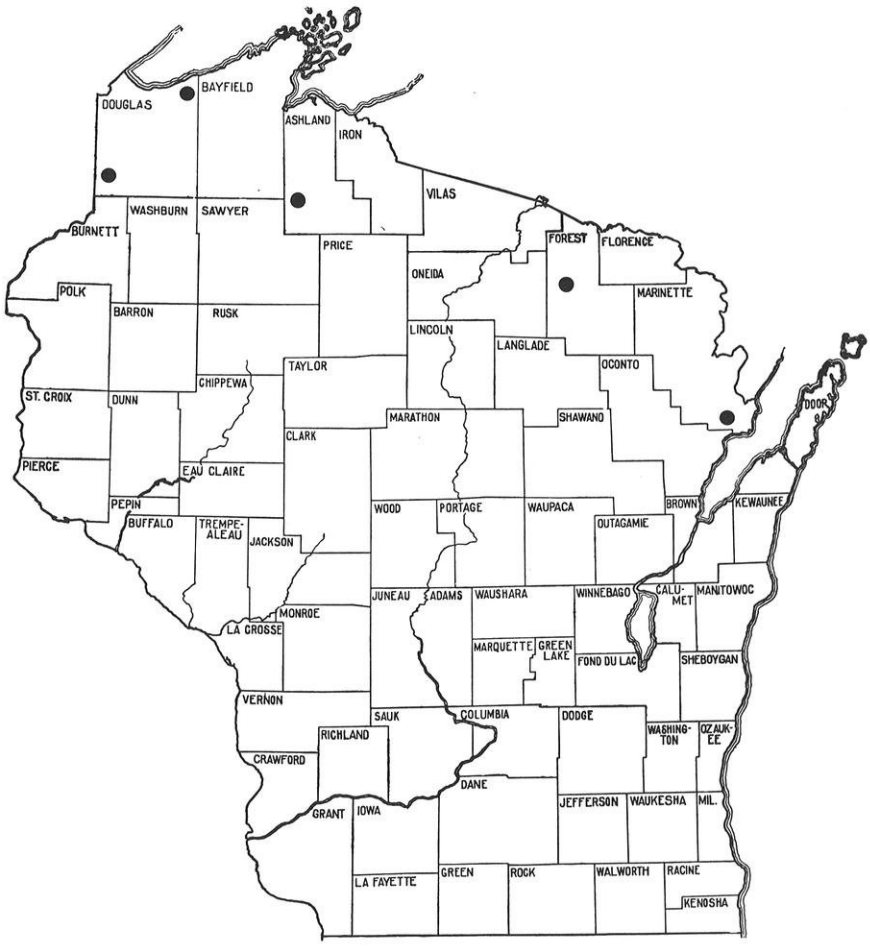


Figure 1. Locations of known and suspected nestings of Great Gray Owls in Wisconsin.

Clam Lake, Ashland County, in the Chequamegon National Forest. Habitat was of the Northern Wet-Mesic Forest type (Curtis 1959). The site was dominated by uneven-aged Black Ash (*Fraxinus nigra*) with lesser numbers of Yellow Birch (*Betula alleghaniensis*), Eastern White Cedar (*Thuja occidentalis*), Balsam Fir (*Abies balsamea*), Red Maple (*Acer rubrum*), and Eastern White Pine (*Pinus strobus*) (Figure 2). The area contained several "islands" of higher ground which were dominated by mature Eastern Hemlock (*Tsuga canadensis*). Ground cover consisted mostly of various grasses (*Graminae* spp.) and sedges (*Carex* spp.). Forests dominated by Black Ash have been found to be of importance to Great Grays in north-central Minnesota, both for nesting and as hunting areas (Steve Loch, pers. comm.).

The platform used for nesting was erected 12 February 1986 at a height of 38 feet in a 70 foot-tall Black Ash with a diameter-at-breast-height of 23 inches. This tree is located 45 yards from the

Figure 2. Habitat at Clam Lake Great Gray Owl nest site. Platform in center of photo. 9 April 1988.

edge of one of the U.S. Navy's ELF lines. The ELF (extremely low frequency) lines are an experimental method of sending information to deeply submerged U.S. submarines by transmitting radio waves through the bedrock. These lines, which are similar to power-line corridors, create a 40–50 foot-wide opening through the forest, resulting in an ideal hunting area for raptors (Figure 3).

Vegetation on this section of the line consisted mostly of grasses and sedges, with small patches of Common Cattail (*Typha latifolia*), Pale Laurel (*Kalmia polifolia*), Labrador Tea (*Ledum groenlandicum*), Leatherleaf (*Chamaedaphne calyculata*), willows (*Salix* spp.), and alders on the wetter sites; and brambles (*Rubus* spp.), saplings, and brushy growth on the upland sites.

Nest Observations.—The following account is a revision of field notes (with related comments) made during visits to the nest site. Because the nest was located 135 miles from my home, visits were limited to weekends.

On 2 April, while checking nesting platforms near Clam Lake, I found one containing a large rounded lump. After moving to within 50 yards, I glassed the "lump" with binoculars and was surprised to find myself looking at a Great Gray Owl! I observed the bird for 15 minutes, then left to check several nearby platforms. Returning two hours later, I watched her for a few more minutes, until a light rain began, then left the area. At this time there was a snow cover of approximately 50%, with depths to 6 inches.

On 3 April Ken Luepke accompanied me to the nest site. Ken noted a similarity between this habitat and Steve Loch's study area in north-central Minnesota, which he and Follen had visited in May 1980. We observed the owl for 20 minutes from a distance of 50 yards. Other than occasional glances in our direction when we imitated the hooting of a Great Gray or squeaked like a mouse, she ignored our presence.

On leaving, we found several owl pellets atop the snow under a large Hemlock, 150 yards from the nest tree. A feather caught on a branch above identified this as a Great Gray roost tree.

On 9 April I observed the owl for one hour and photographed her for the first time. As on the previous visits, she was sitting low in the nest, indicating incubation.

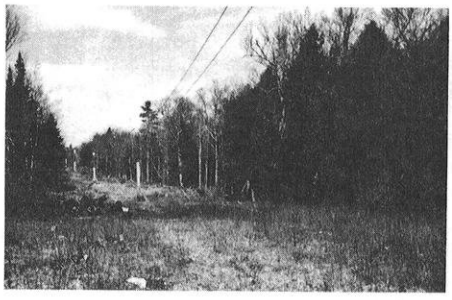


Figure 3. ELF line. Great Gray Owl nest located to right of large White Pine at left center; roost area in Cedar-Hemlock stand in right foreground. 9 April 1988.

To avoid unduly stressing her, the nest contents were not checked. Although female Great Grays are well known to be tight sitters at the nest, some birds are much less tolerant of disturbances, and occasionally a nest will be abandoned after human visitation (Nero 1980).

On 30 April I noted a change in the owl's position on the nest. Instead of sitting low, she was now sitting upright, an indication that she was brooding young.

Unable to see any owlets from the ground, I climbed a nearby tree. Upon reaching the level of the platform the owl glared at me for a few minutes, then appeared to lose interest and ignored me. Shortly thereafter she looked down at the nest and then partially lifted her right wing, exposing a downy, grayish-white owlet. A few minutes later she again lifted her wing, revealing two more owlets (Figure 4).

After observing and photographing the birds for 30 minutes I climbed a tree 17 feet from the nest tree for a closer view. Expecting the owl to flush from the nest while I was climbing the tree, I stopped several times to photograph her. To my surprise, when I reached the level of the platform she remained on the nest! Displaying incredible tolerance, she again only glared at me for a short time and then turned away, ignoring me for the rest of the observation period.

Most of the owl's activity consisted of shading the young and napping. Every few minutes, however, she opened her eyes and looked about. Small birds nearby did not seem to interest her, but several times she became fully alert and stared into the sky. On each of these occasions I turned to see what had attracted her attention. First, it was a Rough-legged Hawk (*Buteo lagopus*) passing overhead, then a Common Raven (*Corvus corax*), and then a Red-tailed Hawk (*Buteo jamaicensis*). Each of these birds was intently watched by the owl until lost to sight within the treetops.

Based on overall size and length of primary quill feathers, the owlets were estimated to be 1½-2 weeks old. Assuming an egg laying interval of three days and an incubation period of 30 days (Nero 1980), the first egg would have been laid in mid-March. This timetable appears consistent with Nero's data from southeastern Manitoba and northwestern Minnesota, where some Great Grays "begin laying as early as mid-March . . ." (Nero 1980).

On 7 May several WFWR members accompanied Ken and me to the nest site. Included were Ken's wife Jan, Phil Luepke, Neal Niemuth, Steve Rennhack, and Dean Albrecht. We planned to band the young owls and to attempt to capture and band the female if possible. Arriving at the site we noted that the female was not on the nest. At least two young were visible; a quick check with binoculars confirmed this, and revealed a fourth owlet. The female was soon discovered perched nearby and, as we continued forward, she began to protest with bill-snapping and a low "Whoop!" call.

Figure 4. Female Great Gray Owl with young on "tire" type platform. 30 April 1988.

As Ken started climbing the nest tree to retrieve the young the female became much more agitated and increased the frequency and intensity of hooting and bill-snapping. She also began moving closer to the nest, and once flew directly at Ken's head, veering off only when he raised his arm to protect himself. Just as he was about to place the owlets in a bag to be lowered to the ground she flew in once more. Incredibly, this time she landed on the edge of the nest! (Figure 5). Everyone watched anxiously as Ken slowly inched his free hand forward and then grabbed her legs. He finally managed to place the struggling bird in the bag and then carefully lowered her to the ground.

When the young had also been lowered, we banded, weighed, and measured them (Table 1). Inspection of the female's primaries and secondaries showed two age-classes of feathers, none of which were of the juvenal type, indicating that she was at least four years old (R. Nero, pers. comm.). With the banding completed, the owlets were returned to the nest and the female released. During this period a low hooting was heard, and soon after the male owl was seen in the distance. This was the first time he had been observed, and he remained in the vicinity for only a few minutes before departing, quickly disappearing into the forest.

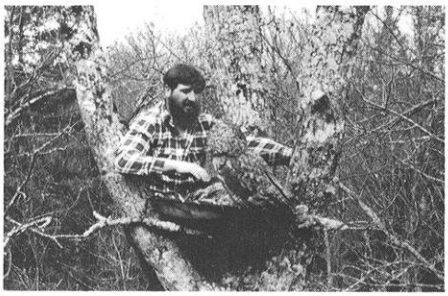


Figure 5. Female Great Gray Owl at edge of nest moments before capture by Ken Luepke. 7 May 1988.

Table 1. Weights of young Great Gray Owls. Clam Lake, Ashland County, WI. 1988.

	Weights (grams) on indicated date		
Band number	7 May	14 May	21 May
608-67621	640	—	740
608-67618	635	630	640
608-67619	500	500	550
608-67620	400	425	540

On 14 May as I approached the site, I heard a loud raspy call coming from the ground near the nest tree. Only one owlet was visible when I glassed the nest, but guided by their persistent food-begging calls, the others were soon located. All were found within 40 yards of the nest tree, perched on downed branches or leaning trees from 1–7 feet above ground. Although unable to fly, they had successfully managed to survive the long drop from the nest without apparent injury. Abandoning the nest well before flying age is normal for young Great Grays, and is believed to be in response to excessive temperatures at the (usually) exposed nest (Mikkola 1983). To avoid forcing the remaining owlet from the nest prematurely, the nest tree was not climbed.

On 21 May Ken, Jan, Phil, Neal, and I were joined by a Public Television film crew to further document the nesting owls. Although the owlets could be heard calling as we approached, they were difficult to locate; it took about ½ hour to find them all. All were found within 75 yards of the nest, at heights of 18–30 feet. Still incapable of flight, they were, however, very good at climbing. With

some difficulty, the owlets were gathered from their perches for weighing (Figure 6). The female remained close by, as usual, occasionally hooting or snapping her bill. In addition to the "Whoop!" call she also gave a new call—in cadence and pitch it was similar to the typical hooting of the Great Horned Owl (*Bubo virginianus*). The male was seen again, but as before, he stayed in the area for only a short while before flying away.

The resulting film footage was aired on the Public Television program *Outdoor Wisconsin* in July. Despite numerous visits to the area over the next two months, and many hours spent looking and listening for them, the owls could not be relocated after 21 May.

Food Habits

Forty-four pellets were collected during visits to the nest site. Most of these (40) were found below the roost tree, three were found in the nest, and one was found on the ground below the nest. Later examination of the pellet contents revealed that the owls had fed almost exclusively on small mammals (Table 2). This dependence on small mammals for prey is typical of Great Grays (Bent 1938, Craighead and Craighead 1969, Nero 1980, Mikkola 1983).

Figure 6. Young Great Gray Owls at approximately 3½-5 weeks of age. 21 May 1988.

Habitat in Wisconsin

The Great Gray Owl is an adaptive species and occurs in a variety of habitats throughout its extensive North American and Eurasian range (Nero 1980, Mikkola 1983, Bull and Henjum 1987, Osborne 1987, Quinton 1988). The preferred breeding habitat in southeastern Manitoba and northwestern Minnesota is Tamarack and Tamarack-Black Spruce bogs (Nero 1980). In north-central Minnesota they nest in forests dominated by Black Ash and have been found breeding in upland hardwoods bordering large Tamarack-Black Spruce stands (Steve Loch, pers. comm.).

While the particular breeding habitat may vary, the actual nest site is generally located fairly close to the forest edge or some other open area (Mikkola 1983). These openings are utilized by the owls as hunting grounds and may consist of meadows, old burns, power line corridors, recently logged areas, and farmland, either active or vacant (Nero 1980, 1984; Mikkola 1983; Steve Loch, pers. comm.).

Of approximately 30 Great Gray Owl sightings in Wisconsin during the breeding season (late March–September), all but three were from the northern one-third of the state (Follen 1980b and unpubl. data). Extensive forests, many containing Tamarack, Tamarack-Black Spruce, and Black Ash stands, are found throughout this area, which lie mostly north of a line representing State Highway '64' (Figure 1). Breeding season records exist for 13 of the 19 counties located mostly or wholly north of this line. These sightings suggest the possibility that Great Gray Owls may have

Table 2. Analysis of 44 Great Gray Owl pellets from near Clam Lake, Ashland County, WI. 1988.

Species	Number of individuals	Percent frequency of occurrence
Short-tailed Shrew (*Blarina brevicauda*)	1	1
Star-nosed Mole (*Condylura cristata*)	3	2
Southern Red-backed Vole (*Clethrionomys gapperi*)	1	1
Meadow Vole (*Microtus pennsylvanicus*)	112	87
Southern Bog Lemming (*Synaptomys cooperi*)	10	8
Passerine bird	1	1
Totals	128	100

bred or may breed throughout this region.

Current information seems to indicate that the owls may be nesting in habitats similar to those found in neighboring Minnesota. More nests need to be located, however, to correctly assess the species' habitat requirements and preferences in the state.

Status in Wisconsin

Historically, the Great Gray Owl was believed to be only a casual visitor to Wisconsin. Kumlien and Hollister (1903) considered it to be a "rare winter visitant" but added "If we could trust reports from hunters and residents in the Lake Superior region we would say that it is not rare in winter in that section, particularly during severe weather." In his 1951 revision of the above work, Schorger reported "The Great Gray Owl continues to be the rarest of our owls. No recent records are known." Gromme (1963) noted it was "Rare before 1900; no recent records." Hamerstrom (1972) determined that "Of the 8 or so state records in the 20th Century most have been in the northwestern part of Wisconsin. It was commoner in the days of big timber. Few trees have holes big enough to accommodate such a big bird. Nest boxes in our northwestern counties might possibly allure them, although their breeding range is primarily in Canada." Although Great Grays are not known to nest in tree cavities, large dead snags are often important nest sites (Bull and Henjum 1987, Osborne 1987, Quinton 1988, Steve Loch, pers. comm.).

More recently, Follen (1980a) stated "I have long wondered if the Great Gray Owl might be a regular resident with a viable population in the state of Wisconsin, and more and more I am suspecting this to be so." In a 1985 letter to the editor (*Passenger Pigeon* 47:83–84) Robert Nero wrote "I have long maintained that my home state [Wisconsin] has a breeding population of this sometimes secretive bird, and it has pleased me to see Don Follen working so actively to determine its status."

As a result of information obtained from Follen's study and this report, it is now clear that the Great Gray Owl breeds in Wisconsin, at least occasionally. No estimate of the number of birds breeding in the state is possible at this time,

nor is it known if most Wisconsin birds are permanent residents.

Because Great Grays sometimes make long flights (up to several hundred miles) from their natal/nesting ranges (Duncan 1987), the owls in Wisconsin, if not resident, may be emigrating from Minnesota and Canada. Movements of this type, thought to be related to declining prey availability (Mikkola 1983, Duncan 1987), could account for the apparent winter influxes mentioned by Kumlien and Hollister (1903), and might also be responsible for the Clam Lake nesting; finding sufficient prey populations and suitable nesting sites, some of these birds may overwinter to breed.

The nearest known active Great Gray Owl nest in Minnesota to Wisconsin was at Cloverton in 1978 (Steve Loch, pers. comm.). That nest was only about 10 miles southwest of the Moose Junction brood found by Follen, and 70 miles west of the Clam Lake nest. Great Grays regularly breed near Floodwood and Hill City, Minnesota (Steve loch, pers. comm.), only 45 and 75 miles respectively, northwest of Superior, Wisconsin. Clearly, then, there is a population of owls close to northwestern Wisconsin, some of which could be moving into the state periodically.

The reclusiveness of these birds makes breeding season observations of them difficult. According to Nero (1980) "This species can occur regularly without being particularly obtrusive. Like most owls, they are generally retiring, keeping to remote or dense woods and avoiding man. Except at active nests or during critical winter periods when they are forced to hunt during daylight hours, their presence in an area may go unnoticed." Even when nesting within 100 yards of roads, "birds were seldom observed" (Nero 1984).

Commenting on the species in Minnesota, Johnson (1982) wrote "In all likelihood we have always had a regular, fluctuating, but until recently an undiscovered population of Great Grays in the state." This statement probably applies to northern Wisconsin as well, but more information is needed to determine the distribution and abundance of this species in our state.

Conclusion

The use of man-made nesting structures has been shown to be an effective method of attracting and studying breeding Great Gray Owls (Nero 1980, 1984; Bohm 1985, 1988; Bull et al. 1987). Encouraged by the successful use of one of our artificial nests by Great Grays, WFWR will continue to install nesting platforms in suitable habitats in northern Wisconsin. To date, over 100 platforms (including Follen's) have been erected. Monetary assistance for this project has been generously provided by private and corporate contributors, although most expenses involved have been met by individual WFWR members.

Additional management opportunities for Great Grays exist in the Chequamegon and Nicolet National Forests and in DNR administered lands. Management activities might include alterations of present logging practices, especially concerning large Tamarack and Black Ash stands, to retain some potential breeding habitats; creation and maintenance of forest openings adjacent to or within potential breeding habitats; and installation of artificial nesting structures.

WFWR is continuing to solicit reports of sightings of Great Gray Owls in Wisconsin, especially those occurring dur-

ing the spring and summer months. Sightings and specimens may be reported to the author or to Wisconsin Foundation for Wildlife Research, B-894 Eau Pleine Road, Spencer, WI 54479 (715)659-3910.

Concluding his 1979 article, Follen stated "It will be interesting to see whether Great Gray Owls will be found nesting in succeeding years in this area (and at other places in Wisconsin)." We at WFWR are optimistically looking forward to another nesting in the not too distant future.

Acknowledgments

This paper is dedicated to the memory of Don G. Follen, Sr., whose passionate interest in Great Gray Owls was a great inspiration to me. Because of his pioneering research on the status of the Great Gray Owl in Wisconsin, our knowledge of this rare and elusive bird has been greatly increased.

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50 Years Ago in *The Passenger Pigeon*

About 80 persons attended the first convention of the Wisconsin Society of Ornithology held at the Kennedy Manor in Madison on May 6–7, 1939. The organization meeting is described in *The Passenger Pigeon* 1(5):63–65. This issue also lists the 123 charter members of the Society.

"Newly elected officers are as follows: President, N. R. Barger; Vice-president, Alvin Throne; Secretary, Murl Deusing; Treasurer, Karl W. Kahmann; Editor, W. E. Scott; Members-at-large, A. W. Schorger and Clarence Jung. Barger had been acting president and is also president of the Madison Bird Club. Throne is president of the Milwaukee Bird Club and with the Milwaukee State Teachers College. Deusing is with the Milwaukee Public Museum and Jung, a member of the Milwaukee Bird Club, is also from that city. Kahmann is a taxidermist at Hayward and a field ornithologist with considerable background, while Schorger is well known as one of Wisconsin's authorities in this field.

Common Yellowthroat *by William R. Stott, Jr.*

Surveying Waterbirds from Airboats at Horicon Marsh

Surveying waterbirds from an airboat proved to be a practical technique for estimating bird numbers in wetland habitats that are otherwise inaccessible. Population estimates for 10 species at Horicon Marsh are presented.

by Karen M. Manci and Donald H. Rusch

Wetland birds are difficult to census, and they have been traditionally counted either from the air or from roads bordering wetlands. Unfortunately, because of the effort needed to obtain population estimates of various waterbirds on large wetland areas, few censuses have been carried out there. On Horicon National Wildlife Refuge (NWR), counts of waterfowl and American Coots (*Fulica americana*) observed from refuge roads and aerial surveys had previously been used to estimate population sizes. Few attempts were made to estimate numbers of other abundant wetland birds such as herons, terns, and blackbirds.

Line-transect sampling has been used to estimate densities of various wildlife species (Burnham et al. 1980), including terrestrial birds (Ralph and Scott 1981). While travelling along a line, an observer estimates the distance from the line to all birds that are detected. Numbers of birds in the area adjacent to the line are estimated from these distance data after adjustments are made for decreasing detectability of birds at greater distances from the observer. Birds can be observed while the observer is travelling on foot, by horseback, or in a moving vehicle (Burnham et al. 1980). In our study we conducted line-transect estimates of waterbird numbers on Horicon NWR while travelling in airboats.

Our objectives were to: (1) estimate densities of various waterbirds by line-transect sampling from airboat routes on Horicon NWR, and (2) provide some guidelines for future use of this sampling technique.

Study Area

Horicon NWR encompasses the northern 8,390 ha of the 12,814-ha Horicon Marsh in Dodge and Fond du Lac counties, Wisconsin. The Rock River is the primary water source for the marsh. Water levels are manipulated by control structures at the 5,680-ha main pool impoundment and 9 subimpoundments (39 to 1,111 ha). During 1981–

1982, approximately one-third of the refuge's wetland was open water with no emergent vegetation, and one-half was vegetated with cattail (*Typha* spp.). Manci (1985) described the wetland habitat types present on the marsh during 1981–1982. Areas of each habitat on the line transect and within other sampling units were calculated from digitized infrared aerial photographs taken in June each year (Manci 1985).

Methods

During spring and summer 1981–1982, we collected data on waterbird numbers from 6 airboat transects (18.3 km total length) in the main pool of the refuge (Figure 1). The east-west airboat transect lines were located at least 0.5 km apart to minimize interference along adjacent transects. Transect lines could not be located randomly because the airboat could not be driven through large areas of dense, dry cattail. We also avoided placing transect lines near Black Tern, Forsters' Tern, and Double-crested Cormorant colonies to minimize disturbance to these nesting birds. Transects were placed systematically to insure that the habitat types along the transect lines were in rough proportion to the areas of habitat in the entire marsh. The 6 airboat transects were partitioned into 32 subareas of more homogeneous habitat types.

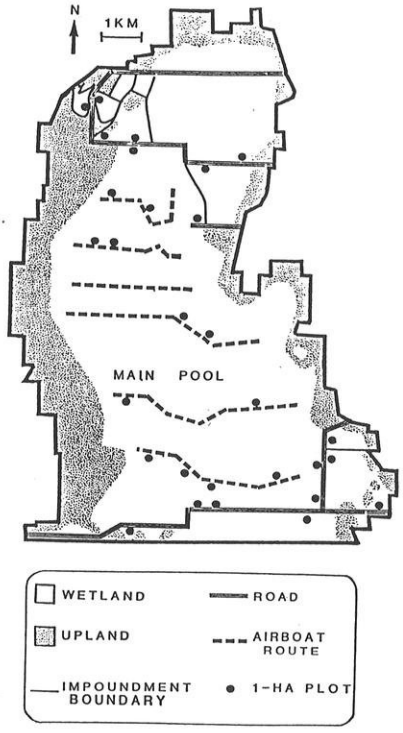

Figure 1. Location of airboat transect lines on Horicon NWR, 1981–1982.

Airboat transects were run weekly from the third week in May through mid-August from 1100 to 1400 hours. We chose those times of day because the early sun, low over the horizon, made identification of certain waterbirds more difficult in the flat, marsh terrain, and because of the rapid changes in bird conspicuousness near dawn (Shields 1977). The sequence in which transects were run each day was randomly decided before each count. Days with strong wind (> 20 km/h), rain, or fog were avoided in accordance with Robbins' (1981) suggestion that both high wind and rain depress counts.

The senior author conducted transect counts while driving an airboat at approximately 16 km/h. The driver sat behind the bow and 1.5 m above the waterline of the boat, well above most vegetation. A cassette tape recorder with a hand-held microphone was used to record the following data: (1) transect number and subarea; (2) species, sex and age (when possible) of each individual bird and number in each group of birds detected; (3) perpendicular distance to

each bird or center of group of birds (with the exception of shorebirds); and (4) supplemental information such as date, time, weather, and notes on bird behavior. At least 2 preliminary runs of transects were made prior to the weekly counts in mid–May to habituate birds to the disturbance.

Perpendicular distance was estimated from the center of the airboat (the transect line) in 1-ft (30.5-cm) increments to 20 feet (6.1 m) and 5-ft (1.5-m) increments beyond 20 feet.

On 3 dates in 1982, airboat transects were run by the senior author with a Horicon NWR employee (D. D. Haugen), sitting directly behind and slightly above her; he also counted birds and estimated perpendicular distances.

We used the computer program "TRANSECT" (Laake et al. 1979) to analyze our field data and estimate densities of waterbirds. For each bird species we selected dates within the field season when we thought our density estimates most accurately reflected the number of birds in the marsh (e.g., when male blackbirds were territorial rather than during migration, when female ducks were nesting, when nearly all young ducks had hatched). In almost all cases our estimates were based on at least 40 sightings of individuals or groups per species (Burnham et al. 1980). We calculated an average group size for species observed in groups along transects and adjusted the density estimate as described by Burnham et al. (1980).

Results

We obtained more than 40 sightings of individuals or groups during specific periods for 10 waterbird species (Table 1).

Density estimates of Red-winged Blackbirds were similar in 1981 and 1982, but Yellow-headed Blackbirds increased from 1981 to 1982 (Table 1). During the same period, counts of Yellow-headed Blackbirds along roads were twice as high in 1982 compared to 1981 (Manci 1985).

From early June to early July, numbers of Black Terns observed on airboat transects were fairly stable. We observed terns primarily foraging in open water and feeding young on nests. Density of adult terns was about twice as high in 1982 as in 1981 (Table 1). We also searched the main pool for nests of terns both years (K. M. Manci, unpubl. data) and found 54 nests in 1982 but only 20 in 1981.

Great Blue Herons, Great Egrets, and Black-crowned Night-Herons nested in a large colony on the southern end of Horicon Marsh, but large numbers of herons used the refuge as feeding areas, primarily in open water (Manci 1985). Numbers of all 3 heron species observed on airboat transects fluctuated throughout the summer, but were relatively stable from late July to mid-August. Density of Great Blue Herons increased from 1981 to 1982, but densities of Great Egrets and Black-crowned Night-Herons decreased (Table 1). Great Blue Herons were also more numerous along roads during 1982 compared to the previous year (Manci 1985). Great Egrets appeared to prefer the smaller impoundments along roads in 1982 over the main pool area. They fed in groups more often than Great Blue Herons and were 10 times more numerous along roads in 1982 compared to 1981. Black-crowned Night-Heron numbers along both airboat transects and roads (Manci 1985) during late July to mid-August were higher in 1982 compared to the previous year; however, the line transect

Table 1. Line transect estimates of waterbirds on Horicon NWR.

Species	Dates	Group size (mean ± SE)	Estimated birds/km² (mean ± SE)
Red-winged Blackbird	10–16 May 1981	1.00 ± 0	33.9 ± 4.4
	9–15 May 1982	1.00 ± 0	35.3 ± 4.2
Yellow-headed Blackbird	10–23 May 1981	1.00 ± 0	16.6 ± 2.2
	9–22 May 1982	1.00 ± 0	64.7 ± 10.4
Black Tern	7 June–4 July 1981	1.06 ± 0.04	13.9 ± 1.9
	7–26 June 1982	1.06 ± 0.05	25.4 ± 3.8
Great Blue Heron	26 July–1 August 1981	1.00 ± 0	18.6 ± 3.0
	26 July–1 August 1981	1.06 ± 0.03	29.2 ± 3.5
Great Egret	26 July–8 August 1981	1.09 ± 0.09	20.8 ± 2.0
	1–14 August 1982	1.62 ± 0.39	8.6 ± 1.7
Black-crowned Night-Heron	26 July–8 August 1981	1.05 ± 0.03	18.0 ± 2.9
	25 July–14 August 1982	1.20 ± 0.06	6.2 ± 2.3
Blue-winged Teal	10 May–13 June 1981	1.00 ± 0	28.7 ± 3.7
	9 May–12 June 1982	1.00 ± 0	21.3 ± 3.0
	21 June–4 July 1981	3.15 ± 0.52	99.9 ± 20.7
	20 June–10 July 1982	3.27 ± 0.45	54.0 ± 10.5
Mallard	10–16 May 1981	1.00 ± 0	31.6 ± 7.2
	9–15 May 1982	1.00 ± 0	29.2 ± 4.3
	7–27 June 1981	1.84 ± 0.27	80.0 ± 14.8
	13–26 June 1982	2.82 ± 0.45	86.3 ± 19.9
Redhead	10 May–6 June 1981	1.00 ± 0	18.3 ± 3.1
	9 May–5 June 1982	1.00 ± 0	7.0 ± 1.1
	14–27 June 1981	2.15 ± 0.36	36.3 ± 8.4
	13–26 June 1982	1.93 ± 0.19	29.1 ± 3.7
American Coot	10–23 May 1981	1.00 ± 0	286.2 ± 14.7
	1–12 June 1982	1.09 ± 0.03	237.3 ± 15.6
	7–20 June 1981	1.21 ± 0.12	417.4 ± 42.8
	1–10 July 1982	1.45 ± 0.15	88.9 ± 13.7
	12–25 July 1981	1.26 ± 0.05	364.9 ± 22.3
	11–24 July 1982	1.26 ± 0.10	58.7 ± 7.2

estimate indicated a decrease in density (Table 1).

Dates on which we calculated population estimates for waterfowl varied according to the behavior, migration, and production of each species. Observations of age of broods through the summer (Table 2) indicated that Mallards nested earlier than other waterfowl each year on the marsh. Nesting periods (defined as the 20th day before the median date of hatch to 14 days thereafter) for Mallards were 26 April to 30 May 1981 and 25 April to 29 May 1982. Redhead and Blue-winged Teal nesting periods were 11 May to 13 June 1981 and 16 May to 19 June 1982.

Observed sex ratios among ducks can vary depending on the stage of the nesting cycles, females become much less conspicuous than males after egg laying has commenced. During the prenesting period, sex ratios should approach 1:1. We found no deviation (X^2, $P > 0.05$) from equity in the observed male-to-female ratio for all 3 waterfowl species observed on 1-ha sample plots (Manci 1985) during the prenesting periods (Table 3). During the nesting periods, male-to-female ratios were different from 1:1 for Blue-winged Teal and Mallards, but not Redheads (Table 3). For all 3 species, the mean numbers of males observed weekly on counts during the prenesting

Table 2. Percent of broods hatched by indicated dates for 3 waterfowl species on Horicon NWR, 1981–1982.

	Percent of broods hatched					
	Blue-winged Teal		Mallard		Redhead	
Dates	1981 (n = 72)	1982 (n = 30)	1981 (n = 38)	1982 (n = 31)	1981 (n = 51)	1982 (n = 34)
Prior to 16 May	6	3	47	42	12	6
16–24 May	19	3	71	55	37	12
25 May–1 June	42	17	77	74	60	38
2–7 June	67	43	84	87	75	65
8–15 June	81	57	97	100	81	82
16–22 June	99	77	100		94	97
23–30 June	99	93			100	100
1–7 July	100	100				

period were similar (*t*-test, $P > 0.05$) to mean numbers during the nesting period. We therefore assumed that counts of male waterfowl during the nesting period equalled the number of breeding pairs on the refuge. Densities of Mallards and Blue-winged Teal were similar both years, but Redheads were more numerous in 1981 compared to 1982 (Table 1).

Two to 4 weeks after the nesting season, group size for each waterfowl species increased, and Blue-winged Teal had the largest group size (3.3 birds/group) of all waterbirds (Table 1). Soon after these "postnesting" dates, waterfowl began congregating in large groups (> 20 birds); numbers observed on both airboat transects and along roads (Manci 1985) sharply rose. Waterfowl from other areas had probably begun to migrate into Horicon Marsh. The large groups of waterfowl were easily flushed by the airboat and appeared to move to other parts of the marsh instead of circling in a short flight and landing in the same approximate location as the resident birds did during late spring and early summer.

Of the 10 waterbird species, coots were the most abundant species on Horicon Marsh during our study. By backdated ages of immature coots banded each year (Manci 1985), we determined that nesting periods for coots were primarily from mid- to late May 1981 and

Table 3. Male-to-female ratio (and sample size) of 3 waterfowl species observed during prenesting and nesting periods on 1-ha plots (Manci 1985) and airboat transects on Horicon NWR, 1981–1982.

Species	Prenesting period[1] 1-ha plots	Nesting period[2] 1-ha plots	Airboat transects
Blue-winged Teal	1.14:1 (252)	3.48:1 (251)*[3]	1.81:1 (284)*
Mallard	1.07:1 (31)	1.83:1 (170)*	2.04:1 (149)*
Redhead	1.19:1 (103)	1.39:1 (122)	1.25:1 (275)

[1]1 April to nesting period.

[2]Nesting period dates of Blue-winged Teal and Redheads were 15 May–13 June 1981 and 20 May–19 June 1982; Mallard dates were 24 April–30 May 1981 and 23 April–29 May 1982.

[3]Asterisk indicates male-to-female ratio different from 1:1 (X^2 test, $P < 0.05$).

early to mid-June 1982. We estimated densities of adult coots during the nesting periods and postnesting periods (18 and 26 June 1981 and 1 and 8 July 1982), and total coots during the third and fourth week of July (Table 1). Throughout spring and summer, coots were observed feeding in open water habitats, on exposed mud, and in emergent plant habitats (Manci 1985). Density of coots was higher in 1981 compared to 1982 during all 3 sampling periods (Table 1).

Stress and associated mortality probably contributed to lower breeding numbers and lower production of coots observed on Horicon NWR in 1982. During early April 1982, Horicon Marsh refroze after coots had arrived. The coots, unlike the waterfowl, did not move off the refuge. Many coots crowded into the few remaining open water areas. We frequently observed fighting between coots over possession of submerged vegetation. We also observed coots feeding on woodlot vegetation, on fish frozen in the ice, and on dead coots. On 9 April 1982, we observed 944 live coots and 139 dead coots along refuge roads. Fredrickson (1969) also reported that a large number of coots had died during a severe spring in 1964 when Little Wall Lake, Iowa, refroze after coots had returned to the lake freed of ice from early warm weather. The severe spring weather may also have been responsible for delayed breeding in coots and other waterbirds (Table 2) in 1982.

In 1981, density of adult coots increased ($P < 0.05$) from the breeding to the postbreeding period, but density decreased ($P < 0.05$) in 1982 (Table 1). The increase in 1981 was probably due to more coots being observed off the nest and in open areas. The decrease in 1982 was possibly due to a large number of nonbreeding coots (due to spring weather conditions) moving off the refuge or grouping in areas of other subimpoundments that were not visible from the roads. However, numbers of coots also declined drastically along areas of subimpoundments visible from the roads (Manci 1985). Clearly, density of coots during July was drastically lower in 1982 compared to 1981 (Table 1).

At least 30 group sightings of 5 waterbird species were obtained simultaneously by the senior author and a Horicon NWR employee (Table 4). Line-transect density estimates of male Red-winged Blackbird, Mallards, and American Coots were similar between the observers. However, the refuge employee's estimate of Mallard cluster size was twice as large as that of the author's, and the employee did not detect as many groups of coots as the author. Coots tend to swim into vegetation rather than flush and may be more easily detected by a driver (front of the airboat) than observer (rear). Practice runs seemed to aid in detecting more inconspicuous species. The differences in density of herons (Table 4) may be caused by difficulties in estimating distances greater than 50 m from the line because large conspicuous herons are detected more easily at greater distances than other species.

Discussion

We were initially concerned that the airboat would flush birds at distances (> 150 m) beyond our ability to detect or identify individuals; or that individuals would flush in large groups which would be difficult to count. Airboats have been used on Horicon NWR since 1977,

Table 4. Comparison of line transect density estimates in 1982 from data collected by Manci (M) and a Horicon NWR employee (H).

Species	Dates	Observer	Number of groups	Groups/km² (mean ± SE)	Group size (mean ± SE)	Birds/km² (mean ± SE)
Male Red-winged Blackbird	14 July	M	34	36.1 ± 4.4	1.15 ± 0.06	41.5 ± 6.0
		H	37	50.0 ± 8.4	1.14 ± 0.06	56.8 ± 10.0
Great Blue Heron	29 July, 6 August	M	126	27.5 ± 3.2	1.06 ± 0.03	29.2*[1] ± 3.5
		H	125	56.0 ± 5.8	1.24 ± 0.08	69.4 ± 8.5
Black-crowned Night-Heron	29 July, 6 August	M	65	10.8 ± 2.3	1.17 ± 0.07	12.6* ± 2.9
		H	62	15.7 ± 1.2	1.68 ± 0.27	26.3 ± 1.3
Mallard	29 July	M	48	41.6 ± 7.1	3.54 ± 0.81	147.3 ± 42.0
		H	39	19.5 ± 2.1	7.51 ± 2.84	146.5 ± 57.8
Coot	12 July	M	53	66.5 ± 6.9	1.33 ± 0.10	88.4 ± 11.3
		H	30	45.4 ± 9.2	1.25 ± 0.12	56.8 ± 12.7

[1]Asterisk indicates M density estimate differed (t-test, $P < 0.05$) from H density estimate.

during spring and summer. Most birds were detected individually at distances less than 50 m. Migrants appeared to flush at much greater distances and in larger groups than residents. They were also not as likely to land or return to the area immediately after being flushed. For these reasons, we do not recommend line-transect estimates from airboats for migrant bird populations on wetland areas.

During the study, flushed birds most often flew perpendicular to the airboat a short distance (< 200 m) before landing, or circled and returned to the area where they were flushed. Herons sighted at distances beyond 50 m from the boat did not often flush, but instead, remained at the location where first sighted. Coots rarely flushed, but instead, swam a short distance out of the path of the boat. Blackbirds observed in cattails rarely flushed at distances greater than 20 m from the boat. Black Terns appeared to ignore the airboat unless directly in its path or if the airboat stopped. When the airboat was not moving, Black Terns would mob the observer. Waterfowl generally either swam away or flushed and returned to their previous location. Except for migrants, waterfowl typically flew short distances (< 200 m).

Because of logistic constraints imposed by dikes and impassible habitats, airboat transects were established only in the main pool (68% of the refuge's wetland). For an adequate appraisal of waterbird populations on an entire management area, line transects should be located through all wetland areas. When this is impractical, line transect estimates from airboats could be supplemented by counts, preferably point transects (Burnham et al. 1980), from roads or other locations.

For some of the less abundant waterbird species (e.g., Forster's Terns and Ruddy ducks) on Horicon NWR, adequate population estimates could only be achieved by running more transects over a shorter period of time. However, we caution in excessive use of airboats.

Swanberg (1982), who used airboats in her research on Horicon Marsh, suggested that Redhead nest success was negatively influenced by investigator disturbance. No adverse effects on breeding waterbirds were documented in our study, but we were not involved with intense nest searches or measurement of nest success, with the exception of Black

Terns and Forster's Terns. During weekly counts, however, we avoided operating airboats near colonial nests of Black Terns, Forster's Terns, and Double-crested Cormorants because these species were on endangered or watch lists in Wisconsin (Les 1979). We did visit colonial nests of terns several times during the nesting season, but could not attribute any nest loss due to abandonment of birds caused by airboat disturbance. At 10 m, nesting American Cots nearly always remained on the nest, but other waterfowl nearly always flushed.

We recommend studies that would assess the effects of airboat transects on behavior and breeding success of waterbird populations before these transects are run more than once per week, and before airboats are used on management areas where they are not currently in use. Since 1977, Horicon NWR personnel and researchers have used airboats periodically for various purposes. We could find no difference in density of waterbirds on 1-ha plots located along roads compared to plots along airboat transects in similar habitats (K. M. Manci, unpubl. data) but again, nesting success was not measured.

We feel line-transect estimates of waterbirds from airboats can be reasonably unbiased and precise on large marshes. Advantages include the ability to cover large areas of difficult terrain in a short period of time, and robust and unbiased estimators that adequately adjust for birds present but not detected. The transects simultaneously run by the senior author and an observer unexperienced with estimating distances of birds from the airboats also indicated that consistent density estimates can be obtained by different observers. Problems involving estimating distances of more conspicuous birds frequently observed beyond 50 m (e.g., herons) can probably be overcome by practice runs prior to actual waterbird surveys.

Summary

Densities of blackbirds, terns, herons, waterfowl, and coots were estimated by line-transect sampling from airboats on Horicon National Wildlife Refuge during selected periods of May–August, 1981–1982. In most cases, 1–4 consecutive weekly counts along 18.3 km of airboat transect lines in the main pool (68% of the refuge's wetland) were adequate to achieve a sample size of 40 sightings of individuals or groups of 10 species. Average cluster size (number of birds/group) varied by species and season from 1.0 for male blackbirds and male waterfowl during the nesting period to 3.3 for Blue-winged Teal in late June to early July 1982. Line-transect sampling from airboats is not recommended for shorebirds and waterfowl when migrants are present because migrants flush in larger groups and at greater distances (beyond 150 m) than do residents.

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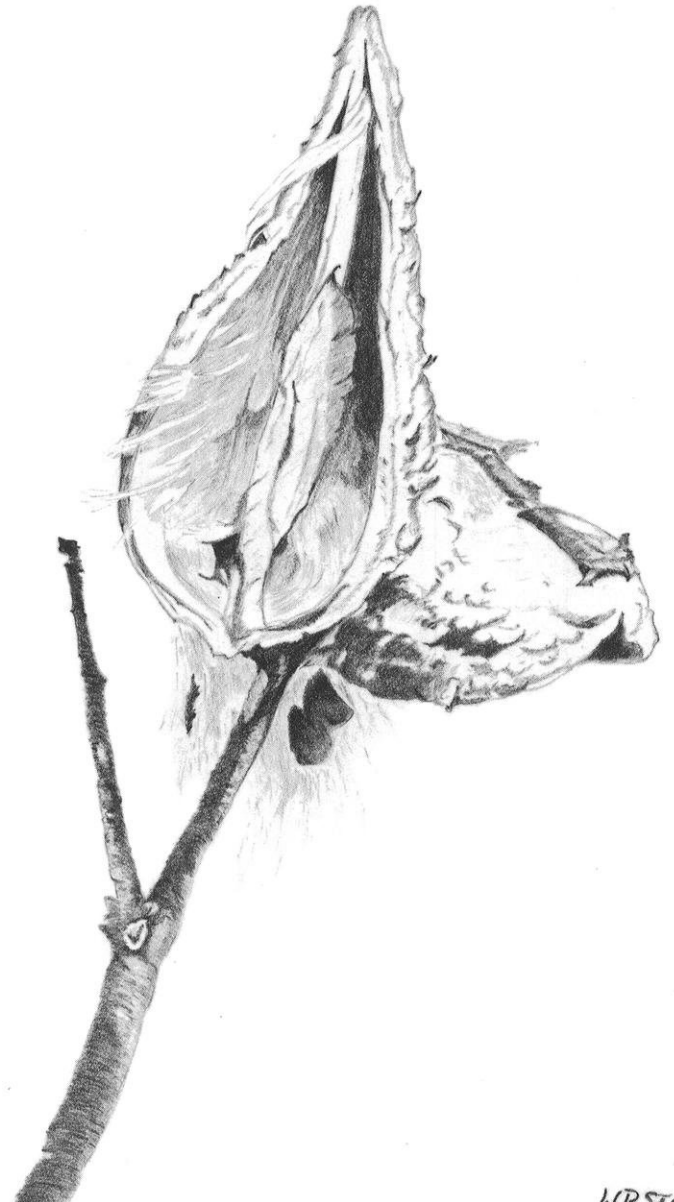

Milkweed pod *by William R. Stott, Jr.*

Bald Eagles Prey on Snakes

Although it apparently happens infrequently, Bald Eagles do occasionally prey on snakes. Several instances have been recorded in Wisconsin.

by Patrick E. Pierce and David A. Ross

On 8 June 1988, at 1630 hours, one of us (PEP) observed an adult Bald Eagle (*Haliaeetus leucocephalus*) carrying a large (about 1.2 m in length) snake near Big Island in DuBay Flowage, Marathon County, Wisconsin. The snake appeared to be a fox snake (*Elaphe vulpina*) and is the only species of snake in Marathon County attaining such a size (Vogt 1981, G. Casper, pers. commun.). The eagle was observed for 15–20 minutes while it was pursued by three Red-winged Blackbirds (*Agelaius phoeniceus*) as it flew and perched in a tree, still grasping the writhing snake, before being lost to sight.

On 26 June 1988, at 1145 hours, an adult Bald Eagle was observed carrying a snake about 1 m in length, possibly a fox snake (C. Collett, pers. commun.), 4 km southeast of the first observation. The bird was observed for about 5 minutes as it flew west from the wooded shoreline over the flowage until out of sight. Three Bald Eagle nests were active within 7 km of these observations in 1988 (C. Sindelar, pers. commun.).

Although turtles have been recorded as Bald Eagle prey (Clark 1982), snakes are a "rare item" in Bald Eagle diets (Stalmaster 1987) and a literature search revealed only four instances of snake as prey (Barrows 1912, Herrick 1934, Baldwin 1940, McEwan and Hirth 1980). Snakes are sometimes a major dietary component of other diurnal raptors (Mendall 1944, Knight and Erickson 1976, Steenhof and Kochert 1988). Small reptiles such as snakes may occur at a higher frequency than often suspected in eagle diets because their small bones can be digested completely or lost in the nest, causing underestimation in the diet (Mollhagen et al. 1972). Future food habits studies of Bald Eagles should consider the use of direct observation to more accurately document prey (Marti 1988).

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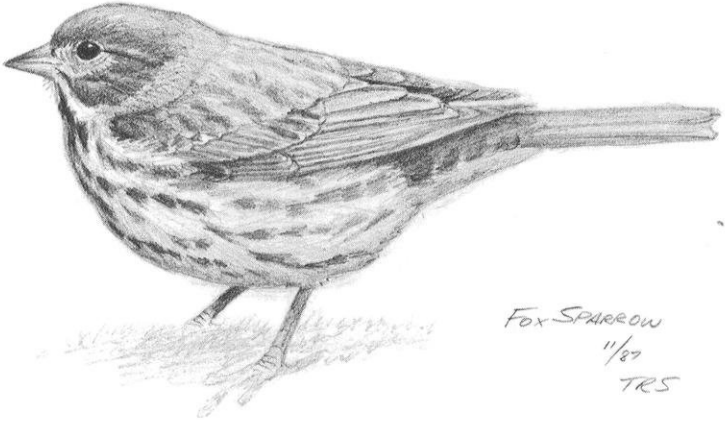

Fox Sparrow *by Thomas R. Schultz*

Salmonellosis Outbreak in a Winter Finch Population

An outbreak of salmonellosis at a winter bird feeder can cause heavy mortality. This case in Wisconsin was particularly well documented.

by Richard P. Thiel and Vicky Mello

Salmonellosis is a disease caused by the bacteria in the genus *Salmonella*. Salmonellosis is an acute intestinal disorder resulting in diarrhea and enteritis. A wide variety of birds are affected by the disease, including waterfowl, gulls, sparrows, finches and poultry (Steele and Galton 1971).

The bacteria are transmitted via contaminated food and/or through the feces of birds that contaminate the food supply (Stroud and Friend 1987). The disease can spread quickly in winter months where feed is concentrated such as at backyard feeding stations (Locke et al. 1973). Salmonellosis is related to age, condition, number of organisms ingested, and the stress placed on the bird at the time of exposure (Wobeser 1981). Signs of infection include "fluffed-up" feathers, lethargy, unsteadiness, flightlessness, shivering and accelerated respiration occasionally resulting in death (Anon. 1982).

This note reports on a salmonellosis outbreak that occurred among finches during the winters of 1981–82 and 1982–83 in northern Monroe County, Wisconsin.

Methods

Banding studies were conducted on wintering finch populations in the City of Tomah and at Fort McCoy Military Reservation in northern Monroe County, Wisconsin during the winters of 1977–78 to 1984–85. Birds were aged, sexed, and banded with numbered U.S. Fish and Wildlife Service bands. Weight and fat classes were collected from subsamples of banded birds, following the methods described by Thiel (1980). Wintering American Goldfinch (*Carduelis tristis*) densities were approximated by dividing total captures into the total hours traps were maintained at banding stations to yield captures per hour for each winter.

Initially bird recoveries from area residents were not solicited, but following discovery of the outbreaks several notices were published in local papers that resulted in the recovery of some additional dead birds. Dead recovered birds—both banded and unbanded—were collected, and at first were kept frozen for necropsy, but later were necropsied

upon collection. The first few specimens were submitted to the Wisconsin Department of Natural Resources for necropsy. Subsequent recoveries were examined in the field and the presence of yellow, caseo-necrotic, crop mucosa was used as evidence of salmonellosis, although its presence is not necessarily diagnostic (Anon. 1982, Fichtel 1978, T. Amundson, personal communication).

Winter weather data were gathered from a weather station in nearby Sparta, WI (U.S. Department of Commerce data).

Results

Salmonellosis outbreaks were documented during the winters of 1981–82 and 1982–83 during which 21 of the 22 *Salmonella*-caused banded bird mortalities occurred. A majority of the birds were found at or near feeding stations at local residences in Tomah and Tunnel City, WI. Cause of death of 20 birds could not be determined because of decomposition, and although they are not included further in our discussions, we suspect disease as a cause. The number of birds (banded and unbanded) dying of salmonellosis during the winters of 1981–82 and 1982–83 were as follows: 47 goldfinches, 3 Evening Grosbeaks (*Coccothraustes vespertinus*), 1 Purple Finch (*Carpodacus purpureus*), and possibly 1 Common Redpoll (*Carduelis flammea*). Goldfinches were the most commonly afflicted species.

A total of 4670 American Goldfinches were banded, and 34 dead banded birds were recovered in our study area in the 8 winters between 1977–78 and 1984–85 (Table 1). Wintering goldfinch densities were low (0.0 to 2.99 captures per hour) in 1979–80, 1980–81 and 1984–85, moderate (5.2 to 6.8 captures per hour) in 1977–78, 1978–79, and 1983–84, and at peak levels (1981–82 = 9.08; 1982–83 = 8.07) during the two winters of salmonellosis outbreaks.

The sex-ratio of the 47 goldfinches that died (62 males:38 females) did not differ from the sex ratio of the 2425 goldfinches banded during these two winters (60 males:40 females). Similarly, age ratios did not differ between the *Salmonella* afflicted birds and the banded population.

In winter 1981–82 most birds were recovered in April, in contrast to the winter of 1982–83 when the majority of recoveries occurred in January and February. During the winter of 1981–82 snow depths were greater, with depths in January and February averaging 48 and 53 cm, respectively. During the following winter snow depths ranged from 7 cm in January to 48 cm briefly in February.

The winter of 1981–82 was also colder than the winter of 1982–83. During 1981–82, temperatures of less than −18°C were recorded on 32 days, while temperatures exceeded 0°C on only 15 days. In 1982–83 only 11 days were recorded with less than −18°C, and on 49 days the temperature exceeded 0°C.

Discussion

Mortalities due to salmonellosis exceeded rates observed during winters when the disease was largely absent. During the winters of the outbreak 29 banded goldfinches were recovered from a total of 2425 banded birds, for a ratio of 11.96 banded birds recovered per 1000 birds banded. During the non-outbreak winters a total of 5 banded goldfinches were recovered out of 2245 banded birds, for a ratio of 2.23 recoveries per 1000 birds banded. The pro-

Table 1. Local recoveries of winter-banded American Goldfinches at Tomah, WI, 1977–78 through 1984–85.

Winter	Number of goldfinches banded	Number of recoveries	Number caused by Salmonellosis
1977–78	270	1	0
1978–79	434	0	0
1979–80	0	0	0
1980–81	1	0	0
1981–82	723	17	10
1982–83	1702	12	11
1983–84	826	1	0
1984–85	714	3	1
Total	4670	34	22

portion of non-salmonellosis caused mortalities during the outbreak winters was similar; 3.3 recoveries per 1000 birds banded.

Although the source of the outbreaks was not determined, a majority of the salmonellosis deaths were concentrated between the cities of Tomah and Tunnel City but did not include the Fort McCoy Military Reservation. This would suggest the disease outbreak was geographically localized in nature.

We analyzed wintering goldfinch population characteristics and environmental conditions as possible causes for the rapid spread of *Salmonella* during the winters of 1981–82 and 1982–83. During the outbreak winters goldfinch densities were at peak levels. This was the only obvious relationship between population characteristics and the outbreaks. Sex and age ratios were not found to be a factor, although Steele and Galton (1971) mentioned that young birds may be more susceptible to mortality.

Extremely cold temperatures are known to increase birds' susceptibility to disease (Steele and Galton 1971, Fichtel 1978, Brittingham and Temple 1986). In our study 64 percent (9 of 14) of the deaths where the exact date was known, the daily temperature exceeded 0°C. Most deaths occurred shortly after thaws. However, since infection may last one to several weeks (Steele and Galton 1971), many of our birds may have been exposed to periodic bouts of cold weather. In other studies extremely cold temperatures were associated with salmonellosis die-offs (Fichtel 1978, Brittingham and Temple 1986).

We were unable to establish the affect that snow depths had on spread of the disease. During the winter of 1981–82 a prolonged period of deep snow essentially precluded the prompt recovery of birds that had succumbed to *Salmonella*. A mean of 68 days elapsed between banding and date of recovery in 1981–82 as opposed to a mean of 26 days in 1982–83 when snow depths were less. During the second winter 8 out of 13 deaths occurred during February, the month with the greatest snow depths. This suggests that increased snow depths, which tend to concentrate birds at feeders, may also have been a factor in the development of the outbreaks.

On several occasions we observed "sick" appearing birds at the feeders that subsequently died and were determined to have had *Salmonella*. In most instances these birds visited feeders at dawn

one hour prior to the arrival of the first feeding flocks, or at dusk, several hours after the flocks had departed for the night. In each case the bird's feathers were fluffed and it made feeble attempts to eat.

Weights and fat classes of *Salmonella* victims differed substantially from birds captured and banded at random during the outbreak winters. The mean weights of 3 females, 4 second-year males, and 1 after-second year male that died of *Salmonella* were 10.7, 12.3 and 12.8 g, respectively. By contrast, the mean weight of 120 banded females, 69 second-year males, and 60 after-second year males was 15.3, 16.6 and 16.3 g. Similar losses in weight were recorded in a *Salmonella* outbreak among passerines in Pennsylvania by Fichtel (1978). None of the dead birds had any subcutaneous fat reserves in comparison to healthy banded bird which displayed heavy fat accumulations similar to those reported by Thiel (1980). Sudden weight loss and depletion of fat reserves were also reported in affected passerines from a recent Pennsylvania die-off (Fichtel 1978).

Conclusions

Salmonellosis outbreaks were observed among a wintering finch populations at Tomah, WI in 2 out of 8 winters during a banding study. The *Salmonella* outbreaks substantially increased mortality rates among wintering finch populations in our study area. Factors that contributed to the outbreaks included peak wintering finch densities concentrated at feeders, thaw periods, and possibly snow depths. Birds that died of the disease displayed symptoms typically observed of *Salmonella*-infected birds, including fluffy appearance and feeding lethargy and acute weight loss.

Recommendations

Varnishing and disinfecting wooden feeders annually, and cleaning feeder surfaces and removing soiled feed from feeding sites bi-weekly are recommended manners that aid in prevention of *Salmonella* outbreaks. If an outbreak does occur, feeding stations should be cleaned and closed down for one month to allow the unusually high concentrations of birds to disperse, and thus diminish the impact of this lethal disease on wintering populations of finches.

Although these tips are "common knowledge" among bird enthusiasts, it is little known among the thousands of birding novices that typically feed birds during winter. We recommend the Wisconsin Society for Ornithology develop means of informing Wisconsinites about safe winter bird feeding practices. The recent article by Brittingham and Temple (1988) is a good start. These may include cooperative ventures with feed suppliers to provide information on packages, the placement of brochures within feed packages, and perhaps public service announcements and news releases.

Acknowledgements

We wish to thank K. Mello for providing banding and recovery data, J. Chinnock for collecting dead birds, and R. Welch and D. Thiel for reviewing the manuscript.

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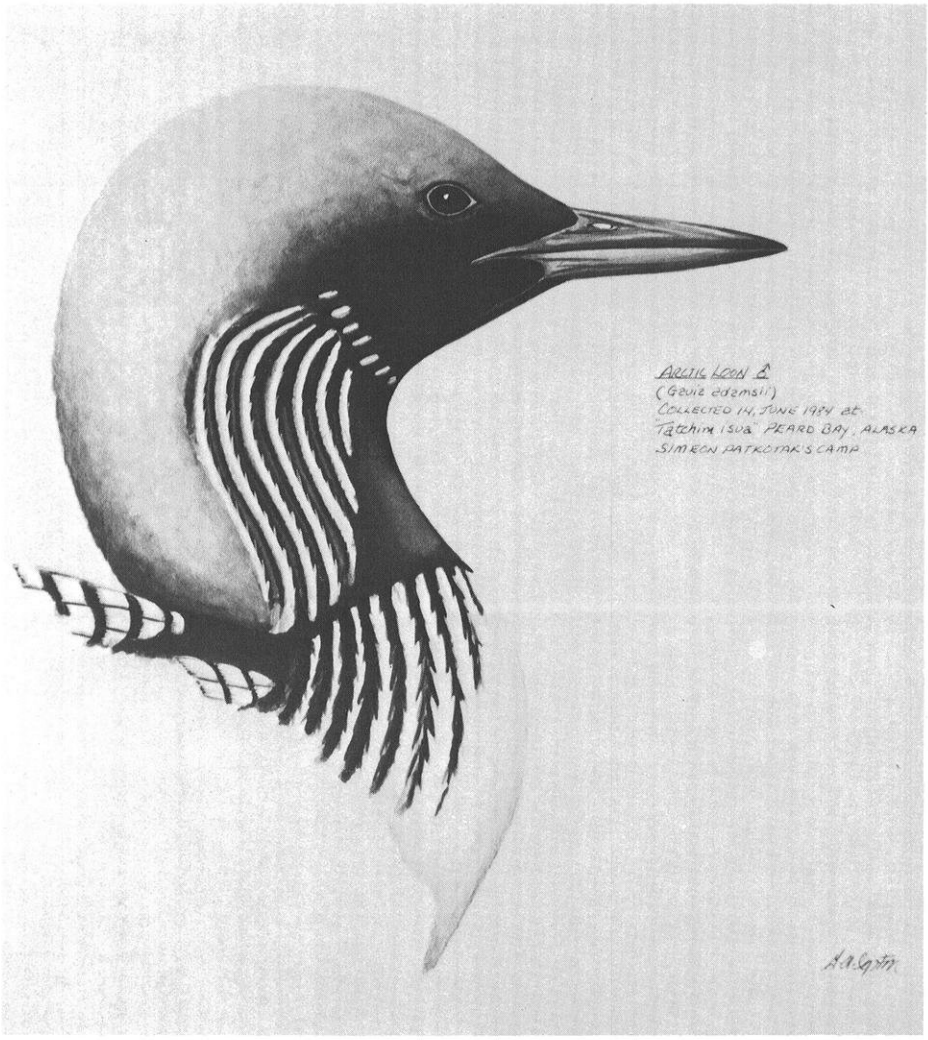

Arctic Loon *by Gregory A. Septon*

Food Habits of Juvenile American Coots on Rush Lake, Winnebago County, Wisconsin

Juvenile American Coots on Rush Lake fed primarily on plant material during the first 40 days after hatching. Only during their first week after hatching did animal material comprise an important portion of the diet.

by Bruce A. Eichhorst

Marshes support a diverse and rich resource of invertebrates which are potential food for breeding birds and their young. Recent studies have shown the importance of invertebrates as food for ducklings (Chura 1961, Perret 1962, Bartonek and Hickey 1969, Bartonek and Murdy 1970, Sugden 1973) and the young of marsh-nesting icterids (Orians 1966, Voights 1973).

The family Rallidae has representatives that span all habitats of a marsh. The American Coot (*Fulica americana*) is the most aquatic member of this family (Fredrickson et al. 1977:123), and is primarily a vegetarian (Jones 1940). Dietary information on the young, however, is incomplete. The purpose of this study was to provide information on the occurrence of invertebrates in the diets of juvenile American Coots (hereafter called coots), up to approximately 40 days of age. My objectives were to: (1) determine foods consumed; (2) compare food habits with food availability; and (3) determine diet change with age.

Study Area

I conducted fieldwork during the spring and summer of 1983 at Rush Lake, Winnebago County, Wisconsin. Rush Lake can be classified as either a class IV or V wetland (Stewart and Kantrud 1971), and has an area of 1,242 ha. The lake's water is clear, hard, and highly productive (Fassbender and Nelson 1975).

Emergent vegetation consisted of hard stem bulrush (*Scirpus acutus*) and cattail (*Typhas* spp.). Predominant species of submergent vegetation were stonewort (*Chara* sp.), sago pondweed (*Potomgeton pectinatus*), holly-leaved water-nymph (*Najas marina*), Eurasian water-milfoil (*Myriophyllum spicatum*), and coontail (*Ceratophyllum demersum*). A more complete description of the study area is given by Eichhorst (1986).

Methods

I located coot nests throughout the breeding season, marked them, and estimated their hatching dates by egg flotation (Boss 1963). As nests began to hatch, I marked some chicks by lobe-clipping (Eichhorst 1986), weighed them to the nearest gram with a Pesola scale, and recorded their age if known.

Prior to collections, I observed broods feeding for at least 15 minutes. My collecting permit allowed me to use a gun only when necessary; therefore, I pursued many chicks by boat and caught them with a dip net. The elapsed time from start of pursuit to capture varied, and ranged from 3 to 25 minutes. All chicks captured alive were given a lethal injection of sodium pentothal. To eliminate post-mortem digestion, I injected 70% ETOH into the gullet (esophagus-proventriculus) and gizzard of each chick. All chicks were frozen within 8 hours of collection.

I sampled submergent vegetation at 26 sites where I collected feeding chicks. This was done by hand since I found it to be the only practical means by which to sample the lake's thick vegetation. Hand samples of all species present at a site were placed in a 450 ml container and frozen within 8 hours. In most cases the vegetation was near the water's surface so no attempt was made to sample the free water zone. I did not sample terrestrial invertebrates. Later, invertebrates were removed from each of the vegetation samples by careful hand sorting and washing.

In the laboratory I weighed each chick on a triple-beam balance and measured the length of its culmen, tarsus, and mid-toe (including the nail) to the nearest 0.1 mm. By using the morphometric data from known-age chicks and the age descriptions of Boss (1963), I was able to place each chick into one of the following age-groups: I (1–6 days old); II (7–13 days old); III (14–21 days old); IV (22–28 days old); and V (29 to approximately 40 days old).

I removed the gullet and gizzard from each chick and placed the contents in separate (esophagus, proventriculus, gizzard), labelled vials containing 70% ETOH. Gullet contents were macroscopically sorted, identified, dried for 24 hr at 103°C, and weighted to the nearest 0.1 mg on a Type H4 Mettler balance. Due to the greater breakdown of gizzard material, I sorted the gizzard contents as whole seeds, invertebrate remains, and vegetation, and treated them as above. Plants and invertebrates were identified using the following guides: aquatic plants, Fassett (1966); insects, Borror et al. (1981); and freshwater invertebrates, Pennak (1978).

Foods consumed were expressed as percent occurrence and aggregate percent (Swanson et al. 1974) by dry weight, and compared by one-way analyses of variance (ANOVA) and Duncan's Multiple Range (DMR) tests. Percentages were transformed prior to statistical analyses; square-root transformation prior to paired *t*-tests (Swanson and Bartonek 1970), and arcsin transformation prior to ANOVA and DMR tests (Noyes and Jarvis 1985).

Results

A total of 60 chicks was collected during the period 22 July to 3 September 1983. The number of chicks I collected from a brood varied, and was distributed as follows: 4 each from 2 broods, 3 from 5 broods; 2 from 13 broods; and 1 from 11 broods. Thirty-one chicks contained usable amounts of food in the gullet

(≥ 1.0 mg dry weight). All gizzards contained sufficient food for analysis.

Gullet Material.—No age-group I chicks contained food in the gullet. Only one age-group II chick had usable gullet material, so I did not include it in any analyses. It contained *Chara* and *Scirpus* seeds (16% and 84%, respectively). The gullet material in one age-group IV chick could not be identified, so I did not include it.

Based on the gullet material, chicks from approximately 14 to 40 days of age consumed few invertebrates (Table 1). Invertebrates occurred in 24% of the gullets, but only comprised 1% of the total food. Total invertebrate items found were: 1 Ephemeroptera nymph, 1 *Helisoma* snail, 1 spider, 1 water mite, 1 Diptera adult, and inset leg and wing fragments. An ANOVA test revealed no differences between the 3 age-groups ($P = 0.81$).

Plant material occurred in 100% of the gullets and comprised 99% of the total food. *Chara*, *Scirpus* seeds, and *Najas* were the major plant items found in the gullets. The *Najas* content of the 3 age-groups differed ($P = 0.019$, ANOVA), and age group III chicks consumed greater amounts than age-group IV chicks ($P < 0.05$, DMR). There was also significant differences between the age-groups for the consumption of *Najas* seeds ($P = 0.009$, ANOVA). Consumption of *Najas* seeds by age-group V chicks was greater than age-group III and IV chicks ($P < 0.05$, DMR).

Gizzard Material.—Swanson and Bartonek (1970) demonstrated the bias associated with determination of foods found in waterfowl gizzards. They found significant differences between esophageal and gizzard contents in Blue-winged Teal (*Anas discors*), and recommended that esophageal contents be used in waterfowl food habits studies. This bias, which is due to the differential digestion rates of food items, has also been demonstrated for adult coots by Ivey (1987).

I compared the percentage of invertebrate material found in each of the 30 gullets having identifiable material with the corresponding gizzards and found no difference ($P = 0.074$, paired *t*-test). However, bias may not have been de-

Table 1. Gullet contents of 29 juvenile American Coots, Rush Lake, Winnebago Co., Wisconsin, expressed as percent occurrence and aggregate percent of dry weight.

	% Occurrence in age-groups				Aggregate % in age-groups			
Food	III ($n = 9$)	IV ($n = 10$)	V ($n = 10$)	ALL ($n = 29$)	III ($n = 9$)	IV ($n = 10$)	V ($n = 10$)	All ($n = 29$)
Plant								
Seeds								
Scirpus	56	40	50	48	31	24	11	21
Najas	11	10	50	24	tr[1]	2	30	11
Vegetation								
Chara	44	70	40	52	24	64	39	43
Najas	44	0	60	34	44	0	18	20
Potamogeton	0	10	0	3	0	10	0	3
Total Plant	100	100	100	100	99	99	98	99
Invertebrate	11	30	30	24	1	1	21	1

[1]tr = < 0.5%.

tected due to the small amounts of invertebrate material found.

To get some idea of digestion rates, I fed invertebrates to 2 hand-reared chicks which weighed approximately 30 grams each. They were fed 17 hemipterans each. One chick was killed after 15 minutes and the other chick after 40 minutes. Most hemipterans were still intact (all located in the gizzard) after 15 minutes. No hemipterans were intact after 40 minutes, but body parts were numerous and allowed identification. Since all collections of chicks took 25 minutes or less, any utilization of invertebrates should have been reflected in the gizzards. Therefore, in spite of some possible bias, and because of my restrictive collecting permit, I included the gizzard material in my analyses. Thompson (1973) suggested that gizzard contents could be used to indicate general differences in food habits of similar species collected in similar areas. I feel that comparisons can also be made between various juvenile age-groups within a species.

Invertebrate material occurred in 82% of the gizzards but only comprised 3% of the total food (Table 2). Age-group I chicks contained significantly more invertebrate material than those of the other age-groups (Table 3). I noted the occurrence of all identifiable invertebrate groups. Insect remains occurred in 92% of the 49 gizzards that contained invertebrate material and occurred as follows: Coleoptera, 69%; Hemiptera, 16%; Diptera, 16%; Trichoptera, 8%; Ephemeroptera, 2%; and Odonata, 2%. Snails (*Helisoma*) occurred in 4%, water mites (Hydracarina) in 27%, and spiders (Araneae) in 4% of the 49 gizzards. One gizzard contained a single louse (Mallophaga) which was probably ingested during preening.

Plant material was present in 100% of the gizzards and comprised 97% of the total food. *Scirpus* was the most common seed type found in the gizzards. Age-group I and V chicks had significantly fewer whole *Scirpus* seeds in their gizzards then age-group II nd IV chicks (Table 3). Age-group V chicks contained significantly more whole *Najas* seeds than the younger chicks. Identifiable plant vegetative material in the 60 gizzards occurred as follows: *Chara*, 65%; *Najas*, 23%; *Potamogeton*, 22%; and filamentous algae, 2%.

Food Availability and Utilization.— Comparisons were only made with the gizzard material since the sample size was

Table 2. Gizzard contents of 60 juvenile American Coots, Rush Lake, Winnebago Co., Wisconsin, expressed as percent occurrence and aggregate percent of dry weight.

	% Occurrence in age-groups						Aggregate % in age-groups					
Food	I (n = 9)	II (n = 14)	III (n = 13)	IV (n = 13)	V (n = 11)	ALL (n = 60)	I (n = 9)	II (n = 14)	III (n = 13)	IV (n = 13)	V (n = 11)	ALL (n = 60)
Plant												
Whole Seeds												
Scirpus	100	100	92	100	100	98	28	55	43	57	33	45
Najas	11	0	31	54	64	32	tr[1]	0	9	3	14	5
Potamogeton	22	21	8	8	0	12	2	1	tr	tr	0	tr
Myriophyllum	0	7	8	0	0	3	0	tr	tr	0	0	tr
Vegetation[2]	100	100	100	100	100	100	58	40	48	40	53	47
Total Plant	100	100	100	100	100	100	88	97	100	100	100	97
Invertebrate	100	86	70	85	73	82	12	3	tr	tr	tr	3

[1]tr = < 0.5%.

[2]Includes vegetative parts and seed fragments.

Table 3. One-way ANOVA and Duncan's multiple range test results for the food items found in 60 juvenile American Coot gizzards.

Food	One-way ANOVA Results[1]			DMR Test Results ($P < 0.05$)
	F-ratio	*P*	df	
Plant[2]	1.83	0.1364	4,55	
Invertebrate	8.23	4,55	0.0000	I>II,III,IV,V
Whole Seeds				
Scirpus	3.51	4,55	0.0127	II,IV>I,V
Najas	4.00	4,55	0.0064	V>I,II,III,IV
Potamogeton	2.11	4,55	0.0918	
Myriophyllum	0.61	4,55	0.6561	

[1]Variable is age (see methods).
[2]Includes vegetative parts and seed fragments.

larger. Snails (Helisoma), midges (Chironomidae), water mites (Hydracarina), and mayflies (Ephemeroptera) were the most common invertebrates in the vegetation and samples (Table 4). Only one sample contained Odonata naiads, even though adults were numerous in the area (personal observation).

Insects were present in 100% of the samples and 75% of the gizzards contained insect remains. Snails were present in only 3% of the gizzards but occurred in 96% of the vegetation samples. Amphipods occurred in 38% of the vegetation samples but were not found in any of the gizzards. Water mites were found in 22% of the gizzards but occurred in 81% of the vegetation samples.

Chara occurred in the greatest proportion of gizzards (65%). It was found at 69% of the sample sites. *Najas* and *Potamogeton* were about equally represented in the gizzards (23% and 22%, respectively). *Potamogeton*, however, occurred at more of the sample sites than did *Najas* (96% and 58%, respectively). Although *Myriophyllum* occurred at 61% of the sample sites it was not found in any of the gizzards. Its seeds, however, were found in 3 gizzards. *Ceratophyllum* was not present at any of the sample sites and was not observed in any of the gizzards.

Intrabrood Comparisons of Food Utilization.—Brood members tended to utilize the same plant foods, based on the gizzard contents. Comparison of the gullet contents, based in a smaller sample, did not show as great a selectivity. I did not make comparisons for invertebrate food items since their identification was more difficult.

Discussion

Greatest utilization of invertebrates by coot chicks, on Rush Lake, occurred during their first week of life. I found the remains of water mites (Hydracarina), spiders (Araneae), and insects (Odonata, Hemiptera, Trichoptera, Diptera, and Coleoptera) in the gizzards of age-group I chicks. Contents of these gizzards, however were dominated by *Chara*, *Potamogeton*, and *Scirpus* seeds (Table 2). I observed one adult pulling up *Potamogeton* plants, nipping off root sections and taking them back to a nest which contained two- to three-day-old chicks. Both chicks collected from this nest contained *Potamogeton*. Gullion

Table 4. Percent occurrence of invertebrates in 26 submergent vegetation hand samples, Rush Lake, Winnebago Co., Wisconsin. Samples are from sites where juvenile coots were collected.

Invertebrates	Percent occurrence
Gastropoda	
Helisoma	96
Lymnaea	4
Physa	23
All	96
Crustacea	
Cladocera	8
Amphipoda	38
All	42
Arachnoidea	
Hydracarina	81
Insecta	
Ephemeroptera	65
Diptera	
Chironomidae larvae and pupae	92
Ceratopogoniadae larvae and pupae	38
Unidentified adults	4
Coleoptera	
Dytiscidae	
larvae	27
adults	31
Haliplidae	
larvae	4
Curculionidae	
adults	8
Odonata	
Zygoptera	4
Hemiptera	
Belostomatidae	4
Mesoveliidae	4
Trichoptera	
Hydroptilidae	
adults	8
larvae	42
Unidentified	
larvae	31
adults	4
All Insecta	100

(1954) noted that food brought to coot chicks during the first few days after hatching consisted exclusively of animal matter. He observed a female collecting large numbers of freshly emerged dragonfly and damsel fly adults for her chicks.

In this study, ingestion of invertebrates declined significantly after the first week (Table 2), and by 14 days of age, chicks were consuming plant matter almost exclusively (Tables 1 and 2). Gullion (1954) found that young coots consumed considerable quantities of plant matter by the time they were eight days old.

Sooter's (1941) observations on the feeding habits of young coots in Iowa, indicated that their feeding was governed largely by what was available. Gastropods and the insect orders Odonata, Hemiptera, and Coleoptera comprised the greatest portions of the 45% animal matter found in the stomachs of the 22 chicks that he collected. Jones (1940) examined the stomach contents of 15 juvenile coots and found that they contained 46.4% animal matter. The major invertebrate items consisted of beetles (mainly Dytiscidae), true bugs (mainly Veliidae), and true flies (mainly Stratiomyiidae larvae). Fitzner et al. (1980) analyzed the food fragments found in the gizzards of 48 juveniles. Animal matter (Odonata, Diptera, Coleoptera, Hemiptera) made up 21% of the food items found, but the authors noted that their values probably underestimated the true importance of invertebrates to chicks from 1 to 30 days old since they pooled the data for all juveniles (1 to 120 days old).

Invertebrate utilization in this study was lower than any of the above studies. Large, dense beds of submergent plants were common in most areas of the lake utilized by feeding coots. Adults commonly fed their broods in these open water areas, and I frequently observed adults feeding *Chara* to their chicks. Self-feeding young appeared to select what was most abundant. In one case, I observed a 10- to 12-day-old chick stretching for and consuming achenes from low hanging *Scirpus* stems.

Sugden (1973), in his study of the feeding ecology of four species of ducklings, showed that both preference and availability influenced the ducklings in their selection of food, and the choice of invertebrates appeared to depend more on availability than did the choice of plants. Thompson (1973) found distinct differences between the gizzard contents of adult coots collected from backwater and open river areas of the Mississippi River. Backwater coots fed extensively on aquatic vegetation on or near the water's surface. Conversely, coots on the open river dived for their food and consumed less vegetation and more invertebrates.

I suspect that the coots on Rush Lake, utilized the most abundant food source, plants. The large amount of submergent plant biomass on the lake may have allowed this population to offer vegetation to their young sooner and more frequently than a like population nesting in a habitat such as a prairie pothole. Desrochers and Ankney (1986) studied the feeding behavior of coots in a series of potholes. They found that parents fed a greater proportion of prey obtained while diving, versus that caught by pecking at surface items, to their chicks. Successful dives by the parents invariably resulted in the capture of salamander larvae or large clumps of submerged vegetation; whereas, successful pecks resulted in the capture of single leaves or seeds from emergent vegetation or the occasional damselfly.

Utilization of the most abundant food source should require the least amount of parental energy expenditure during foraging. Horsfall (1981) found that the most powerful bias upon the diet of young European Coots (*Fulica atra*) was due to the parents, since the majority of food items offered to the chicks were eaten.

Horsfall (1981) suggested that, for the European Coot, dependence on an animal diet may be the result of an inability to digest plant food efficiently during early life. He found that rates of intestine and gizzard growth during the first 10 to 15 days of life were higher than the rates of liver and general body growth, and therefore, suggested that such disproportionate growth might be expected if the development of the digestive organs allowed young to switch from insect to plant food. Even if plants are not efficiently digested by young chicks they may still be utilized if they are superabundant and are consumed in large quantities, along with some invertebrates, thereby providing a balanced and nutritional diet. This may have been the case for the coots on Rush Lake. A study on the effects of various invertebrate and plant diets on the growth and survival of young coots is needed to better understand the value of invertebrate foods to them.

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Wisconsin Forster's Tern Recovery Plan

The Forster's Tern, an uncommon bird in Wisconsin, is locally common around a few large marsh-lake complexes. The species was placed on Wisconsin's endangered species list in 1979 because of its small numbers, poor productivity, and instability of recent colonies. A DNR plan plots the course to its eventual recovery.

by Michael J. Mossman

This article summarizes the Wisconsin Forster's Tern Recovery Plan (Mossman 1988), and updates it with data from the 1988 breeding season (Fruth et al. 1988). The recovery plan details the current and historical status and distribution of Forster's Terns in Wisconsin, summarizes life history information, identifies limiting factors that contribute to the species' endangered status, and delineates those actions required for securing this species as a viable and self-sustaining member of the Wisconsin ecosystem. The plan provides much information that has been deleted from the present paper, including: descriptions and histories of all nesting colonies; details, timetable, and justifications for recovery goals and actions; and thorough literature citations.

Forster's Tern Status and Distribution

Although a century ago the Forster's Tern bred throughout much of North America (Baird et al. 1884), it now breeds locally mainly in the prairie states and provinces, the western U.S., the Atlantic and Gulf coasts, and the western Great Lakes. It winters in coastal areas from central California and Virginia south to Costa Rica (American Ornithologists' Union 1983). Among our neighboring states, it is considered endangered in Illinois and of special concern in Michigan.

Historical information on the breeding status and distribution of Forster's Terns indicates a decline in Wisconsin over the past century, although specific data are scant. King (1883) remarked that "this is a summer resident and not very rare", and Kumlien (1891) stated, "Have found them nesting on the islands of Green Bay and in several small inland lakes. Our experience is that this species is much more common during the breeding season than either *hirundo* or *paradisaea*." Kumlien and Hollister (1903) found it "not nearly as numerous as formerly . . . A good many still nest

within the state principally in the small reedy lakes, even in the southern counties." In Illinois and Wisconsin, Cory (1909) considered it a common summer resident nesting in "the small interior ponds and lakes." It was considered a "rare summer resident" in the state by Barger et al. (1942, 1960). Barger (1959) stated that the species had been "nearly exterminated" by early plume hunters and later by the draining of marshes.

Robbins (*in press*) currently considers the Forster's Tern's summer status as uncommon in eastern Wisconsin and rare in western Wisconsin. This reflects not only breeding populations, but also a substantial number of nonbreeding and post-breeding Forster's Terns that normally reside in or travel through the state during the summer months.

Specific breeding records are summarized in Table 1 and Figure 1 and are detailed by Mossman (1988). Prior to 1960, these records consist of: up to 200 or more pairs during the period 1872–1894 at Lake Koshkonong, where the species evidently disappeared by 1919; nesting at Pewaukee Lake, probably in 1889; at least 36 nesting pairs on Lake Puckaway in 1934, and at least 10 pairs in 1936; a few nests each year, 1935–1937, at Big Muskego Lake; and a few pairs nesting on Horicon Marsh beginning in 1949.

Beginning in the 1960's, many Forster's Tern colonies were located. A few of these colonies were found in areas where Forster's Terns had evidently not nested previously, or for at least several decades. But because of the scarcity of historical information on the majority of newly reported colony sites, their discovery does not denote a statewide population increase.

During 1960–69, observers continued to find scattered pairs of Forster's Terns nesting at Horicon Marsh. Tom Erdman began working in the Green Bay area and documented 4 colonies along the Wisconsin shore of the Bay in Brown County. The third largest colony ever recorded for Wisconsin (431 nests) was found along the Bay at Duck Creek Delta.

During the 1970's, high water levels on Lake Michigan destroyed much of the emergent vegetation along Green Bay. Coupled with the effects of human disturbance and the filling of the Atkinson Marsh area at the City of Green Bay, this severely restricted the available nesting habitat and Forster's Terns were forced to nest in marginal habitats where the effects of predation, wind, wave, and seiche minimized productivity. It was largely on the basis of the Green Bay situation, the rarity of Forster's Terns elsewhere in the state, and their absence elsewhere in the Great Lakes that the species was added to Wisconsin's list of endangered species in 1979. During this decade observers documented other nest colonies along the Mississippi River, Lake Montello, Grand River Marsh, Horicon Marsh, Big Muskego Lake, Rush Lake, and Lakes Poygan and Butte des Morts.

The first statewide survey of Forster's Tern breeding populations was conducted in 1978 and 1979 by Trick and Harris (1978, 1979), and surveys have since been repeated annually by Wisconsin Department of Natural Resources (WDNR) and volunteer observers (e.g., Mossman et al. 1988), with varying degrees of thoroughness. Although these annual surveys may have overlooked a few small active colonies, the approximations of annual statewide breeding populations are sufficiently accurate to document a steady and major increase during the period 1978–84 (Table 1, Figure 2). The statewide nesting population declined in 1985, due

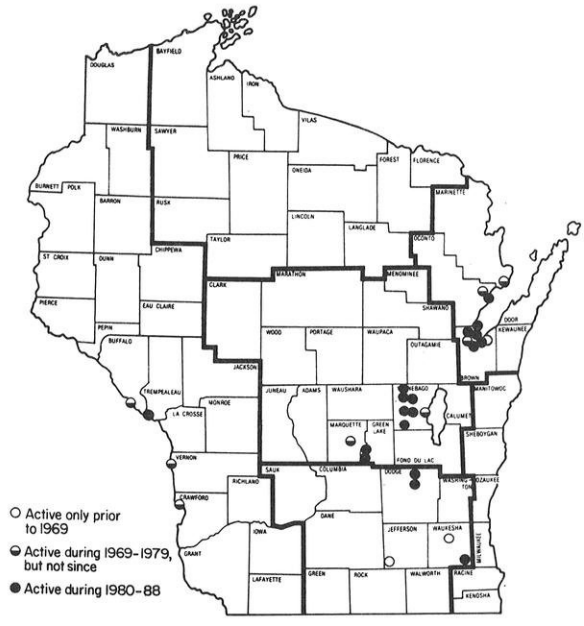

Figure 1. Locations of Forster's Tern colonies in Wisconsin, 1869–1988.

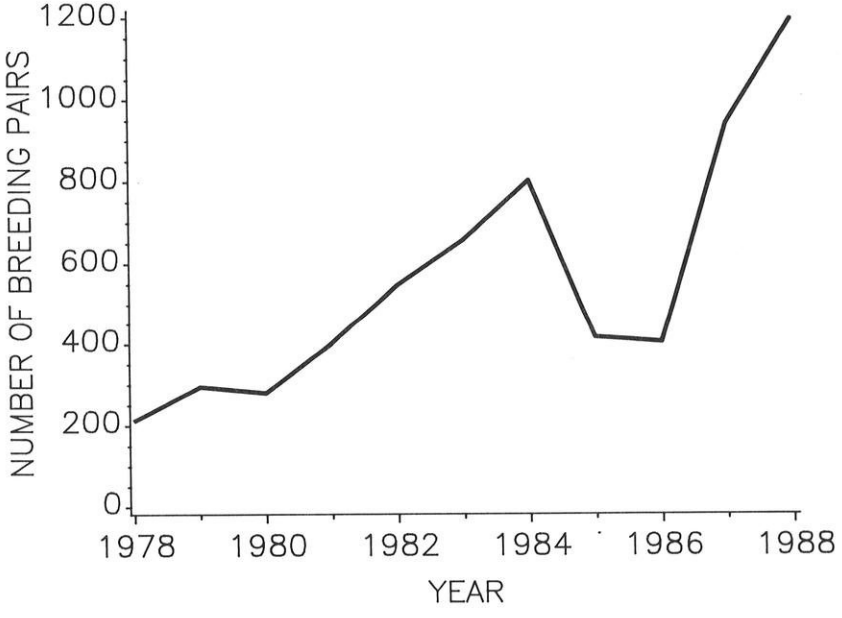

Figure 2. Size of Wisconsin's Forster's Tern breeding population, 1978–88.

Table 1. Estimated numbers of Forster's Tern breeding pairs at Wisconsin colony sites, 1969–1988.

County	Colony Site	Number of Breeding Pairs by Year																				
		pre-1969[1]	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Brown	Point Au Sauble	6	—[2]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—
	Duck Creek Delta	+[3]	431	+	+	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—
	Bay Port Ind. Tract	—	—	0	0	0	+	130	85	80	30	22	5	2	0	0	10	8	0	0	0	—
	Little Tail Point	≤20	≤20	≤20	≤20	20	≤20	≤20	≤20	103	0	0	0	0	0	0	0	0	0	15	0	—
	Long-tail Point	+	—	185	—	110	0	0	0	0	0	103	0	10	95	130	94	157	0	0	0	—
	Sensiba Wildlife Area	—	—	—	—	—	—	+	90	0	6	115	0	0	0	0	0	10	0	0	—	
	Kidney Island	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75	435	581
Buffalo	Spring Lake	—	—	—	—	—	—	—	—	—	19	0	—	—	—	—	0	—	—	—	—	—
Crawford	Lafayette Slough	—	—	—	—	—	—	—	—	—	5	0	—	—	0	0	0	—	—	—	—	—
Dodge	Horicon Marsh W. A.	2	(+)[4]	(+)	(+)	(+)	(+)	(+)	(+)	(+)	—	—	—	—	2	—	—	—	0	0	0	0
	Horicon N.W.R.	≥2	—	—	(+)	(+)	(+)	(+)	(+)	(+)	—	30	≥50	18	29	26	1	80	57	30	0	—
Green Lake	Grand River Marsh	—	—	—	—	—	—	—	—	—	—	5	0	—	+	—	20	42	4	3	1	7
	Lake Puckaway	36	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	0	0	0	7	22
Jefferson	Lake Koshkonong	≥200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0	—	—	—

continued

Table 1. *Continued*

County	Colony Site	Number of Breeding Pairs by Year																			
		pre-1969[1]	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Marinette	Peshtigo Harbor W. A.	—	—	—	—	—	+	+	65	37	0	0	0	0	0	0	0	0	0	—	—	—
Marquette	Lake Montello	—	—	—	(+)	(+)	(+)	(+)	(+)	(+)	7	(+)	(+)	(+)	0	—	0	—	0	—	—	—
Oconto	Oconto Marsh	0	0	0	0	0	0	0	0	75	35	0	0	0	0	0	0	0	0	0	—	—
	South Oconto Marsh	—	—	—	—	—	—	—	—	0	0	0	120	160	60	≥20	150	150	2	0	—	—
Trempealeau	Trempealeau N.W.R.	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—	0	0	—	—	0	3
Vernon	Coon Slough	—	—	—	—	—	—	—	—	—	10	0	—	—	—	—	—	—	—	—	—	—
Waukesha	Big Muskego Lake	8	—	—	—	—	—	—	—	—	—	—	30	—	39	—	26	61	40	20	44	50
	Pewaukee Lake	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
Winnebago	Rush Lake	—	—	—	≥8	25	28	25	27	17	—	≥40	0	4	21	3	12	1	43	47	18	10
	Sunset Bay	—	—	—	—	—	—	—	—	—	22	1	0	0	0	0	0	0	0	0	0	0
	Scotts Bay	—	—	—	—	—	—	—	—	—	—	—	85	0	0	60	100	70	0	0	0	0
	Poygan E, W, WW	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	85	156	287	148	103	170	149	281	396
	Clarks Point	—	—	—	—	—	—	—	—	—	0	0	0	0	0	21	97	96	90	65	158	98
	Terrell Island	—	—	—	—	—	—	—	—	—	0	0	0	0	0	1	0	22	0	0	0	34
	Wolf River	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	21	0	0	0	0
MINIMUM STATEWIDE POPULATION[5]		—	431	185	8	155	28	155	267	312	134	*>212*	*>295*	*>279*	*>402*	*>548*	*658*	*803*	*416*	*404*	*944*	*1201*

[1]Maximum number known to breed in a single year prior to 1969.
[2]— = no data.
[3]+ = nesting occurred but number of pairs unknown.
[4](+) = nesting occurred during period, but no annual data.
[5]Values in italics represent approximate statewide population.

largely to record high water levels on Green Bay. Numbers increased again in 1987 and 1988 with the establishment of the state's largest recorded colony (Table 1) on recent dredge spoils at Kidney Island (Renard Isle), and with improved nesting habitat at Lake Poygan caused by drought-induced low water levels.

The recent decade's growth of the statewide breeding population is also due in part to the success of the artificial nest platform program, initiated in 1978 in Winnebago County (Techlow 1986). Since that time, the number of platforms installed and the percentage of platforms used by nesting Forster's Terns have increased. A total of 117–271 pairs nested annually on these platforms during the period 1981–88.

Wisconsin Phenology and Migration

Forster's Terns arrive in Wisconsin in late April or early May. Although they have been recorded as early as 5 April, peak numbers are generally recorded about 1 May. From the time of arrival until mid–May birds are found in many nonbreeding areas in the state, and may even exhibit courtship or mildly territorial behavior at some of these sites. Although apparent nonbreeders are sometimes found throughout late May and June, most birds present in the state during 20 May through 10 July are associated with breeding colonies. Birds may begin nest building as early as the first of May but this activity generally peaks in mid-May. Wisconsin's earliest known egg date is 5 May, but most eggs are laid during mid- to late May. Late-nesting or renesting birds may lay eggs as late as early July. Eggs hatch in the earliest nests at the end of May, and in late nests up to late July. Young fledge between late June and mid–August, and soon disperse from the colonies with their parents. Adults and immatures are found in many nonbreeding areas, especially in eastern and southcentral Wisconsin, from mid-July through October, although some occasionally do not leave the state until early November. Winter records for Wisconsin are exceedingly rare.

Wisconsin Forster's Terns probably winter along the Gulf Coast. With few exceptions, they remain on the wintering grounds through at least their second winter.

Feeding and Nesting

Although Forster's Terns are known to pluck insects from the air, water, and plant surfaces, they feed primarily by diving for fish 2–8 cm long, within 30 cm of the water's surface, usually in shallow water. They often forage close to their nesting colonies, but sometimes travel at least 10 km and return with fish for their chicks.

This species typically nests in large marshes or estuaries, building its nest on floating dead or live vegetation, active or dilapidated muskrat houses, or occasionally mud bars. Nests are generally 20–60 cm in outside diameter, built of dead stems of emergent vegetation that are collected at the nest site. On muskrat houses, nests may consist of little more than a cup formed in the house material.

Forster's Terns are usually colonial in their nesting habits, but also nest singularly. Known Wisconsin colonies (Table 1, Figure 3) ranged in size from 1–581 pairs, the largest occurring at Kidney Island in 1988. This also appears to be the largest inland colony ever reported in North America. Of the 106

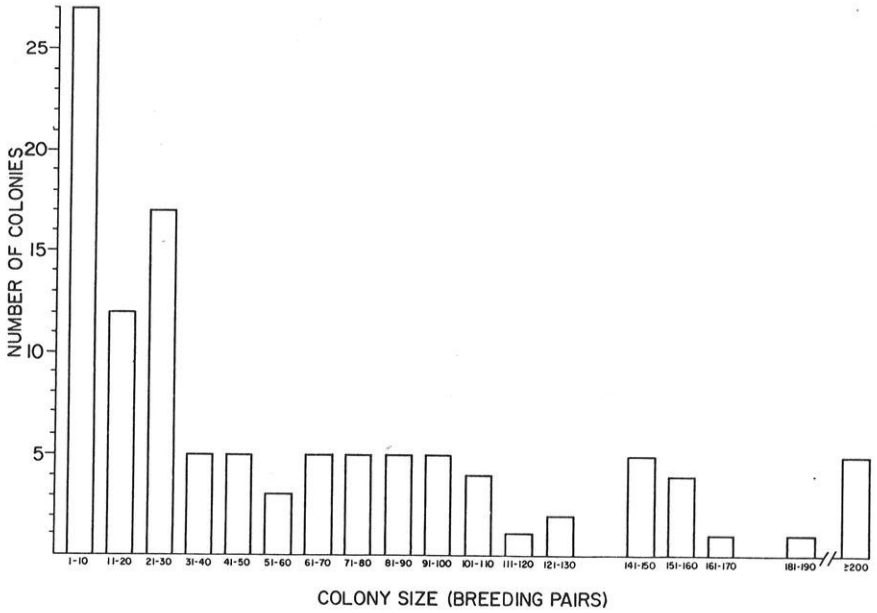

Figure 3. Size of Forster's Tern colonies in Wisconsin, 1969–87.

colonies with precise size estimates (1988 data excluded), mean colony size was 61.9 (SD = 78.0), with a median of 30 pairs. Of the 6,565 nestings represented by these data, 25% occurred in each of the following ranges of colony sizes: 1–75, 76–125, 126–180, 181–435 pairs.

The dispersion of nests within colonies varies. In colonies such as at Horicon National Wildlife Refuge (NWR) in 1981 and 1982, nests were scattered, generally 1 per muskrat house with many nests over 30 m from their nearest neighbor. At the other extreme are colonies on isolated rafts of dead vegetation such as Longtail Point, where 154 pairs nested in an area of ca 0.3 ha in 1984 and neighboring nests were generally 1–3 m apart. In rare instances, 2 nests may occur simultaneously on a single 60 × 60 cm artificial nest platform.

Although Forster's Terns raise but a single brood annually, they have apparently renested when early clutches were destroyed or abandoned. Wisconsin clutch sizes are similar to those reported elsewhere (e.g., Bergman et al. 1970): typically 3, occasionally 2 or 4, and rarely 5. Clutches of late-nesting or renesting Forster's Terns average significantly smaller than early nests (Techlow 1986).

Eggs hatch after an incubation period of 23–24 days. Beginning at the age of 3–4 days, chicks leave the nests when disturbed, hiding in nearby live or dead vegetation. Chicks swim well and venture farther from the nest with age but continue to return to the nest when disturbances subside, until near the age of 4 weeks, when fledging usually occurs. At least some juveniles begin to disperse with their parents from colony sites within 1–2 weeks of fledging, and adults apparently feed fledglings for several weeks.

Adult Forster's Terns are gregarious

in their defense of nesting areas, where they typically mob and dive-bomb intruders. The intensity of mobbing behavior peaks late in incubation and when chicks are young. Forster's Terns sometimes mob birds such as gulls, herons and owls, yet tolerate other species that often nest within the colonies, including Pied-billed Grebes, Yellow-headed Blackbirds, Marsh Wrens, and Black Terns. Common Terns have nested within or immediately adjacent to several Forster's Tern colonies in Wisconsin, especially along Green Bay.

Nesting colonies tend to recur at traditional sites, but colonies often shift, disappear, or reappear between years if habitat conditions change. The between-year variation in numbers of breeding pairs at particular sites or areas of the state, and the frequent appearance and disappearance of colonies (Table 1), suggest a mixing of breeding groups.

Forster's Terns have nested in a variety of large, marsh-lake complexes in Wisconsin. Most commonly, colonies occur in stands of cattail (*Typha* spp.), roundstem bulrush (*Scirpus validus*, *S. acutus*), phragmites (*Phragmites australis*), arrowhead (*Sagittaria latifolia*), and/or burreed (*Sparganium* spp.). These stands may be islands isolated amid open water, such as the phragmites stands in Lakes Poygan, Winneconne, and Butte des Morts, the floating cattail-jewelweed (*Impatiens biflora*) islands of Big Muskego Lake, the cattail islands at various Green Bay colony sites, the cattail-arrowhead stands along the Mississippi River, or the roundstem bulrush stands of Rush Lake. In a few cases, Forster's Terns nest in extensive marshes that are not surrounded by open water, such as at South Oconto Marsh and Grand River Marsh.

In recent years the most common nest substrate in Wisconsin has been floating, artificial nest platforms (Figure 4). Techlow (1986) found that Forster's Terns preferred standard, 60-cm platforms over smaller ones, which failed to provide sufficient protection against wave action. The most common natural substrates have been: floating mats consisting of a combination of mud and the rhizomes of emergent vegetation such as cattail or roundstem bulrush; mats of dead stems of emergent vegetation that have been windrowed among stands of living emergents or that have been windrowed atop very shallow or exposed bars of mud or sand; and muskrat houses and feeding platforms that are either active or dilapidated. Several unsuccessful nests at Rush Lake have been found on thick floating mats of the alga *Chara*. One nest was recorded on a floating log on the Mississippi at Spring Lake, and several have been found on wooden platforms of duck hunting blinds at Rush Lake and Big Muskego Lake. At Longtail Point and Kidney Island, several nests were built directly on sand at the edge of marsh colonies isolated from the mainland.

In Wisconsin, the average size of completed egg clutches in natural nests (mean = 2.54, n = 302) is within the range of values reported elsewhere (e.g., Bergman et al. 1970), but is significantly smaller ($P < 0.001$, $t = 10.29$) than the value for nests on WDNR artificial nest platforms (mean = 2.99, n = 1426). Hatching success and nest success both vary widely among colonies, from 0% to approximately 90%, with values being most consistently high at stable, platform colonies such as Lake Poygan. Although accurate estimates of fledging success are few, the Poygan platform colonies appear consistently to fledge 1.0–1.6 young per nest, more than most

Figure 4. A floating artificial nest platform on Grand River Marsh, Green Lake Co. (*Photo by M. J. Mossman*).

other Wisconsin colonies, where the average is typically less than 1 per nest.

Habitat Requirements

Several breeding habitat requirements are apparent for Wisconsin Forster's Terns, based on observations of the fates of nests occurring in various situations. In general, a colony is likely to succeed only if:

1. *Nesting substrate is available.* This may include windrowed stems of emergents, muskrat structures, artificial nest structures, floating mats of emergent vegetation and mud, or (rarely) islands of exposed sand or mud.

2. *Nests are protected from severe wind and wave action, seiche and other extreme changes in water level.* Forster's Tern nests are protected from wind and wave action by the mitigating effects of surrounding emergent and/or submergent vegetation, and often by the nest substrates, which usually float to some extent. A paucity of emergent vegetation has evidently been responsible for the destruction of eggs, nests, or entire colonies by wind and wave action in various years at several colonies. The destructive effects of wind and waves have been augmented by seiche activity on Green Bay, by generally high seasonal water levels, and by rapid rises in water levels following heavy rains. In most cases, extensive beds of aquatic vegetation serve to reduce these effects as well, although prolonged periods of high water may eliminate the emergent vegetation.

3. *Nest-site vegetation provides protection for chicks, but is not dense.* Chicks readily leave their nests and hide very effectively among nearby emergent vegetation when disturbed. However, although vegeta-

tion is essential at colony sites to provide protection for chicks and to mitigate the effects of wind and wave action, Forster's Terns do not nest amid dense vegetation except in openings created by muskrat activity, duck blind platforms, or natural deficiencies of the substrate. The reasons for avoiding thick vegetation may be that it restricts the ability of adults to find, approach, and leave the nest and chicks or that some degree of visibility is necessary so that birds on the nest can detect the approach of predators; another reason might be that predators can readily hide from mobbing terns among dense vegetation.

4. *The colony is relatively isolated from mammalian predators such as mink and raccoon.* Several nesting colonies have been destroyed by mammalian predators (probably mink) or disturbed enough that adults abandoned the site. These colony sites were within mainland marshes or were connected to mainland marshes by less than 200 m of exposed or barely submerged mudflats. Although mobbing behavior may effectively protect colonies from diurnal predation by mink, colonies are apparently vulnerable to predation at night.

5. *The colony is not susceptible to nocturnal avian predation, especially by Great Horned Owl.* Great Horned Owl predation has evidently destroyed many nests, or caused wholesale abandonment, in at least three colonies. The likelihood of Great Horned Owl predation is probably minimized at colonies located far from the mainland or from wooded islands. However, this predator is capable of hunting far out into marshes, as one was found near a Forster's Tern nest at Grand River Marsh, 1.5 km from the mainland, and another on a cattail island 1 km from the shore of Rush Lake. Isolation is probably not the only factor in minimizing Great Horned Owl predation. This species has become a threat to several over-water nesting species at Rush Lake, concurrent with the disappearance of emergent vegetation on that lake and the increased exposure of nests.

6. *The colony is protected from severe human disturbance.* Forster's Tern colonies are no longer subject to wholesale destruction at the hands of fishermen, as apparently occurred at Lake Poygan and probably other sites years ago. However, human disturbance has recently been suspected of contributing to the failure or abandonment of several Wisconsin colonies. Although Forster's Terns apparently become tolerant to repeated mild disturbances, such as the presence of anglers within 100 m of Lake Poygan and Winneconne colonies, any activity that disturbs adults and young from their nests theoretically increases the risks of predation, egg loss or inviability, piracy, or intraspecific attacks on trespassing chicks. Bird watchers may have contributed to nest failures at some Green Bay sites where dikes provided ready access to the vicinity of colonies. Human disturbance was suspected of causing colonies to be abandoned on Rush Lake particularly by duck hunters who claimed the colony sites for blinds over the July 4th weekend. At Longtail Point, all artificial platforms were stolen in 1979.

Human disturbance is habitat-related in the sense that it is minimized when colonies occur in sites that are poorly accessible to the public, such as Big Muskego Lake, where nesting islands are surrounded by extensive and thick mats of submergent vegetation, or at Horicon NWR, where access is restricted not only by regulation but by the vastness of the marsh. Human disturbance at Rush Lake also appears to be habitat-related, in that the loss of emergent vegetation has in-

creased competition between terns and duck hunters for available islands of emergent vegetation.

7. *Ring-billed Gulls do not nest at the colony site.* This gull is a serious competitor for nest sites with Common Terns in Wisconsin, and has the potential to usurp Forster's Tern nest sites in those rare cases (e.g., Kidney Island) where Forster's Terns nest on exposed sand or mud.

8. *Extensive feeding areas occur nearby.* Forster's Terns are typically found feeding up to 10 km from their breeding colonies, and the proclivity of this species to nest only in large wetland complexes probably reflects a need for extensive feeding areas for a large number of birds.

The quality of foraging habitat is undoubtedly important to Forster's Terns, in that it must produce a sufficient supply of fish of appropriate size available near the water surface. This implies an abundance and perhaps a diversity of prey, and good water clarity, although evidence for this is circumstantial.

9. *Feeding areas are not severely chemically contaminated.* In lower Green Bay, contamination by dioxins and other industrial pollutants has been implicated in low nest success of Forster's Tern (Harris et al. 1985, Hoffman et al. 1987). The specific compounds responsible, and the critical levels of environmental contamination, have yet to be identified.

In summary, Forster's Terns breeding in Wisconsin appear to require suitable nesting substrates among thin or moderately thick beds of emergent vegetation, or in openings of dense vegetation. Large marshes or wetland complexes are necessary. Nests are most likely to succeed if they are protected from wind, wave, and seiche action; if they are isolated from mammalian predators, Great Horned Owls, and human disturbance; and if they are located in areas that are not severely contaminated by toxic organochlorines.

Limiting Factors

The scarcity of information on mortality, recruitment, and production rates makes it difficult to determine factors that limit Forster's Tern populations in Wisconsin. Some limits may be imposed outside of Wisconsin during migration and wintering periods by factors such as weather, prey abundance or availability, and habitat loss or degradation, although there is no firm evidence for this.

Available information on Wisconsin Forster's Tern populations strongly suggests that the major limiting factor is nesting habitat, in particular, the availability of suitable nesting sites. This habitat limitation appears to keep some birds from nesting and forces others to nest in suboptimal situations where nests are subject to destruction by weather, waves, or predation. Several lines of evidence support this conclusion.

Forster's Tern colonies have disappeared or declined at several Wisconsin sites concurrent with the disappearance of suitable nesting habitat. In some cases the habitat change was due to artificially high water levels maintained by man-made dams (e.g., Lake Koshkonong, Rush Lake, natural sites on Lake Poygan and Winneconne, and possibly Lake Puckaway and Pewaukee Lake). At Lake Poygan, numbers of breeding birds typically increase during drought years, when water levels decline and expose mud and sand bars suitable for nesting. On Green Bay (Point Au Sauble, Little Tail Point, Longtail Point, Peshtigo Harbor, South Oconto Marsh), habitat loss was due to apparently natural, extended

periods of high water. Populations on Green Bay declined markedly during and after the prolonged high water of 1973–76, recovered somewhat as vegetation subsequently returned, then plummeted with record high water levels in 1985, when only 12 pairs nested, most of them within a protected impoundment. This loss of Green Bay nesting birds was responsible for the majority of the statewide population decline in 1985 (Figure 2). The statewide population increased substantially in 1987 and 1988 with the rapid growth of the colony on Kidney Island, a Green Bay dredge spoil site that is protected from water level fluctuations.

Another factor involved in the disappearance of suitable nesting habitat is carp activity, which uproots and prevents the establishment of aquatic vegetation. This has undoubtedly been a factor at many sites, including Lake Puckaway, Horicon Marsh Wildlife Area, the Lake Poygan area, and Green Bay marshes. An intensive carp removal program on Lake Puckaway was largely responsible for recent improvements in that lake's water quality, forage fish populations, and emergent vegetation. Concurrent with these habitat improvements was an increase in Forster's Terns feeding on the lake, and the eventual nesting of several pairs on artificial nest platforms in 1987–88.

Normally, Forster's Terns are not highly tenacious to nest colony sites (e.g, McNicholl 1975), but rather they appear adapted to the changeable conditions of marsh habitats. Prior to our society's wholesale alteration of Wisconsin's large lake-wetland complexes, it is likely that Forster's Tern colonies moved about from site to site within a particular complex or among complexes, as the suitability of nesting habitat at individual sites varied from year to year with changes in water levels and muskrat activity. However, the extent of potentially suitable habitat has been reduced remarkably over the past century, with most large lakes and complexes having lost most or all of their emergent vegetation as a result of dams, carp activity, lake shore development, and filling. The species now has dismally few choices for nest sites, and as a result often nests in suboptimal situations, particularly in stands of emergents that are too small, thinly vegetated, or exposed to mitigate the effects of wind, wave and seiche, or in stands that are not sufficiently isolated from predators.

Nesting in inadequate sites generally results in the loss of eggs, young, or entire nests. Destruction of nests by wind, waves, seiche, and predators has been reported elsewhere (e.g., McNicholl 1979) and has probably always been an important component in the species' reproductive biology. However in Wisconsin today it appears to be the dominant factor.

The limiting effect of nesting habitat is also suggested by the increases in breeding pairs at Lakes Poygan, Winneconne, and Butte des Morts with the development and placement of artificial nest platforms since 1979 (Techlow 1986, Mossman et al. 1988), and the phenomenal increase of pairs nesting on Green Bay with the development of nesting habitat among dredge spoils on Kidney Island. In 1987, 641 (68%) of the state's 944 Forster's Tern nests were on platforms or dredge spoils. In 1988, 852 (71%) of 1201 nests were on these artificial substrates. In recent years, all or nearly all available artificial nest platforms are used by nesting Forster's Terns, and there appear to be additional pairs present that cannot find suitable

nest sites, as indicated by the common occurrence of eggs apparently "dumped" into the nests of other birds or onto platforms beside active nests. On some platforms, a second clutch is produced, apparently by "waiting" pairs, after the first has fledged. Successive nestings are possible because of the extremely early initiation of clutches at traditional platform colonies.

Available data on clutch size, hatching success, and fledging success indicate that platform colonies are more productive than natural colonies occurring in similar sites, again suggesting that the availability of suitable nesting habitat may be limiting. Artificial nest platforms are rarely disrupted seriously by wind and wave action if installed correctly. Clutch sizes average significantly higher on platforms than on natural substrates, and estimates of fledging success are greater for platform colonies.

It is possible that other factors such as food availability are limiting Wisconsin Forster's Tern populations in some areas and/or in certain years, for example at Big Muskego Lake, where many nesting adults travel 5 km to feed in other, less polluted wetlands.

Chemical contamination from the industrialized lower Fox River has recently been implicated as a limiting factor for Forster's Tern populations on Green Bay. Harris et al. (1985) and Hoffman et al. (1987) found that Forster's Tern eggs from South Oconto Marsh on Green Bay had median concentrations of dioxins and PCBs that were 7–12 times higher than eggs from Lake Poygan colonies. Under controlled laboratory conditions, Green Bay eggs exhibited longer incubation periods and lower hatching success, and produced chicks and embryos with lower body weight, higher liver:body weight ratios, and more developmental anomalies than did eggs from Lake Poygan. These differences are consistent with the known effects of dioxins and PCBs on avian reproduction and development (e.g., Cheung et al. 1981).

Chicks and/or adults of Forster's Tern and 4 other fish-eating species have been found with similar congenital defects on Green Bay since 1973 (Harris et al. 1985), but rarely if ever in other parts of the state.

Recovery Strategy

The increase in Wisconsin's Forster's Tern breeding population (Figure 2) is encouraging, but does not necessarily indicate that the species is on the road to recovery. Most of the recent increases are due to the attraction of birds to artificial substrates at Kidney Island and Lake Poygan. It is risky to concentrate the nesting population in so few sites, any of which may be vulnerable to disturbances, habitat changes, or natural catastrophes.

Although the nest platform program and management of dredge spoils at Kidney Island have been remarkably successful in increasing the breeding population, primary reliance on artificial nest substrates is unwise in the long term. Platforms are expensive and time-consuming to build, install, remove, and maintain, and are of little value when habitat has severely deteriorated. Kidney Island's future is insecure in part because of competing demands for recreation, dredge spoil deposits, and nesting Ring-billed Gulls; but also because annual management is required to control the rank growth of vegetation, and chemical contamination is high and may be affecting production. Assuring the presence of appropriate natural

breeding habitat will encourage a truly self-sustaining population, as well as benefiting other fauna and flora, many of which are also suffering from habitat deterioration, and some of which serve as food for Forster's Tern.

The long-term recovery of the Forster's Tern will depend on management that is guided by an accurate knowledge of the species' habitat needs, limiting factors, and population characteristics. Although regular monitoring and experimental nest-site management have taught us a great deal during the past decade, we still lack enough understanding to interpret the population increase that has occurred since 1978, or to anticipate the future of the species in Wisconsin.

For example, are Wisconsin's Forster's Terns reproducing at a rate sufficient to maintain or increase their population? A glance at Figure 2 may imply so, yet we do not know whether the birds added to our breeding population were produced in Wisconsin or elsewhere. According to DiCostanzo (1980), Common Terns must produce an annual average of 1.1 young per pair to maintain a stable breeding population. If this is also the case with the closely related Forster's Tern, then it appears on the basis of our limited production data that the Lake Poygan area platforms may be producing surplus young, whereas most other nest colonies in the state are not producing young in numbers sufficient to maintain stable breeding populations.

This sort of information has obvious implications for management. Yet production data are difficult to obtain because chicks are hard to locate in marsh vegetation without severe disturbance to the colony; and counts of fledglings at colonies are often poor estimates because some fledglings typically leave the vicinity of the colony before other young have fledged. Nest enclosures or observations from blinds can provide good estimates, but are unwieldy for wide application. This is one case in which a technique or standard procedure should be developed in order to gain needed data, not only for monitoring the statewide population, but to measure the effect of various management activities or habitat characteristics on breeding success. There are several other research and management needs as well, as summarized in the action plan below.

Recovery Goal

To be removed from both endangered and threatened species list, over a 10-year period there must be an average annual statewide nesting population of at least 800 pairs at an annual average of 10 or more colonies. No more than half of all nests can be on artificial structures, and the mean annual production must be at least 800 young.

To move from endangered to threatened species list, over a 10-year period there must be an average annual statewide population of at least 700 pairs at an annual average of 8 or more colonies. Mean annual production must be at least 700 young.

Action Plan

Recovery activities are planned to begin in 1989, and include the following:

Surveys.—Determine annual breeding population, number of colonies, nest substrates, production of young, and causes of reproductive failures. Determine sites suitable for providing artificial nest platforms and sites suitable for cre-

ation of nesting habitat by impoundments or dredge spoil deposits.

Research.—Determine methods for estimating populations and production. Determine where young produced from the highly successful Lake Poygan area platform colonies are returning to nest. Determine feeding habitat requirements, the effects of ongoing habitat management, and limiting factors at platform and natural colonies. Monitor chemical contaminants.

Management.—Provide artificial nest platforms for up to 400 nests annually. Create nesting areas with dredge spoil deposits or impoundments. Manage feeding and nesting areas in accordance with results of the above research. Reduce chemical contamination in problem areas.

Protection.—Post nesting areas when necessary, and consider Forster's Terns in agency plans for recreational use of public lakes and wetlands.

Education.—Educate local and general publics, to encourage active involvement in and monetary contributions to recovery activities.

In general, artificial nest platforms are considered effective for temporarily maximizing production. However, management and protection of large wetland ecosystems will be necessary to secure a truly viable and self-sustaining population of Forster's Tern in Wisconsin.

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Forster's Tern (*photo by Owen J. Gromme*)

Why Do Some Birds Defend Their Nests so Vigorously?

by Stanley A. Temple

Anyone visiting a marsh in North America during the spring or summer has probably been attacked by Red-winged Blackbirds defending their nests. Most domestic cats are regularly attacked by nesting Bluejays, American Robins, or even House Wrens. And, the life of every raptor is punctuated by irritating episodes of being attacked by the nesting birds in the vicinity. The vigor of some of these attacks can be impressive, and it is not uncommon for a breeding bird to take considerable risks while defending its nest and occasionally to inflict serious injury on the intruder. Different species of birds, however, defend their nests with a wide range of vigor from all-out physical attacks to passive scolding from a distance; some birds merely slip away quietly and engage in no obvious display of defensive skill.

There are also dramatic differences between individuals of the same species, and even the same individual may show a considerable range of variation in the vigor of its nest defense, depending on the circumstances. Researchers have recently devoted much attention to the question of why these differences in nest-defense behavior occur between different individuals of a species and within the same individual, and some of the most controversy-generating findings have been made by Wisconsin ornithologists.

Much of this interest in the nest-defense behavior of birds arose from the "theory of parental investment." Trivers (1977) proposed that parent animals should defend their offspring with a vigor that is proportional to how much time and effort they have already invested in rearing them. According to this theory, nesting birds should steadily increase the vigor of their nest defense as the breeding season progresses from egg-laying through fledging, that is as the extent of their investment in raising the young increases. The investment really does accumulate: territory defense, courtship, nest-building, incubation, brooding, and, of course, feeding the nestlings until they are independent. In all, a substantial portion of a parent bird's time and energy during the breeding season is invested in the care of their young. After investing so much, it seems logical that they would want to protect that substantial

investment from loss by attacking anything, such as a predator, that threatened to destroy their offspring.

A number of ornithologists quickly recognized that birds seemed to fit the pattern predicted by the new theory of parental investment, and dozens of researchers devised clever ways to measure the intensity of nest-defense behavior through a nesting cycle. Generally, the researchers made regular visits to a bird's nest throughout the nesting cycle. At each visit they recorded the details of the bird's nest defense as it attacked either the researcher or a taxidermy mount of a predator. In some instances, the birds were visited daily while researchers recorded their reactions to a threat. They counted dives, pecks, and calls and measured how closely the defending bird approached the intruder. All of these were assumed to reflect how aggressive the defending bird was and how much risk it was willing to take on behalf of its offspring. Clearly, the more attacks made, the more aggressive the bird was; and the closer it approached a potentially dangerous predator, the more risk it was willing to take. After making each brief observation the researchers left and, of course, never actually harmed the birds or their nests.

When the results were in, there was almost complete agreement with the predictions of the theory of parental investment. For a wide variety of different birds the intensity of nest defense *did* increase as the nesting cycle progressed. Everything seemed to be fitting a nice predictable pattern, and ornithologists were largely convinced that the theory of parental investment explained much of the variation in nest-defense intensity that they had observed among and within individuals. Then, one of my Ph.D. students, Richard Knight, and I burst their collective bubble by suggesting that the patterns these researchers had recorded were not the outcome of parental investment at all, but instead had a completely different and somewhat embarrassing explanation.

Knight and Temple (1986a, 1986b, 1987a, 1987b, 1988) took a close look at some of the more subtle factors that can influence a bird's nest-defense behavior, and what they found revealed some serious flaws in the way previous researchers had studied nest-defense behavior. They discovered that birds recognize the researchers and their taxidermy mounts and treat them differently. For example, Red-winged Blackbirds recognized the difference between a taxidermy mount of a crow and a living crow, and they attacked the mounted crow more vigorously, probably because they were less afraid of it. Red-winged Blackbirds also recognized human beings as individuals. They attacked a person who had visited the nest previously (a familiar person) more vigorously than a person who had never been to the nest before (a novel person). Probably they learned that the familiar person was no threat to them because that person had never harmed them; they still, however, regarded the familiar person as a potential threat to the nest. The novel person, on the other hand, posed an unknown threat to both the birds and their nest, so they were more cautious and reserved in their attack.

Red-winged Blackbirds also attacked a person with less vigor when the person stared at the attacking bird then when the person stared in another direction. A direct stare was more threat-

ening to the birds than an averted gaze. Urban-nesting American Crows attack human beings that threaten their nests whereas rural-nesting crows retreat quietly at the approach of a person. Urban crows have learned that in town people can't hurt them, whereas rural crows have learned that people in the country shoot crows. Urban crows have little fear of people and hence defend their nests vigorously while rural crows fear people and dare not defend vigorously at risk of being killed.

These findings suggested that birds could quickly learn to modify their nest-defense behavior on the basis of their previous experience with a potential nest predator. Knight and Temple's next experiment showed that this ability to modify nest-defense behavior through learning had a major influence on the results of the experiments purporting to show that parental investment was responsible for nest-defense intensity increasing through the nesting cycle.

Because previous researchers had repeatedly visited birds' nests to measure their defensive behavior, they gave the birds ample opportunity to learn to recognize them as individuals and modify nest-defense behavior accordingly. Knight and Temple tried a different approach. Instead of revisiting the same nesting Red-winged Blackbirds and American Robins repeatedly during the nesting cycle, they visited different individuals only once at different stages of the nesting cycle. They compared the nest-defense intensity of these once-visited birds with the nest-defense intensity of birds that had been repeatedly visited. The results were as clear-cut as they were unexpected. The birds that were repeatedly visited steadily increased their nest-defense intensity through the nesting cycle, but the once-visited birds showed no such increase. Apparently, the number of previous visits by researchers, not parental investment, was causing the steady increase in defensiveness.

Unwittingly the researchers had modified the birds' behavior by the way they had studied it. By repeatedly visiting birds, allowing birds to attack them, never harming the birds, and then leaving after a short visit, the researchers had changed the birds' behavior. The birds gradually learned that the researcher was no threat to them but was still a threat to the nest. As a result the bird lost the initial fear that had restrained the vigor of their attack. Furthermore, the researcher always left after a short visit. This rewarded the birds for their defensive activities and positively reinforced those behaviors that had succeeded in driving the researcher away in the past. Loss of fear and positive reinforcement had caused the increase in nest-defense intensity, not parental investment. Previous studies had fatal flaws in the way they were done that lead to incorrect conclusions.

The moral of the story for scientists is that one has to be very careful in designing experiments that measure the behavior of intelligent animals, such as birds. There are often several possible explanations for patterns of behavior—in this case either parental investment or loss of fear and positive reinforcement—and one has to be careful to clearly distinguish between them before reaching conclusions.

On a less scientific level, this story provides yet another example of how birds have befuddled dozens of Ph.D.s in ornithology. The world of birds is generally more complex than we imag-

ine, and unravelling the subtleties of bird behavior requires a careful attention to details that can easily be overlooked in the quest for proof of an exciting new theory.

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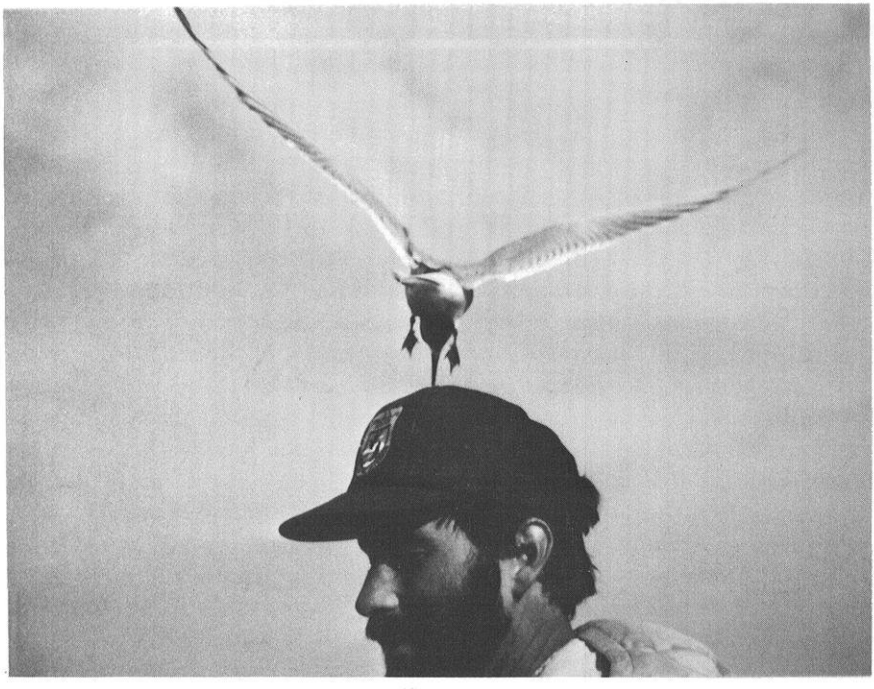

Arctic Tern defending nest (*photo by Barry Allen*)

Wildlife Law and the Birder

by Scott R. Craven

We all enjoy seeing and hearing birds around our homes or places of work, and doing so is a basic right available to everyone. There is no impact on the birds, and no permit, license, or wildlife laws are involved. However, there are numerous circumstances in which you must know and understand state and federal laws pertaining to live birds, dead birds, or bird parts, such as feathers.

Since I am neither a lawyer nor a wildlife law enforcement officer, I am not an authority on the interpretation of wildlife law. However, from experience and consultation with both state and federal officials, I can suggest several potential areas of conflict and offer some advice on the proper course of action.

In Wisconsin virtually all of our 392 species of birds are protected by state and federal laws. State law may be more restrictive, but not more liberal, than federal law. Protected species may be an endangered bird, a resident game bird, a migratory game bird, or simply a migratory bird covered under the Migratory Bird Treaty Act—between the U.S. and Great Britain (Canada) in 1916, with Mexico added in 1936—or some combination of these categories. In Wisconsin, the only "unprotected" birds are feral Rock Doves, House Sparrows, European Starlings, and 2 species of much less significance—Coturnix Quail and Chukar. Despite the "unprotected" status of exotic pest species, such as starlings and sparrows, they do receive some measure of protection under the law. The hunting regulations clearly state "A valid hunting license is required for hunting any unprotected species." Thus, assuming no firearms laws are being broken, a homeowner with an overabundance of House Sparrows at the feeder or the farmer with a silo full of pigeons must have a valid Wisconsin small game hunting license before resorting to a pellet gun or .22 rifle as a solution. Likewise, if such species are to be killed with an avicide, such as Starlicide or Avitrol, a permit from the Wisconsin Department of Natural Resources (WDNR) is required. The nests and eggs of "unprotected" species are treated as adult birds. Thus, under a strict interpretation of the law, removal of a House Sparrow nest from

your Purple Martin condo or Eastern Bluebird box also requires permission from the WDNR. In most cases, a verbal authorization from your local conservation officer is sufficient.

As the protection level of the species increases, so does the complexity of the pertinent laws. Take, for example "blackbirds," including American Crows, Common Grackles, and Brown-headed Cowbirds. Once routinely persecuted for agricultural damage and "target practice," these birds are now protected. Quoting again from the Wisconsin hunting regulations: "crows, grackles, red-winged blackbirds, and cowbirds may not be killed at any time without a federal permit unless they are causing damage or about to cause damage to trees, crops, livestock, or wildlife or when concentrated in large numbers that may constitute a health hazard or nuisance." This, of course, creates a gaping loophole in the intended protection; it is basically open to interpretation. For example, do these provisions allow you to control nuisance grackles in a suburban area or to remove cowbird eggs from a warbler's nest? Yes, I believe they do. Remember that no permits are needed if you only scare or herd depredating migratory birds, other than endangered or threatened species or eagles. The permits come into play for lethal control of problems.

The woodpecker problem in Wisconsin is an excellent example of permit requirements. Each year, woodpeckers cause thousands of dollars in damage to many kinds of wood siding on homes. Frustration levels for the affected homeowners are also significant, because no easy, effective, non-lethal control technique now exists. However, before homeowners can legally kill a woodpecker of any kind, by any means, they must have a federal permit which is also approved by the area WDNR office. The proper procedure is to contact the USDA Animal Damage Control office in Sun Prairie, WI (608-837-2727); a permit will be processed through the U.S. Fish and Wildlife Service. In cases of severe damage, immediate verbal authorization may be granted. Remember that most bird damage or nuisance problems can and should be solved with non-lethal, unrestricted techniques. The purpose of this discussion is to point out circumstances where legal issues must be considered.

The hunting of resident game birds, such as pheasants, grouse, turkeys, and quail, is covered by state law. Migratory game birds such as ducks, geese, or woodcock are covered by federal *and* state law. A hunter must be familiar with numerous and sometimes complex regulations relating to open and closed seasons, bag limits, license and special permit requirements, means of taking, and others before taking to the field. During most of the year "game" birds are not hunted and are then covered by the same general protection afforded to other species.

Hawks and owls, once widely persecuted as vermin, are now completely protected. A permit is required to kill raptors, even when causing damage; such a permit may or may not be granted depending on the situation.

The pet bird trade is another area with many laws and regulations designed to protect species in their native habitats, wildlife health in this country, and the integrity of our native wildlife communities. The release of exotics gave us the European Starling and House Sparrow. Without rigorous

eradication efforts, we might now be dealing with expanding populations of Monk Parakeets. In 1979, the U.S. Fish and Wildlife Service reported that 422,000 live birds were imported into the U.S. The burgeoning interest in exotic pet birds means the annual total is much larger today. Most of these birds are legally taken in the wild and imported; but many are not, and smuggling and illegal trade remains a major conservation and enforcement problem. With prices for some birds in the thousands of dollars—perhaps $12,000 for a pair of Golden-shouldered Parakeets, for example—the incentive for illegal activity is clearly present. In the case of live animals, the direct relationship between rarity and dollar value is a dangerous trend. Court cases for illegal trade in live birds are pending right here in Wisconsin.

What can you do? If you desire a pet bird of any species, attempt to determine its origin. Purchase from a reputable dealer or get involved with a cage-bird association. Many species are raised in captivity in the U.S., with no impact on native populations. Never release an unwanted pet bird of any kind in the wild; it is both unwise and illegal. Find a home for it or have it euthanized by a veterinarian.

What about native species as a pet? The state has no statutory authority to issue permits to retain a live protected or unprotected bird as a pet. Falconry is a special case. Licensed falconers may take raptors from the wild but under a very rigorous set of regulations, including a written exam and a 2-year apprenticeship with an experienced falconer.

Young or injured birds may be given immediate care or transported to a rehabilitator or release site without a permit; however, to care for a bird for an extended period of time you must notify a conservation warden within 24 hours of taking possession of the bird. Remember, in the case of "orphaned" young, the best help you can provide is to remove them from immediate danger (cats, cars, etc.) and then leave them alone. They may not be obvious, but the parent birds are usually in attendance.

Birds' eggs, nests, feathers or other parts are generally afforded the same legal protection as the bird itself. Thus, possession of a handful of Northern Cardinal feathers is, for example, illegal. Schools, nature centers, and museums have the appropriate permits to possess such materials; the average citizen does not and cannot expect to obtain them. Native Americans have special rights when it comes to possessing migratory bird parts, such as eagle feathers, for ceremonial purposes, but they cannot be sold.

There are many bird related laws and regulations—too many to allow a complete review here. But if you are now aware of some possible conflicts between the law and your own activities, my purpose has been accomplished.

The bottom line: virtually all of our birds are afforded the protection of numerous laws and regulations, and with just cause. Admittedly, some of the laws (e.g., the requirement for a hunting license to shoot "unprotected" pigeons in a barn) are confusing or seem inconsistent. However, if you intend to control a pest species with a lethal technique, or if you have the opportunity to handle any live or dead bird or parts thereof, it's better to be safe then sorry; CHECK with your local Wisconsin DNR Conservation Officer to determine the legality of your

actions and to obtain any necessary verbal or written permission.

Copies of federal bird laws are available from the U.S. Fish and Wildlife Service, Law Enforcement Office in Madison (608-264-5237) or other offices around the country. State laws are covered in the various WDNR annual Hunting Regulations pamphlets available from WDNR offices and private license vendors. Permits and more detailed information should be obtained from WDNR offices.

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CORRIGENDUM

In a recent article on birds of wet-mesic and wet prairies in Wisconsin by Hoffman and Sample (*Passenger Pigeon* 50:143–152), the definitions for bird abundance in Table 2 were incorrectly listed. The proper definitions are as follows. Common: greater than 16 birds per 100 acres; uncommon: between 2 and 16 birds per 100 acres; rare: less than 2 birds per 100 acres.

Birds of Dry-Mesic and Dry Prairies in Wisconsin

by David W. Sample and Randy M. Hoffman

An introduction to the birdlife of Wisconsin's wet-mesic and wet prairies was presented in a recent issue of *The Passenger Pigeon* (Hoffman and Sample 1988). The present, complementary article focuses on the other half of the prairie continuum: dry-mesic and dry prairies. Mesic prairies are not being considered in these articles, because no large, high-quality examples remain in the state. The structure and species composition of the vegetation in dry-mesic and dry prairies differ from those in wet-mesic and wet prairies, and the bird communities are different as a consequence. Because of their specific habitat requirements, some bird species may occur in only one prairie type, and those which occur in more than one type are usually more abundant in one type than in another.

Historically, dry-mesic and dry prairies were found primarily on the dry slopes and ridges of the Driftless Area in southwestern Wisconsin. They also occurred in sandy river corridors, glacial outwash plains, and areas of thin-soiled glacial till deposits in many southern, central, and western counties. The primary factor influencing the vegetation in these communities is a lack of moisture, which may be caused by excessively drained soils that are thin, sandy, gravelly, or rocky, or by steep southwest-facing bluff conditions with their associated high temperatures and winds. Condensation is often a major source of moisture for dry prairie vegetation (Curtis 1959).

Curtis (1959) described the plant species composition of Wisconsin's dry-mesic and dry prairies. The ten most prevalent plant species in dry-mesic prairies in descending order are: big bluestem (*Andropogon gerardi*), little bluestem (*Andropogon scoparius*), flowering spurge (*Euphorbia corollata*), porcupine grass (*Stipa spartea*), leadplant (*Amorpha canescens*), gray goldenrod (*Solidago nemoralis*), rose (*Rosa* sp.), purple prairie clover (*Petalostemum purpureum*), aster (*Aster ericoides*), rough blazing star (*Liatris aspera*). The ten most prevalent plant species in dry prairies, in descending order, are: little bluestem (*Andropogon scoparius*), sideoats grama (*Bouteloua curtipendula*), leadplant (*Amorpha canescens*), purple prairie clover (*Petalostemum purpu-*

reum), flowering spurge (*Euphorbia corollata*), gray goldenrod (*Solidago nemoralis*), silky aster (*Aster sericeus*), big bluestem (*Andropogon gerardi*), pasque flower (*Anemone patens*), whorled milkweed (*Asclepias verticillata*). Over 100 plant species occur in dry-mesic prairies, and over 60 occur in dry prairies. The total number of species present in dry-mesic and dry prairies is roughly similar to that of wet-mesic and wet prairies, but the species composition is different; see Hoffman and Sample (1988).

Dry-mesic prairies are characterized by tall and mid-sized grasses such as big bluestem, northern dropseed (*Sporobolis heterolepis*), side-oats grama, and also by showy forbs, especially members of the composite, legume, rose, and milkweed families. The vegetation is not as tall and dense as that in wet-mesic and wet prairies. In addition to the dominant species the following species are found more often in dry-mesic prairies than anywhere else: azure aster (*Aster azureus*), a panic grass (*Panicum oligosanthes*), blue-eyed grass (*Sisyrinchium campestre*), indian grass (*Sorghastrum nutans*), prairie violet (*Viola pedatifida*), satin-grass (*Muhlenbergia cuspidata*) and the state-threatened prairie thistle (*Cirsium hillii*).

Dry prairies occur on thinner, drier soils than dry-mesic prairies and have even shorter, sparser vegetation structure. Plant species unique to dry prairies are innately shorter in stature than species found on dry-mesic prairies; and prairie grasses and forbs common to both prairie types (such as big bluestem and flowering spurge) are typically shorter on dry prairies than on dry-mesic sites. The common grasses include little bluestem, side-oats grama, big bluestem, northern dropseed, and long-stalked prairie grass (*Panicum perlongatum*). Several forbs are conspicuous early spring bloomers, such as pasque flower and prairie smoke (*Geum triflorum*). In addition to these species and the dominants Curtis found the following species more often in dry prairies than anywhere else: green milkweed (*Asclepias viridiflora*), Plains ragweed (*Ambrosia artemisiifolia*), sand wort (*Arenaria stricta*), wormwood (*Artemisia caudata*), stiff aster (*Aster ptarmicoides*), aromatic aster (*Aster oblongifolius*), yellow painted-cup (*Castilleja sessilifolia*), coreopsis (*Coreopsis palmata*), daisy fleabane (*Erigeron strigosus*), false boneset (*Kuhnia eupatorioides*), dwarf blazingstar (*Liatris cylindracea*), puccoon (*Lithospermum incisum*), clammy ground cherry (*Physalis heterophylla*), and hoary vervain (*Verbena stricta*).

Dry prairies that occur on steep slopes with thin soil over fractured limestone bedrock are often called "goat prairies" (or dry lime prairies). The name originates from settlers who believed that the only good use of such sites was as pasture for goats. Many of the dry prairie remnants in Wisconsin are goat prairies.

Dry prairies that occur on very sandy soils are sometimes referred to as dry sand prairies. Some plant species, including blazing star (*Liatris aspera*), pasque flower, and prairie thistle are particularly well-adapted to such sandy sites.

Dry-mesic and dry prairies are rare in present-day Wisconsin, and few of them have escaped disturbance of one form or another. Like wet-mesic and wet prairies, they have been extensively fragmented by conversion to agriculture. However, because dry prairies tend to occur on poorer soils

and steeper slopes than wet-mesic and wet prairies (often on unplowable ridgetops, for example), they were used as pastures or left to be invaded by woody vegetation more often than they were cultivated. Invasion by red cedar (*Juniperus viginiana*) is the primary cause of degradation in most remnant dry prairies in certain areas of the state (such as the Wisconsin River valley); in other areas prairie degradation is most commonly caused by heavy grazing or encroachment of deciduous trees and shrubs.

Curtis (1959) estimated that 630,500 acres of dry-mesic prairie and 105,000 acres of dry prairie were present at the time of settlement in Wisconsin. Currently, the Wisconsin Natural Heritage Inventory (WNHI) has identified about 400 remaining acres of dry-mesic prairie and 1,500 acres of dry prairies, comprising a total of 207 sites; however, this inventory identifies only the best and largest examples of these communities. Preliminary results from an air photo interpretation of portions of the Driftless Area in the southwest part of the state indicate there may be as many as 7,000 to 8,000 "potential" acres of dry prairie in Wisconsin, including many small, steep, and degraded areas (R. Hoffman, unpublished data). Most of these "potential" sites have, to varying degrees, some remaining dry prairie vegetation.

The average size of the dry-mesic and dry prairies on the WNHI list is nine acres; and only 10 sites are larger than 25 acres. If all the "potential" acreage is included, the average prairie size drops to three to four acres, and less than five areas larger than 25 acres are added. While the total number of large dry and dry-mesic remnants (> 25 acres) identified by the WNHI is greater than for wet-mesic and wet prairies, the total acreage is smaller. Of the 15 largest prairies identified by the WNHI, 11 are mostly confined to steep bluffs in the Driftless Area.

It is impossible to get a complete picture of the bird communities of the original dry prairies in Wisconsin. However, recent surveys have shown what birds commonly occur in remnant prairies. Data are available from two major sources: the Natural Areas Breeding Bird Survey (Mossman and Matthiae 1988), and the Wisconsin Department of Natural Resources (WDNR) grassland bird study (see Hoffman and Sample 1988).

In the WDNR study, breeding birds were censused in 21 grassland habitat types, ranging from agricultural crops to native prairies. Included in the study were six 2-hectare (4.94 acre) study plots in dry prairies. Censuses were conducted three times on each plot, and lasted an average of 20 minutes each. These prairies were small remnants located in agricultural landscapes in southern Wisconsin (Iowa, Green, Sauk, and Grant Counties). Dry prairie was defined in this study as any site with >14% cover of little bluestem, <7% cover of big bluestem, and presence of other dry prairie indicator species. No attempt was made to separate dry from dry-mesic prairies in this study.

Dry prairie study plots were characterized by sparse vegetation of low height and density, and had substantial amounts of dead herbaceous vegetation on the ground. Of the 21 habitats in the study, dry prairies had above average cover of woody vegetation, most of which was less than 1 meter tall. The most common woody species invading the prairies were red cedar, cherries

(*Prunus* spp.), sumacs (*Rhus* spp.), and oaks (*Quercus* spp.)

Among the 21 habitat types, dry prairie was intermediate in bird species richness, with an average of 5.3 species per study plot. A number of native and disturbed habitats, including wet and mesic prairies, pastures, and oldfields, were higher in species richness than dry prairies. Bird density in dry prairies was very low, with 7.7 pairs per study plot; the only habitats with lower bird densities than this were small grains and row crops. Relatively short and sparse vegetation may limit the number of pairs that can coexist in dry prairies.

A total of 16 bird species occurred on the dry prairie study plots (Table 1). The species composition of dry prairie was different from any other habitat in the study. Grasshopper Sparrow was the most abundant species in dry prairie (where it also reached its highest density). The next most common species were Vesper Sparrows and Field Sparrows. Some of the species occurring in dry prairies, such as Eastern Meadowlarks and Savannah Sparrows and Song Sparrows, are habitat generalists that occurred in a wide variety of habitats in this study.

Table 1. Birds Found on WDNR Grassland Bird Study Plots.

Species	Status on Study Plots[3]
Northern Bobwhite[2]	rare
Mourning Dove[2]	rare
Eastern Kingbird[2]	uncommon
Horned Lark	rare
Blue Jay[2]	uncommon
American Robin[2]	rare
Brown Thrasher[2]	rare
Dickcissel[1]	rare
Rufous-sided Towhee[1,2]	rare
Field Sparrow[1,2]	common
Vesper Sparrow[1]	common
Lark Sparrow	uncommon
Savannah Sparrow[1]	uncommon
Grasshopper Sparrow[1]	common
Song Sparrow[2]	uncommon
Eastern Meadowlark[1]	uncommon

[1]Breeding population declining in Wisconsin (USFWS 1988).

[2]Considered a brush or savanna species.

[3]Common: greater than 16 pairs per 100 acres; uncommon: between 3.4 and 16 pairs per 100 acres; rare: less than 3.4 pairs per 100 acres.

Of the 16 species in Table 1, nine (56%) can be considered edge or brush species attracted to the woody vegetation found in, or adjacent to, the study plots (note that many of the species in the site lists—Table 2—are also edge species). The other seven species are less dependent upon woody vegetation than the brush species, are generally ground-nesters, and may be considered true grassland species: Horned Lark, Eastern Meadowlark, Dickcissel, and Vesper Sparrow, Savannah Sparrow, Grasshopper Sparrow, and Lark Sparrow. Thus, without woody cover in or near the study plots, the total number of species in dry prairie would have been reduced. The small size of the prairie remnants in Wisconsin, and their usual proximity to hedgerows, woodlots, or brushy areas, provide ample habitat for a variety of edge species that use the prairies for foraging or nesting, especially when woody vegetation is present. The impacts on grassland species of competition from edge species are poorly known.

Each species found in dry prairies has different habitat requirements, although these differences are sometimes slight. In general, most dry prairie birds are adapted to shortgrass habitats. We have chosen a few species as examples for discussion.

The Grasshopper Sparrow is a ground-nesting species primarily found

Table 2. Comparison of species presence during the breeding season on four dry prairie remnants.

Species	Sites			
	Rush Creek	Dewey Heights	Spring Green	Muralt Bluff
Northern Bobwhite			X	X
Mourning Dove	X	X	X	X
Black-billed Cuckoo		X		
Common Nighthawk	X	X	X	X
Red-headed Woodpecker	X	X	X	X
Red-bellied Woodpecker		X		
Downy Woodpecker	X			
Northern Flicker	X	X	X	X
Eastern Wood-Pewee	X			X
Great Crested Flycatcher				X
Eastern Kingbird	X		X	X
Purple Martin	X			
Rough-winged Swallow	X			
Cliff Swallow	X	X		
Barn Swallow			X	X
Blue Jay		X	X	X
American Crow				X
Black-capped Chickadee	X			X
Tufted Titmouse		X		
White-breasted Nuthatch		X		X
House Wren	X	X		X
Wood Thrush		X		X
Eastern Bluebird			X	
American Robin		X	X	X
Gray Catbird	X		X	X
Brown Thrasher	X	X	X	X
Cedar Waxwing	X	X	X	X
Bell's Vireo				X
Northern Cardinal	X	X	X	
Rose-breasted Grosbeak	X	X	X	X
Indigo Bunting	X	X	X	X
Dickcissel			X	
Rufous-sided Towhee	X	X	X	X
Chipping Sparrow		X	X	X
Field Sparrow	X	X	X	X
Vesper Sparrow	X	X	X	X
Lark Sparrow		X	X	
Savannah Sparrow			X	X
Grasshopper Sparrow			X	X
Song Sparrow	X			X
Bobolink			X	X
Red-winged Blackbird	X	X	X	X
Eastern Meadowlark			X	X
Western Meadowlark			X	X
Common Grackle	X	X		
Brown-headed Cowbird	X	X		X
Northern Oriole	X	X	X	X
American Goldfinch	X	X	X	X

in dry habitats with relatively short, patchy vegetation; these habitats include dry prairies, upland pastures, oldfields, and weedy hayfields. It is a locally distributed species, and may even be loosely colonial. It is often found in areas with some bare ground, but requires some dead ground vegetation for nesting. This species tolerates, but does not require, woody vegetation. It often sings from tall forbs, fences, or low woody plants.

The Vesper Sparrow also prefers dry habitats with short, sparse vegetation. It is strongly attracted to habitats with bare ground, which explains the fact that in addition to dry prairies and sandy barrens (its historical habitats in the state), this species also occurs in plowed fields and rowcrops. It is a ground-nesting species; but it usually nests near a hedgerow or other woody cover such as shrubs, saplings, or trees (usually 3 meters high or taller), which serve as song perches.

Field Sparrows are birds of dry to slightly mesic brushy habitats and edges. They are highly associated with woody cover, and would not have occurred in the dry prairie study plots were it not for the presence of woody vegetation in or near the plots. They are found in native or disturbed habitats (e.g., oldfields), but rarely, if ever, in agricultural habitats such as hayfields or other crops. Often the first nest of this species is placed on the ground, with later nests located off the ground in woody vegetation (Bent 1968).

The Lark Sparrow has perhaps the most striking habitat distribution of any avian inhabitant of dry prairies in Wisconsin. This rare western species is restricted to extremely dry sites with sparse vegetation, and it is usually associated with the presence of exposed sandy soil ("sand blows"). Some scattered woody vegetation, such as young red cedars or jack pines, is often present. It nests on the ground or sometimes in a shrub or small tree (Bent 1968).

The Horned Lark is likely to be found only on the most barren and shortgrass dry prairie sites. It is a species that prefers habitats with much bare soil and very sparse, if any, vegetation; hence it is well-adapted to and commonly found on plowed fields and rowcrops. In contrast, the Dickcissel is characteristic of disturbed or managed habitats with relatively lush, dense vegetation, including hayfields and mesic oldfields; as such, it is unlikely to occur frequently on dry prairie sites.

Other grassland species that may be found in dry prairies, but which were not found on the study plots, include Western Meadowlark, Upland Sandpiper, Bobolink (on dry-mesic sites), Short-Eared Owl, Northern Harrier, Greater Prairie-Chicken, and Common Nighthawk; when some woody vegetation is present, American Goldfinch and (especially in the northern two-thirds of the state) Clay-Colored Sparrow can be found. The Greater Prairie-Chicken is now found mostly in the central part of the state, primarily in specially managed areas such as the Prairie-Chicken Management Area in Portage County.

The Western Meadowlark is typically more characteristic of dry upland sites with short grass (such as dry prairies) than the Eastern Meadowlark, which prefers mesic sites (Lanyon 1953). However, the Eastern Meadowlark did occur in a number of dry habitats in the grassland bird study. Although the Western Meadowlark was uncommon

in Wisconsin prior to the early 1900's, it had become the dominant meadowlark species in south-central Wisconsin by the 1950's. It has declined severely in numbers in the last 20 years (USFWS 1988, John T. Emlen, personal communication). It is now far outnumbered by the Eastern Meadowlark, which appears to be replacing—possibly outcompeting—it.

The relatively low density of true grassland birds in dry prairies is caused partly by the sparseness and relatively low productivity of the vegetation. However, other important contributing factors include the facts that dry prairie remnants in Wisconsin are small, isolated, often on steep slopes, invaded by woody vegetation, and surrounded by large patches of suitable agricultural habitats. For example, although steep bluff-top prairies often harbor many prairie plants, they appear to provide little suitable habitat for most prairie birds, even when the sites are fairly large. Natural Areas surveys found that species such as the Grasshopper Sparrow were absent from these steep sites. In the Loess Hills of western Iowa, Howe et al. (1985) noted that small, steep-sloped dry prairie remnants had fewer grassland species than adjacent agricultural areas. They felt that ground-nesting species are likely to have difficulty nesting on steep sites.

Many species that were characteristic of dry prairie habitats prior to the settlement of the Midwest have adapted to agricultural habitats, and may even prefer them to native habitats (Birkenholz 1972), especially when native habitats are fragmented and degraded. Most of the species found on dry prairies in the WDNR grassland bird study occurred more abundantly in other habitats, such as hayfields, pastures, and oldfields, than in dry prairies. The adaptability of these birds has helped them survive in an agriculture-dominated landscape. However, agricultural habitats preferred by birds, such as pastures, are also disappearing from our landscape. In addition, some agricultural habitats can be ecological traps for nesting prairie birds. For example, birds nesting in hayfields (including Savannah Sparrow, Grasshopper Sparrow, Eastern Meadowlark, Dickcissel, and Upland Sandpiper) often lose nests or nestlings to harvesting operations. Vesper Sparrows nesting in rowcrop fields often have their nests destroyed by farm machinery (Rodenhouse and Best 1983).

Of the 16 species in Table 2, seven (44%) are declining significantly in numbers in Wisconsin, as determined by the Federal Breeding Bird Survey (USFWS 1988); with the exceptions of the Rufous-sided Towhee and Field Sparrow, all of these are true grassland species. Only three of the species in Table 2 are increasing significantly (Bobwhite, Mourning Dove, American Robin), and none of these are primarily grassland species. The declines of grassland species may have been caused by a number of factors, including the loss of prairie and other uncultivated habitat, lowered nest productivity (due to a variety of factors), and overwinter mortality (Temple 1988, Hoffman and Sample 1988).

The fragmentation and degradation of all prairie habitats in Wisconsin is undoubtedly an important cause of declining grassland bird populations statewide. Few large, continuous grassland habitats—native or agricultural—remain in the patchwork landscape of Wisconsin. Wide-ranging species such

as the Greater Prairie-Chicken, Short-eared Owl, Upland Sandpiper, and Northern Harrier have been lost as elements of dry prairie avifauna, in part due to the lack of large expanses of open prairie habitat. Other grassland species have been shown to require a minimum habitat size in which to maintain a viable population. For example, Samson (1980) estimated that dry prairie species such as Vesper Sparrows and Lark Sparrows, and Upland Sandpipers require a minimum habitat size of 25 to 250 acres. Given that the average dry or dry-mesic prairie remnant in Wisconsin is only nine acres, these habitat size requirements are not being fulfilled. To make matters worse, it is known that prairie habitats less than 45 meters from a woody edge have reduced nest productivity due to increased predation and parasitism (Johnson and Temple 1986). Thus, on a prairie less than ten acres in size surrounded by woody edge, most or all breeding birds are likely to be influenced by edge effects. Very few of the remnant dry prairies in Wisconsin are large enough to be free of these edge effects. The protection, restoration, and management of large acreages of prairie, or of prairie-like habitat with non-native vegetation, may be crucial to the survival of some grassland birds. A healthy, functioning grassland ecosystem consists of more than a few, scattered prairie remnants.

Despite the various factors that have reduced the suitability of prairies and related agricultural habitats for grassland birds, surviving prairie remnants are being managed to offset those trends. The primary management activities in dry prairies are burning (to discourage exotic grasses and forbs) and brush removal. Bird species will respond to burning in various ways. For example, Horned Larks, Lark Sparrows, and other species preferring barren habitats may be attracted to recently burned dry prairies, while species such as the Eastern Meadowlark that require ample dead ground vegetation, are likely to avoid areas burned in the current growing season. In Minnesota prairies, nest productivity for five grassland bird species (all of which require some residual vegetation cover) was the highest one full growing season after a burn (Johnson and Temple 1986). The removal of woody vegetation from prairies is crucial to favoring dry prairie birds over brush and edge species.

Although dry-mesic and dry prairies of Wisconsin harbor relatively few bird species, other animal groups use these areas quite heavily, regardless of slope. These include several rare or uncommon reptiles such as blue racer, six-lined racerunner, slender glass lizard, bull snake, and eastern box turtle. Rapid warming of dry-mesic and dry prairies with southwestern exposure provides for long daily periods of activity for these cold-blooded vertebrates. Butterflies are also found abundantly in dry-mesic and dry prairies; there are as many as 12 species which require relatively undisturbed dry prairie, including the state-threatened regal fritillary.

Sites

We have chosen four sites to exemplify the dry-mesic and dry prairies of Wisconsin. They are all relatively large sites with good access and parking. However, due to the lack of large, high-quality dry prairies on level terrain, two of the sites described here are

bluff top prairies. The Prairie Chicken Management Area in Portage County, a large expanse (over 11,000 acres) of grassland habitat, is one of the best areas in the state for viewing many of the dry prairie birds mentioned in this article. The management area consists of a variety of grassland habitats, including two State Natural Areas (one of which is a dry prairie), pastures, and many oldfields that are gradually being invaded by native dry prairie vegetation. It is not included here; it will, however, be discussed in a forthcoming article on Sharp-tailed Grouse and Greater Prairie-Chicken habitat.

Rush Creek State Natural Area

Location.—Northwestern Crawford County.

Size.—This 1,200 acre State Natural Area contains about 95 acres of steep bluff prairie. The remainder is southern dry to dry-mesic forest and flood plain forest.

Access.—From State Hwy 35 and County Hwy B northwest of Ferryville, take Hwy 35 west and north 1.2 miles. Turn right on Rush Creek Road, and continue about 0.8 miles to the parking lot. Trail to the bluff top begins here, and ascends 400 feet.

Description.—The outstanding feature of this natural area is a series of dry lime prairies on the steep limestone-capped bluffs paralleling the Mississippi River (Figure 1). These prairie remnants are part of the most extensive series of "goat prairies" left in the state, and host a nearly complete range of dry to dry-mesic prairie plant species. Bluffs without southwest exposures are forested with red and white oak, and some black walnut, hickory, basswood, silver maple, and aspen. A lowland forest of silver and red maples, elm, cottonwood, river birch, and willow grows along Rush Creek. In the floodplain is a small sedge-reed canary marsh. Soils range from Dubuque and Fayette silt loams on the bluff tops to Orion silt loams and alluvial soils in the bottom of Rush Creek valley.

Birds.—The birds listed for this site (Table 2) were recorded on two Natural Area Breeding Bird Surveys run on the prairie portion of the State Natural Area. The surveys were conducted away from woods edges, and were an average of 2.5 hours in length. We initially anticipated that the large prairie acreage would have a good complement of dry prairie bird species. However, the steep slope and presence of scattered birch trees apparently precluded all true grassland birds other than the Vesper Sparrow, which occurred on the relatively level bluff top, and Common Nighthawk. Most of the species found on the site are characteristic of the surrounding forest edge and shrub habitats; they used the prairie primarily for foraging. Several are aerial foragers (e.g., swallows) were also present. Management plans call for the removal of all birches and other woody vegetation from the prairie.

Dewey Heights State Natural Area

Location.—Western Grant County, within Nelson Dewey State Park.

Size.—Contains 14 acres of bluff top prairie (the Natural Area itself is 27 acres).

Figure 1. Rush Creek, showing steep topography, rock outcrops, and scattered birch trees. (*Photo from DNR Bureau of Endangered Resources*).

Access.—Easy access from within Nelson Dewey State Park. From Cassville, junction of Hwy 133 and County Hwy VV, go west on VV 1.2 miles to Nelson Dewey State Park entrance. Follow park road to the bluff summit.

Description.—Dewey Heights Prairie is a dry lime (or "goat") prairie on a southwest-facing Mississippi River bluff (Figure 2). Elevations of the bluff range between 800 and 870 feet, slightly less than 300 feet above the Mississippi River. The cap rock is Ordovician-age dolomite, covered partially by thin soil, and is exposed in places. There are a number of ledges and cliffs at the site. The prairie is dominated by big and little bluestems, side-oats grama, hairy grama (*Bouteloua hirsuta*), June grass (*Koeleria cristata*), Indian grass, and porcupine grass. There are many seasonally-flowering native prairie forbs, including pasque flower and wood betony (*Pedicularis canadensis*) in the spring, butterfly weed (*Asclepias tuberosa*) and compass plant (*Silphium laciniatum*) in the summer, and asters and goldenrods in the fall. This site is going to be gradually restored to an open bluff prairie from bluff base to ridge top.

Birds.—Birds were recorded on this site during seven different Natural Area Breeding Bird Surveys of the State Natural Area (Table 2). Each survey took about one hour. The open prairie is currently surrounded by woods, which is responsible for the predominance of edge and woods species. However, some open prairie species do use the site, including the Lark Sparrow. With further reduction of woody

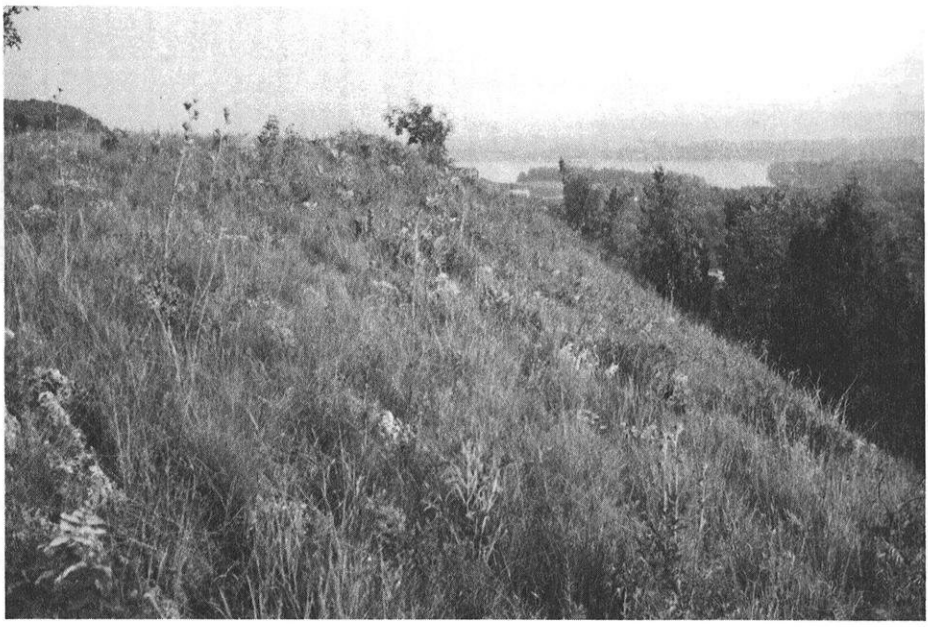

Figure 2. Dewey Heights Prairie, showing level bluff top and steep slopes. (*Photo from DNR Bureau of Endangered Resources*).

encroachment through management, more open prairie habitat will be created.

Spring Green Reserve State Natural Area

Location.—Southwestern Sauk County.

Size.—700 acres, 250 of which is a State Natural Area; the remainder is under a joint management agreement. The site includes about 250 acres of high quality dry sand prairie and bluff prairie.

Access.—From the junction of U.S. Hwy 14 and the Wisconsin River just east of Spring Green, go west on U.S. Hwy 14 1.75 miles to Davies Road, then north 0.75 mile to Jones Road, then east 0.25 mile to a crushed stone access lane next to a trailer residence, then north on access lane 0.1 mile to a parking area.

Description.—Spring Green Reserve contains the state's largest example of dry sand prairie (Figure 3). This site, due to its exceedingly dry conditions and abundance of prickly pear cactus (*Opuntia compressa*), has been called "Wisconsin's Desert." The dry sand prairie is formed on a sandy slope running from the base of a limestone bluff on the north to agricultural lands to the south. The bluff prairie is on the steep south-facing slope overlooking the sand prairie. To the east are old fields that are gradually reverting back to dry prairie vegetation. The remainder of the site is covered with oak barrens and southern dry forest.

Figure 3. Spring Green Prairie, showing dry sand prairie on the slope in the foreground and the steep dry lime prairie in the background. Notice the large population of red cedar. (*Photo from DNR Bureau of Endangered Resources*).

Throughout the prairie are scattered red cedars and black cherries. Proceeding upslope, the red cedars become very dense, producing an almost impenetrable thicket in places. The gradual invasion of the prairie by woody species has occurred in the last 60 to 80 years. Through active management, the former and current prairie areas on this site are being converted back to treeless habitat, to help restore the integrity of the grassland ecosystem.

Birds.—The bird list compiled for this site (Table 2) is the result of six Natural Area Breeding Bird Surveys, and 11 WDNR grassland bird study transect surveys. The total time spent on each Natural Area Survey varied from one to four hours; and the grassland bird study surveys averaged 20 minutes in length. Only those results from the dry sand prairie and oldfield areas were used in the compilation of the bird list. The first surveys were conducted before many of the pine windrows and plantations and scattered red cedars had been removed. This is the largest and most diverse dry prairie site in the state and consequently it is inhabited by the largest number of dry prairie bird species.

Cautionary Note.—This site is owned by The Nature Conservancy. If damage to the fragile plant communities occurs or signs of negligent behavior appear, the site may be closed to the public in order to insure access in the future.

Muralt Bluff Prairie State Natural Area

Location.—Green County.

Size.—62 acres, 45 of which are dry prairie.

Access.—From Albany, go 2 miles south and west on Hwy 59, then north and west on Hwy 39 for 1.8 miles to a parking lot at north end of tract. There is a small sign on the north side of Hwy 39 across from the parking lot, and a large sign just west of the parking lot.

Description.—Muralt Bluff occupies a long, sweeping ridge top in an area of old glacial drift about midway between the recently glaciated lands to the east and the Driftless Area to the west (Figure 4). The sandstone bluff is capped with a thin rocky layer of limestone on which the dry prairie has developed. Dominant grasses are little bluestem, side-oats grama, Indian grass, and northern dropseed. Outstanding displays of pasque flower, shooting star (*Dodecatheon meadia*), wood betony, and bird's foot violet (*Viola pedata*) occur in spring; asters, goldenrods, blazing stars, and gentians flower in the fall. Several uncommon plants are present, including satingrass, prairie thistle, and cancer root (*Orobanche uniflora*).

Birds.—The bird list for this site (Table 2) was compiled from nine Natural Area Breeding Bird Surveys of the State Natural Area. Each survey lasted approximately 2.5 hours. Due to its long, irregular shape and extensive woody

Figure 4. Muralt Bluff Prairie, facing west along the north slope. Notice the areas of trees in the background. (*Photo by Randy Hoffman*).

edges, the bird community at Muralt Bluff is typical of shrubby communities. Extensive removal of woody fencerows and red cedar has opened the prairie significantly in recent years. Bell's Vireo has recently appeared as a nesting species at Muralt Bluff prairie. Its occurrence seems to coincide with the removal of fencerows, thereby creating small shrubby patches in the prairie landscape. Other responses of birds to the management of the prairie include a reduction in the number of nearly all edge species. To date, there have been notable declines in the abundances of Field Sparrows, Brown Thrashers, Catbirds, Rose-breasted Grosbeaks, and Indigo Buntings.

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The Fall Season: 1988

by Mark S. Peterson

The summer of 1988 will long be remembered for its hot and dry weather. Many cities in Wisconsin set records for most days above 90 degrees with many of those days exceeding 100 degrees. The drought, which had begun in spring, continued well into August. By then, it was too late for many crops in the state. Goose Pond in Columbia County was completely dried up and Schoeneberg Marsh was almost dried up, as were many other areas. Shorebird habitat was excellent in Horicon National Wildlife Area, the Highway "V" pond in Dane County, Goose Pond, Schoeneberg Marsh, Atkinson Marsh at Green Bay, as well as other smaller areas. Tessen reported 2100–2200 shorebirds at Horicon National Wildlife Refuge on August 14. Many of the passerines seemed to leave early with a significant migration occurring in late July. Songbirds were much quieter than usual by early August.

August began with continued hot weather with high temperatures of 108 at Mount Mary College on the 1st and at Port Edwards on the 16th. A strong cold front arrived from Canada on the 17th and the heat wave, which began in May, finally came to an end. Hansen reported 16 species of warblers in Dane County on the 24th. The Smiths reported a warbler migration in St. Croix County from August 28 to September 10 and Berner reported a passerine movement in Manitowoc County from August 31 to September 10. The low temperature for the month was 36 in Wisconsin Rapids on the 30th.

September began with warm weather that quickly cooled. The first frost was reported on the mornings of the 5th and 6th. Hurricane Gilbert in combination with a strong cold front brought significant rains on the 19th and 20th. Berner reported hundreds of songbirds after midnight early on the 14th and another passerine movement from the 17th to the 21st, in Portage County. Ashman found 15 warblers in Dane County on the 18th. A high temperature of 93 was reported in La Crosse on the 17th and a low of 28 was reported in Wisconsin Rapids on the 24th.

October had very changeable weather. Light snow was reported in the north on the 3rd and 4th. A state-

wide freeze was reported on the 5th and 6th. It warmed up to a high of 79 in Marshfield on the 15th and then got much colder toward the end of the month. Four inches of snow was reported near Lake Superior, with up to 1 inch in the central part of the state on the 24th. A low of 5 was reported at Lake Thompson on the 30th.

November continued to have weather that fluctuated. A high of 64 was reported in Lone Rock and West Allis on the 3rd. A significant snowfall occurred on the 5th and 6th with up to a foot in the far northwest and up to 7 inches in the eastern part of the state. The weather changed frequently throughout most of the rest of the month. It was warm the day after Thanksgiving and then colder with snow as the month ended.

78 observers found 286 species during the period. This is down slightly from the 291 species found the previous fall. The following rarities were found in Wisconsin during the fall of 1988: A Pacific Loon in Bayfield County, Western Grebes at 3 locations, a Little Blue Heron in Sawyer County, Yellow-crowned Night-Herons in Milwaukee County, an Eurasian Wigeon in Dunn County, Harlequin Ducks in Milwaukee and Ozaukee Counties, a Mississippi Kite in Ozaukee County, Swainson's Hawks in Ozaukee and Sheboygan Counties, a Ferruginous Hawk in Ozaukee County, Golden Eagles in 7 locations, Gyrfalcons in Milwaukee and Ozaukee Counties, Spruce Grouse in Forest County, King Rails in Dane County, an American Avocet in Columbia County, Whimbrels at 3 locations, Marbled Godwits in Columbia and Milwaukee Counties, Western Sandpipers at 4 locations, Buff-breasted Sandpipers at 5 locations, a Red Phalarope in Milwaukee County, a Frigatebird (species unknown) in Douglas County, Little Gulls in Manitowoc and Milwaukee Counties, a Black-legged Kittiwake in Dunn County, a Royal Tern in Milwaukee County, Black-backed Woodpeckers at 4 locations, a Townsend's Solitaire in Pierce County, a Varied Thrush in Milwaukee County, a White-eyed Vireo in Walworth County, a Worm-eating Warbler in Manitowoc County, and a Sharp-tailed Sparrow in Milwaukee County.

Reports (August 1–November 30, 1988)

Pacific Loon.—Swengel saw one in Bayfield County on October 26. This sighting was accepted by the Records Committee. See "By the Wayside."

Red-throated Loon.—Reported from September 24 to November 3 in Douglas County by Johnson and on October 30 and November 13 in Ozaukee County by Tessen.

Common Loon.—Found at the beginning of the period in Ashland, Bayfield, Burnett, Douglas, Forest, Oneida, Polk, Price, and Vilas Counties. Hansen found 20 in Dane County on November 19 and Ashman found 20 in Dane County on November 25. Reported at the end of the period in Dane, La Crosse, and Manitowoc Counties.

Pied-billed Grebe.—Found in scattered areas throughout the state at the beginning of the period. Berner found 128 in St. Croix County on August 20. Last reported by Belter in Marathon County on November 29.

Horned Grebe.—First reported by Verch in Ashland and Bayfield Counties on August 31. Cowart found 47 in Ozaukee County on October 7. Found at the end of the period in Milwaukee County by Bontly.

Red-necked Grebe.—Reported at the beginning of the period in Winnebago County by

Ziebell. The Smiths found 3 in St. Croix County on August 7. Last reported by Robbins in Dane County on November 4. Also found in Ashland and Bayfield Counties during the period.

Western Grebe.—Reported by the Greens in Vilas County on October 2, by Gustafson in Ozaukee County on October 28, and in Manitowoc County by Sontag from November 19 to November 25.

Double-crested Cormorant.—Found at the beginning of the period south to Manitowoc, Winnebago, and Trempeleau Counties. Belter found over 300 in Marathon County on August 1. Last reported by Lesher in La Crosse County on November 27.

American Bittern.—Reported at the beginning of the period in Ashland, Bayfield, Burnett, Door, Douglas, Marinette, Oconto, Price, and Taylor Counties. Last reported by Hoefler in Burnett County on October 10.

Least Bittern.—Found at the beginning of the period in Dane and Oconto Counties. Last reported by Sunby in Waukesha County on September 6.

Great Blue Heron.—Found throughout the state at the beginning of the period. Belter found over 300 in Marathon County on August 1. Reported at the end of the period in Ashland and Bayfield Counties by Verch.

Great Egret.—Reported at the beginning of the period in Burnett, Trempeleau, and Winnebago Counties. Hunter found 150 in Trempeleau County on September 4. Last reported by Ziebell in Winnebago County on October 15.

Little Blue Heron.—Heim found an adult in a beaver meadow along Spring Lake Creek in Sawyer County on September 18 and September 19.

Green-backed Heron.—Found throughout the state at the beginning of the period. The Brassers found 15 in Sheboygan County on August 15. Last reported by Sontag in Manitowoc County on November 3.

Black-crowned Night-Heron.—Reported at the beginning of the period in Brown, Clark, Door, Manitowoc, Marinette, Milwaukee, Oconto, Shawano, and Winnebago Counties. Sontag found 14 in Manitowoc County on August 13. Last reported by Ashman in Dane County on October 23.

Yellow-crowned Night-Heron.—Reported by Sunby in Milwaukee County on September 9 and by Gustafson in Milwaukee County on October 3.

Trumpeter Swan.—A pair was observed on Oakridge Lake in St. Croix County by Berner and the Smiths. If the release programs by Minnesota and Wisconsin are successful, and if hidden perils such as lead shot can be avoided, Trumpeter Swans should soon become fairly common in Wisconsin.

Tundra Swan.—Lesher reported a flightless individual in La Crosse County on August 14. Early individuals were reported by Pickering in Langlade County on September 1 and by Norris in Oconto County on September 27. Hunter found 2000 in Trempeleau County on November 24. Found at the end of the period in Ashland, Bayfield, Columbia, Jefferson, Trempeleau, and Winnebago Counties.

Mute Swan.—Found at the beginning of the period in Ashland, Bayfield, and Dane Counties. Swengel found 17 in Bayfield County on October 29. Reported at the end of the period in Ashland, Bayfield, Dane, Shawano, and Winnebago Counties.

Greater White-fronted Goose.—Reported in the Horicon National Wildlife Refuge by the refuge staff on September 15, by Robbins in Horicon National Wildlife Refuge on October 7, by Norris in Brown County on October 8, and by the Smiths in Burnett County on October 9.

Snow Goose.—Berner found an early one in St. Croix County on August 29. The refuge staff found 505 in Horicon National Wildlife Refuge on November 15. Reported at the end of the period in Taylor County by P. Risch.

Canada Goose.—Reported at the beginning of the period south to Walworth, Jefferson, Richland, and La Crosse Counties. The refuge staff reported 201,250 in the Horicon Marsh area on October 17. By October 20, this had dropped to 113,000. The total reported in the state on October 17 was 423,580 with 386,880 of these reported in Horicon and East Central

Wisconsin. Found at the end of the period north to Burnett, Ashland, Bayfield, Oconto, and Door Counties.

Wood Duck.—Found throughout the state at the beginning of the period. The refuge staff reported 500 in Horicon National Wildlife Refuge on September 15 and October 7. Reported at the end of the period in Chippewa, Shawano, and Trempeleau Counties.

Green-winged Teal.—Found at the beginning of the period in Ashland, Bayfield, Brown, Burnett, Langlade, Milwaukee, and Oconto Counties. The refuge staff found 27,000 in Horicon National Wildlife Refuge on September 30. Reported at the end of the period in Dane, Manitowoc, and Milwaukee Counties.

American Black Duck.—Reported at the beginning of the period in Ashland, Bayfield, Brown, Door, Manitowoc, Marinette, Oconto, and Vilas Counties. The refuge staff found 5800 in Horicon National Wildlife Refuge on November 22. Reported at the end of the period in scattered areas throughout the state.

Mallard.—Reported throughout the state during the period. The refuge staff reported 139,200 in Horicon National Wildlife Refuge on November 22.

Northern Pintail.—First reported by the LaValleys in Forest County on August 4. The refuge staff found 2500 in Horicon National Wildlife Refuge on October 26. Reported at the end of the period in Portage County by Berner.

Blue-winged Teal.—Found throughout the state at the beginning of the period. The refuge staff reported 5000 in Horicon National Wildlife Refuge on September 15. Last reported by Parsons in Walworth County on November 11.

Northern Shoveler.—First reported by Peterson in Shawano County on August 5. The refuge staff found 1300 in Horicon National Wildlife Refuge on October 19. Reported at the end of the period in Dane and Milwaukee Counties.

Gadwall.—First reported by Swengel in Dodge County on August 23. The refuge staff found 1800 in Horicon National Wildlife Refuge on October 26. Found at the end of the period in Chippewa, Dane, and Milwaukee Counties.

Eurasian Wigeon.—Reported by Polk on Lake Tainter in Dunn County from October 21 to November 13, and by Soulen from the same location on November 6. See "By the Wayside."

American Wigeon.—First reported by Lesher in La Crosse County on August 3. The refuge staff found 6000 in Horicon National Wildlife Refuge on October 19. Reported at the end of the period in Dane County by Ashman, Cederstrom, and Hansen.

Canvasback.—First reported by the Sheas in Burnett County on September 23. The refuge staff found 300 in Horicon National Wildlife Refuge on October 26. Last reported by Lesher in La Crosse County on November 27.

Redhead.—First reported by Sontag in Manitowoc County on August 11. Ashman found 7 in Dane County on November 20. Reported at the end of the period in Dane County by Ashman and Hansen.

Ring-necked Duck.—Found at the beginning of the period in Burnett and Forest Counties. The refuge staff found 1200 in Horicon National Wildlife Refuge on October 26. Reported at the end of the period in Dane and Shawano Counties.

Greater Scaup.—First reported by the Sheas in Manitowoc County on September 2. Woodmansee found 2000 in Milwaukee County on November 20. Found at the end of the period in Ashland, Bayfield, Milwaukee, Ozaukee, and Sheboygan Counties.

Lesser Scaup.—Reported at the beginning of the period in Manitowoc County by Sontag. Tessen reported over 1000 in Milwaukee County on October 30. Found at the end of the period in Ashland, Bayfield, Chippewa, Dane, Douglas, Manitowoc, Marathon, Sauk and Winnebago Counties.

Harlequin Duck.—Many observations in Milwaukee and Ozaukee Counties during October and November. First reported by Woodmansee in Milwaukee County on October 11. Last reported by Sundell in Milwaukee County on November 30. Sundell reported five birds or more and easier to find than during the past 20 years.

Oldsquaw.—First reported by Tessen in

Ozaukee County on October 16, with 22 present that day. Reported at the end of the period in Manitowoc County by Sontag.

Black Scoter.—First reported by Sundell in Ozaukee County on October 12. Sundell found 4 in Ozaukee County on October 12, Tessen found 4 in Ozaukee County on October 30, Gustafson found 4 in Ozaukee County on November 3, and Tessen found 4 in Sheboygan County on November 13. Last reported by Tessen in Ozaukee County on November 27.

Surf Scoter.—First reported by Tessen in Ozaukee County on September 24. Woodmansee found 13 in Milwaukee County on October 20. Last reported by Tessen in Ozaukee County on November 27.

White-winged Scoter.—First reported by Tessen in Ozaukee County on October 16. Tessen found 9 in Milwaukee County on October 30. Lastly reported by Bontly in Milwaukee County on November 27.

Scoter Sp..—Cowart reported 6 that were not White-winged Scotters at Concordia College in Ozaukee County on August 28.

Common Goldeneye.—First reported by Offord in Taylor County on September 16. Parsons reported 192 in Walworth County on November 20. Reported at the end of the period in scattered areas throughout the state.

Bufflehead.—First reported by Offord in Taylor County on September 16. Frank found 162 in Milwaukee County on November 5. Reported at the end of the period in Ashland, Bayfield, Chippewa, Dane, La Crosse, Manitowoc, Milwaukee, Ozaukee, Sauk, and Sheboygan Counties.

Hooded Merganser.—Reported at the beginning of the period in Shawano County by Peterson. Hoefler found 300 in Burnett County on October 26. Found at the end of the period in Ashland, Bayfield, Chippewa, Dane, Portage, and Sauk Counties.

Common Merganser.—Reported at the beginning of the period in Ashland and Bayfield Counties by Verch. The Lukes found 64 in Door County on November 29. Found at the end of the period in Ashland, Bayfield, Chippewa, Door, Eau Claire, Manitowoc, Marathon, Shawano, and Winnebago Counties.

Red-breasted Merganser.—Reported at the beginning of the period in Ashland, Bayfield, Door, and Manitowoc Counties. Tessen found over 1500 in Ozaukee County on October 30. Found at the end of the period in Door, Manitowoc, Milwaukee, and Ozaukee Counties.

Ruddy Duck.—First reported by Sunby in Milwaukee County on August 26. The refuge staff found 2500 in Horicon National Wildlife Refuge on October 26. Reported at the end of the period in Dane and Milwaukee Counties.

Turkey Vulture.—Reported at the beginning of the period in scattered areas throughout the state. The Kuhns found 20 in Sheboygan County on September 21. Last reported on October 22 in Columbia County by Ashman and in Waukesha County by Tessen.

Osprey.—Found at the beginning of the period in Ashland, Bayfield, Douglas, Forest, Langlade, Manitowoc, Marathon, and Vilas Counties. Cowart found 30 in Ozaukee County on September 23. Last reported on October 18 in Forest County by the LaValleys.

Mississippi Kite.—Cowart found one at Concordia College in Ozaukee County on September 20. This sighting was accepted by the Records Committee. See "By the Wayside."

Bald Eagle.—Reported at the beginning of the period south to Polk, Taylor, and Marinette Counties. Offord and P. Risch reported 20 in Taylor County on October 18. Reported at the end of the period south to Trempeleau and Sauk Counties.

Northern Harrier.—Found at the beginning of the period south to Polk, Dane, Oconto, and Door Counties. Harmer found 4 in Jackson County on September 4, Lindberg found 4 in Marinette County on September 17, and Belter found 4 in Marathon County on September 23. Reported at the end of the period in Burnett, Dane, and Oconto Counties.

Sharp-shinned Hawk.—Found at the beginning of the period in Ashland, Bayfield, Clark, Door, Langlade, Outagamie, and Taylor Counties. Berger reported 1228 at Cedar Grove Ornithological Station in Sheboygan County on

September 23. Reported at the end of the period in Clark, Door, Sauk, Taylor, and Walworth Counties.

Cooper's Hawk.—Reported at the beginning of the period in Brown, Clark, Langlade, Richland, Taylor, and Vilas Counties. Berger reported 6 at Cedar Grove Ornithological Station in Sheboygan County on October 10. Found at the end of the period in Clark and Manitowoc Counties.

Northern Goshawk.—Reported at the beginning of the period in Ashland, Bayfield, and Door Counties. Found at the end of the period in Ashland, Bayfield, Door, Langlade, Milwaukee, and Sawyer Counties.

Red-shouldered Hawk.—Found at the beginning of the period in Chippewa, Dunn, Eau Claire, Marinette, Outagamie, Polk, and Shawano Counties. Last reported by Anderson and Brittnacher in Outagamie County on November 8.

Broad-winged Hawk.—Reported at the beginning of the period south to Sauk, Shawano, Oconto, and Door Counties. Cowart found 1786 in Ozaukee County on September 23. Last reported by Swengel in Sauk County on October 20.

Swainson's Hawk.—Reported by Berger in Sheboygan County on August 29, two by Berger in Sheboygan County on September 12 (one of which was banded), by Cowart in Ozaukee County on September 20, and by Gustafson in Ozaukee County on October 29.

Red-tailed Hawk.—Found throughout the state at the beginning of the period. Cowart and Gustafson found 67 in Ozaukee County on October 29. Reported at the end of the period north to Burnett, Polk, Clark, and Door Counties. A Harlan's Red-tailed Hawk was seen by Cowart and Sundell at Concordia College in Ozaukee County on November 6. An albino Red-tailed Hawk was seen by P. Risch in Ozaukee County on October 27. It had been banded the previous day at Cedar Grove Ornithological Station. Another albino was seen by the Brassers near Sheboygan Falls on October 7.

Ferruginous Hawk.—Berger reported one that had been caught just south of Harrington Beach State Park in Ozaukee County and was brought to Cedar Grove Ornithological Station. This record was accepted by the Records Committee. See "By the Wayside."

Rough-legged Hawk.—First reported by Semo in Burnett County on August 23. Gustafson found 3 in Ozaukee County on October 29 and Merkel found 3 in Sawyer County on November 13. Reported at the end of the period south to Winnebago and Sauk Counties.

Golden Eagle.—Reported by Semo in Douglas County on October 22, by Robbins in Grant County on October 28, by Gustafson in Ozaukee County on October 29, by Berger in Sheboygan County on October 29, by Donald in Ozaukee County on October 30, by P. Risch in Taylor County on November 2, and by Cowart in Ozaukee County on November 8.

American Kestrel.—Found throughout the state at the beginning of the period. Berger found 36 at Cedar Grove Ornithological Station in Sheboygan County on September 23. Reported at the end of the period north to Burnett, Clark, Oconto, and Door Counties.

Merlin.—Reported by Verch in Ashland and Bayfield Counties at the beginning of the period. Berger reported 58 at Cedar Grove Ornithological Station on September 23. Last reported by Berger in Sheboygan County on November 24.

Peregrine Falcon.—First reported by Pickering in Langlade County on August 25. Berger reported 8 at Cedar Grove Ornithological Station in Sheboygan County on September 25. Last reported by Johnson in Douglas County on October 18.

Gyrfalcon.—Reported by Mueller in Milwaukee County on October 4 and by Sundell in Ozaukee County on October 28. Both records were accepted by the Records Committee. See "By the Wayside."

Gray Partridge.—Found during the period in Brown, Marinette, Monroe, Oconto, and St. Croix Counties. The Smiths found 11 in St. Croix County on November 19.

Ring-necked Pheasant.—Found during the period north to Douglas, Marinette, and Door Counties. Ziebell found 6 in Winnebago County on October 1 and Frank found 6 in Ozaukee County on November 2.

Spruce Grouse.—Reported by the La-Valleys in Forest County from the beginning of the period to November 13.

Ruffed Grouse.—Reported during the period south to Sheboygan, Sauk, and Grant Counties. Merkel found 22 in Sawyer County on November 23.

Greater Prairie Chicken.—Reported throughout the period in Burnett County by Hoefler, 11 by P. Risch in Taylor County on August 25, and 4 in Marathon County by Belter on November 25.

Sharp-tailed Grouse.—Reported during the period in Burnett, Langlade, Marathon, and Taylor Counties. P. Risch found 44 in Taylor County on September 1.

Wild Turkey.—Found during the period in Grant, Jackson, Marinette, Monroe, Sauk, and Walworth Counties. Swengel found 9 in Sauk County on November 2.

Northern Bobwhite.—Reported during the period in Monroe, Price, Richland, St. Croix, and Sauk Counties. The Smiths found 7 in St. Croix County on August 21.

King Rail.—The Sheas found 2 in Waunakee Marsh in Dane County on September 6.

Virginia Rail.—Reported at the beginning of the period in Ashland, Bayfield, Columbia, Dane, Oconto, and Winnebago Counties. Last reported by Diehl in Milwaukee County on October 26.

Sora.—Found at the beginning of the period in scattered areas throughout the state. Ashman found 31 in Dane County on September 16. Last reported on October 22 in Columbia County by Robbins and in Sheboygan County by the Brassers.

Common Moorhen.—Reported at the beginning of the period in Dane and Oconto Counties. Ashman found 13 in Dane County on August 20. Last reported by Ashman in Dane County on October 15.

American Coot.—Reported at the beginning of the period south to Eau Claire, Dane, Winnebago, and Manitowoc Counties. The refuge staff reported 4000 in Horicon National Wildlife Refuge on September 30 and October 26. Found at the end of the period in Dane, Jefferson, and Walworth Counties.

Sandhill Crane.—Reported in scattered areas throughout the state at the beginning of the period. Peterson found over 400 in Shawano County on September 29. Reported at the end of the period in Burnett and Columbia Counties.

Black-bellied Plover.—First reported on August 6 in Brown County by Norris and in Dodge County by Tessen. Sontag found 11 in Manitowoc County on September 11. Last reported by Tessen in Sheboygan County on November 13.

Lesser Golden Plover.—First reported by Mueller in Milwaukee County on August 4. Tessen found 250 in Racine County on September 17. Last reported by Cederstrom in Columbia County on November 4.

Semipalmated Plover.—Found at the beginning of the period in Dane, Douglas, Manitowoc, and Milwaukee Counties. Tessen found 30 in Dodge County on September 5. Last reported by Mead in Brown County on October 15.

Killdeer.—Reported throughout the state at the beginning of the period. Ashman found 375 in Columbia County on August 2. Reported at the end of the period in Brown County by Mead.

American Avocet.—Reported by the Sheas in Columbia County on October 3, by Swengel in Columbia County on October 6, and by Ashman and Hansen in Columbia County on October 8.

Greater Yellowlegs.—Reported at the beginning of the period in scattered areas throughout the state. Belter found 51 in Marathon County on September 12. Last reported by Sontag in Manitowoc County on November 14.

Lesser Yellowlegs.—Found at the beginning of the period in scattered areas throughout the state. Tessen found 1500 in Dodge County on August 14. Last reported by Tessen in Milwaukee County on November 10.

Solitary Sandpiper.—Reported at the beginning of the period in Burnett, Columbia, Dane, Douglas, Manitowoc, Oconto, Ozaukee, and Shawano Counties. Tessen found 15 in Columbia County and 15 in Dodge County on August 6, and Ashman found 15 in Dane County on August 13. Last reported by Sontag in Manitowoc County on November 16.

Willet.—First reported in Milwaukee County on August 2 by Gustafson, Sunby, and Sundell. Last reported on August 27 in Sheboygan County by the Brassers. Also reported in Burnett, Dodge, Manitowoc, and Marathon Counties.

Spotted Sandpiper.—Found at the beginning of the period in scattered areas throughout the state. Sontag found 17 in Manitowoc County on August 15. Last reported by Hudick in Polk County on October 15.

Upland Sandpiper.—Reported at the beginning of the period in Burnett, Langlade, and Oconto Counties. Last reported by Martin in Columbia County on September 3.

Whimbrel.—Reported by Sundell in Milwaukee County on August 3, by Johnson in Douglas County on August 24, and by Sontag in Manitowoc County on September 5.

Marbled Godwit.—Reported by Sunby in Milwaukee County on August 17, by Freese in Columbia County on September 3, and by Hansen in Columbia County on September 4.

Ruddy Turnstone.—Found at the beginning of the period in Manitowoc and Milwaukee Counties. Johnson found 3 in Douglas County on September 22. Last reported by Sundell in Ozaukee County on November 5.

Red Knot.—First reported by Polk in Milwaukee County on August 18. Mead found 5 in Brown County on August 21. Last reported by Robbins in Sheboygan County on November 10.

Sanderling.—Reported at the beginning of the period in Douglas County by Johnson. Johnson found 15 in Douglas County on September 5. Last reported by the Brassers in Sheboygan County on November 19.

Semipalmated Sandpiper.—Found at the beginning of the period in Ashland, Bayfield, Brown, Columbia, Dane, Manitowoc, Marinette, Milwaukee, and Shawano Counties. Sontag found 35 in Manitowoc County on September 10. Last reported by the Smiths in St. Croix County on October 24.

Western Sandpiper.—First reported on August 3 in La Crosse County by Lesher and in Milwaukee County by Gustafson and Sunby. Last reported by Tessen in Milwaukee County on September 5. Also reported in Dane and Manitowoc Counties.

Least Sandpiper.—Reported at the beginning of the period in scattered aress throughout the state. Ashman found 30 in Columbia County on August 2. Last reported by Swengel in Columbia County on October 18.

White-rumped Sandpiper.—First reported by Tessen in Milwaukee County on August 6. Last reported by Gustafson in Milwaukee County on September 15.

Baird's Sandpiper.—Reported at the beginning of the period in Dane, Douglas, and Marinette Counties. Berner found 14 in St. Croix County on August 27. Last reported by Ashman in Columbia County on October 16.

Pectoral Sandpiper.—Found at the beginning of the period in scattered areas throughout the state. Ashman found 500 in Dane County on August 15. Last reported by the Brassers in Sheboygan County on November 19.

Dunlin.—First reported by Johnson in Douglas County on August 27. Norris found 35 in Oconto County on October 9. Last reported by Gustafson in Milwaukee County on November 30.

Stilt Sandpiper.—Reported at the beginning of the period in Columbia, Dane, and Douglas Counties. Hansen found 20 in Dane County on August 29. Last reported by Hansen in Dane County on September 26.

Buff-breasted Sandpiper.—First reported on August 2 in Milwaukee County by Gustafson and Sunby. Sundell found 4 in Dane County on August 25. Last reported by Swengel in Columbia County on September 14. Also reported in Dodge and Eau Claire Counties.

Short-billed Dowitcher.—Found at the beginning of the period in Burnett, Manitowoc, and Milwaukee Counties. Tessen found 120 in Dodge County on September 5. Last reported by Hoefler in Burnett County on October 16.

Long-billed Dowitcher.—First reported on August 3 in Milwaukee County by Gustafson and Sundell. Ashman found 9 in Columbia County on October 16. Last reported on October 22 in Columbia County by Ashman, Peterson, and Tessen and in Dane County by Ashman and Tessen.

Common Snipe.—Reported at the beginning of the period south to Sauk, Dane, and Winnebago Counties. Ashman found 30 in Dane County on October 16. Last reported by Swengel in Sauk County on November 23.

American Woodcock.—Found at the beginning of the period south to Richland and Winnebago Counties. Merkel found 3 in Sawyer County on September 5. Last reported by Hudick in Polk County on November 23.

Wilson's Phalarope.—Reported at the beginning of the period in Brown, Burnett, Columbia, Milwaukee, and Oconto Counties. Tessen found 100 in Dodge County on August 14 and Swengel found 100 in Horicon National Wildlife Refuge on August 23. Last reported by Berner in Manitowoc County on September 10.

Red-necked Phalarope.—First reported by Tessen in Milwaukee County on August 2. Peterson found 5 in Horicon National Wildlife Refuge on August 28. Last reported by Swengel in Columbia County on September 14.

Red Phalarope.—Cowart found one in Milwaukee County on November 19. This record was accepted by the Records Committee. See "By the Wayside."

Frigatebird (species unknown).—Swedberg saw one at St. Louis Bay in Superior while trawling for fish. This record was accepted by the Records Committee as a frigatebird (species unknown), probably magnificent. See "By the Wayside."

Franklin's Gull.—Reported on August 3 in Ashland and Bayfield Counties by Verch, from October 22 to October 29 in Columbia County by Ashman, and on October 30 in Milwaukee County by the Sheas.

Little Gull.—Reported at the beginning of the period in Manitowoc and Milwaukee Counties. Gustafson found 3 in Milwaukee County on August 2 and Polk found 3 in Milwaukee County on August 30.

Bonaparte's Gull.—Found at the beginning of the period in Brown, Manitowoc, Milwaukee, and Sheboygan Counties. Johnson found 152 in Douglas County on October 29. Reported at the end of the period in Manitowoc County by Sontag.

Ring-billed Gull.—Reported throughout the state during the period. The Brassers found 1850 in Sheboygan County on November 19.

Herring Gull.—Found in scattered areas throughout the state at the beginning of the period. Sontag found 505 in Manitowoc County on October 3. Reported throughout the state at the end of the period.

Glaucous Gull.—Reported by Swengel in Green Lake County on October 19 and by Berger in Sheboygan County on November 25.

Black-legged Kittiwake.—Polk found one on Lake Menomin in Dunn County on November 15. This sighting was accepted by the Records Committee. See "By the Wayside."

Caspian Tern.—Reported at the beginning of the period in Brown, Burnett, Door, Manitowoc, Marinette, Milwaukee, and Oconto Counties. Tessen found 45 in Milwaukee County on August 6. Last reported by Sontag in Manitowoc County on October 5.

Royal Tern.—Reported at the Coast Guard Impoundment in Milwaukee on August 2 by Gustafson and Sunby and August 3 by Donald and Sundell. These sightings were accepted by the Records Committee. See "By the Wayside."

Common Tern.—Reported at the beginning of the period in Ashland, Bayfield, Burnett, Clark, Douglas, Manitowoc, Marinette, Milwaukee, and Winnebago Counties. Sontag found 12 in Manitowoc County on August 15. Last reported by Gustafson in Ozaukee County on October 28.

Forster's Tern.—Found at the beginning of the period in Manitowoc, Marinette, Milwaukee, Oconto, and Winnebago Counties. Ziebell found 10 in Winnebago County on September 10 and Sontag found 10 in Manitowoc County on September 12. Last reported on October 16 in Manitowoc County by Sontag and in Milwaukee County by Soulen.

Black Tern.—Reported at the beginning of the period south to Dane and Milwaukee Counties. Tessen found 65 in Dodge County on August 14. Last reported by Pickering in Langlade County on September 13.

Rock Dove.—Found throughout the state during the period. Merkel found 185 in Wood County on August 21.

Mourning Dove.—Reported throughout the state during the period. Ashman found 150 in Columbia County on September 14.

Black-billed Cuckoo.—Reported at the beginning of the period in Burnett, Dane, Door, Douglas, Langlade, Ozaukee, and Shawano Counties. Last reported by Hoefler in Burnett County on September 20.

Yellow-billed Cuckoo.—Found at the beginning of the period in Clark, Dane, Douglas, Langlade, Marathon, Milwaukee, and Walworth Counties. Last reported by Belter in Marathon County on September 29.

Eastern Screech Owl.—Reported during the period in Dane, Jefferson, Kenosha, Manitowoc, Marathon, Milwaukee, Monroe, Portage, St. Croix, Sauk, Taylor, and Winnebago Counties. In Sauk County Swengel found 3 in November 8 and 3 on November 17.

Great Horned Owl.—Found throughout the state during the period. Berner found 4 in Portage County on October 1.

Snowy Owl.—Reported from November 11 to the end of the period in Ashland and Bayfield Counties by Verch, on November 14 in Manitowoc County by Sontag, and on November 25 in Taylor County by P. Risch.

Barred Owl.—Reported during the period south to Milwaukee, Dane, and Grant Counties. Merkel found 6 in Sawyer County on October 30.

Long-eared Owl.—Reported on October 4 in Sheboygan County by Berger, on October 28 in Portage County by Semo, on November 1 in Sauk County by Swengel, and on November 29 in Door County by the Lukes.

Short-eared Owl.—Reported at the beginning of the period in Burnett County by Hoefler. The Sheas found 4 in Burnett County on September 23 and Cowart and Gustafson found 4 in Milwaukee County on October 8. Found at the end of the period in Burnett and Polk Counties. Also reported during the period in 11 additional counties.

Northern Saw-whet Owl.—Reported at the beginning of the period in Ashland, Bayfield, and Oconto Counties. Berger reported 37 at Cedar Grove Ornithological Station in Sheboygan County on October 30. Reported at the end of the period in Ashland and Bayfield Counties by Verch.

Common Nighthawk.—Found throughout the state at the beginning of the period. Pickering found 600 in Langlade County on August 29. Last reported by Cowart in Ozaukee County on October 10.

Whip-poor-will.—Reported at the beginning of the period in Door, Oconto, Price, Shawano, and Vilas Counties. Karow found 4 in Vilas County on August 29. Last reported by Berger in Sheboygan County on October 2.

Chimney Swift.—Found throughout the state at the beginning of the period. Mueller watched 1090 enter a chimney in Milwaukee County on September 7. Last reported by Cowart in Ozaukee County on October 24.

Ruby-throated Hummingbird.—Reported at the beginning of the period south to Walworth, Dane, Sauk, and Richland Counties. Hardy found 20 in Price County on August 1. Last reported by Offord in Taylor County on October 11.

Belted Kingfisher.—Found throughout the state at the beginning of the period. Belter reported 10 in Marathon County on September 5. Reported at the end of the period in Chippewa,

Manitowoc, Sheboygan, and Trempeleau Counties.

Red-headed Woodpecker.—Reported at the beginning of the period throughout the state. Ziebell found 8 in Winnebago County on August 28. Reported at the end of the period in Sauk County by Swengel.

Red-bellied Woodpecker.—Found during the period north to Burnett, Price, Langlade, Marinette, and Door Counties. Berner found 7 in St. Croix County on August 23.

Yellow-bellied Sapsucker.—Reported at the beginning of the period south to Trempeleau, Clark, Langlade, and Marinette Counties. Lindberg found 6 in Marinette County on September 24. Last reported by Offord in Taylor County on October 11.

Downy Woodpecker.—Found throughout the state during the period. Berner found 12 in St. Croix County on August 19.

Hairy Woodpecker.—Reported throughout the state during the period. Berner found 4 in Portage County on October 22.

Black-backed Woodpecker.—Reported by Merkel in Sawyer County on September 10, by Swengel in Ashland County on September 21, by Johnson in Douglas County on October 1, and by Hardy in Price County on October 5.

Northern Flicker.—Found throughout the state at the beginning of the period. Hardy reported 200 in Price County on September 12. Reported at the end of the period in Clark, Kenosha, Outagamie, Ozaukee, and Sauk Counties.

Pileated Woodpecker.—Reported during the period south to Manitowoc, Winnebago, Sauk, and Grant Counties. Merkel found 3 in Sawyer County on September 10.

Olive-sided Flycatcher.—Reported at the beginning of the period in Ashland and Bayfield Counties by Verch. Berner found 5 in St. Croix County on August 24. Last reported by Verch in Ashland and Bayfield Counties on September 11.

Eastern Wood-Pewee.—Found throughout the state at the beginning of the period. Berner found 35 in St. Croix County on August 24. Last reported by Hunter in Trempeleau County on October 4.

Yellow-bellied Flycatcher.—First reported by the Sheas in Oneida County on August 22. Last reported by Hansen in Columbia County on September 10.

Alder Flycatcher.—Found at the beginning of the period in Ashland, Bayfield, Douglas, Oconto, and Shawano Counties. Last reported by Tessen in Ozaukee County on September 17.

Willow Flycatcher.—Reported at the beginning of the period in Columbia, Dane, and Oconto Counties. Ashman found 4 in Dane County on August 20. Last reported by the Sheas in Dodge County on September 2.

Least Flycatcher.—Found at the beginning of the period in Ashland, Bayfield, Clark, Douglas, Langlade, Marinette, Oconto, Oneida, and Price Counties. Last reported by Pickering in Langlade County on September 25.

Eastern Phoebe.—Found throughout the state at the beginning of the period. Merkel found 7 in Wood County on August 21. Last reported by Ashman in Dane County on November 20.

Great Crested Flycatcher.—Reported throughout the state at the beginning of the period. Woodmansee found 9 in Milwaukee County on August 30. Last reported by Anderson and Brittnacher in Outagamie County on September 23.

Eastern Kingbird.—Found throughout the state at the beginning of the period. Peterson found 38 in Shawano County on August 1. Last reported by Pickering in Langlade County on September 21.

Horned Lark.—Found in scattered areas throughout the state at the beginning of the period. The Lukes found 150 in Door County on October 8. Reported at the end of the period north to Burnett, Taylor, and Langlade Counties.

Purple Martin.—Reported throughout the state at the beginning of the period. Ziebell found 500 in Winnebago County on August 20. Last

reported by Sontag in Manitowoc County on September 25.

Tree Swallow.—Found throughout the state at the beginning of the period. Berner reported over 5500 in St. Croix County on August 17. Last reported by Cowart in Ozaukee County on October 24.

Northern Rough-winged Swallow.—Reported throughout the state at the beginning of the period. Last reported by Sontag in Manitowoc County on September 22.

Bank Swallow.—Reported at the beginning of the period south to Milwaukee, Dane, and Trempeleau Counties. Ziebell found 120 in Winnebago County on August 20. Last reported by the Smiths in St. Croix County on September 18.

Cliff Swallow.—Reported at the beginning of the period south to Milwaukee, Columbia, and Trempeleau Counties. Merkel found 55 in Wood County on August 21. Last reported by Sontag in Manitowoc County on September 20.

Barn Swallow.—Found throughout the state at the beginning of the period. Ziebell found 180 in Winnebago County on August 14. Last reported by Cowart in Ozaukee County on November 5.

Gray Jay.—Reported during the period in Douglas, Forest, Langlade, Oneida, Price, Sawyer, Taylor, and Vilas Counties. Merkel found 15 in Sawyer County on September 17.

Blue Jay.—Found throughout the state during the period. Epstein found 254 in Monroe County on September 24.

American Crow.—Reported throughout the state during the period. Parsons found 300 in Walworth County on November 30.

Common Raven.—Reported during the period in its usual range south to Burnett, Clark, Shawano, and Door Counties. Also reported south to this area in Ozaukee and Winnebago Counties. Merkel found 12 in Sawyer County on August 28.

Black-capped Chickadee.—Found throughout the state during the period. Cowart reported over 50 in Ozaukee County on October 15.

Boreal Chickadee.—Reported during the period in Bayfield, Douglas, Forest, Langlade, Oneida, and Sawyer Counties. Gustafson found 4 in Forest County on August 15.

Tufted Titmouse.—Found during the period in Chippewa, Crawford, Dane, Dunn, Eau Claire, Jackson, Portage, Richland, St. Croix, and Sauk Counties.

Red-breasted Nuthatch.—Reported during the period in scattered areas mostly in the northern and eastern areas of the state. Belter found 20 in Marathon County on November 18.

White-breasted Nuthatch.—Found throughout the state during the period. Berner found 20 in St. Croix County on August 19.

Brown Creeper.—Reported at the beginning of the period in Ashland, Bayfield, Douglas, Forest, Oconto, Oneida, Outagamie, Polk, and Vilas Counties. Tessen found 20 in Ozaukee County on September 24. Found at the end of the period in Ashland, Bayfield, Dane, Jefferson, Manitowoc, and Milwaukee Counties.

Carolina Wren.—Reported by the Sheas in Dane County on August 2, by Hansen in Dane County from August 2 to September 6, on August 6 in Dane County by Tessen, on August 10 in Dane County by Robbins, on August 21 in Dane County by Ashman, on September 13 in Milwaukee County by Bontly, on November 2 in Ozaukee County by Sundell, and on November 25 in Waukesha County by Aune.

House Wren.—Found throughout the state at the beginning of the period. Ashman found 5 in Dane County on September 18. Last reported by Richter in Monroe County on October 6.

Winter Wren.—Reported at the beginning of the period in Door, Douglas, Forest, Oconto, Sauk, and Vilas Counties. Sontag found 3 in Manitowoc County on September 20 and Ashman found 3 in Dane County on October 9. Last reported by Hansen in Dane County on November 29.

Sedge Wren.—Reported at the beginning of the period south to Manitowoc and Dane Counties. Berner found 16 in St. Croix County on August 15. Last reported by Robbins in Dane County on October 3.

Marsh Wren.—Found at the beginning of the period in Ashland, Bayfield, Dane, Jefferson, Marinette, Oconto, Shawano, and Winnebago Counties. Ziebell found 4 in Winnebago County on September 3 and Ashman found 4 in Dane County on September 16. Last reported by Ashman in Dane County on November 13.

Golden-crowned Kinglet.—Reported at the beginning of the period in Door, Douglas, Forest, and Walworth Counties. Tessen reported over 70 in Ozaukee County on September 24. Found at the end of the period in Dane, Manitowoc, Milwaukee, Sawyer, Taylor, and Winnebago Counties.

Ruby-crowned Kinglet.—First reported by Karow in Vilas County on August 31. Ashman found 30 in Dane County on October 9. Last reported by the Smiths in St. Croix County on November 24.

Blue-gray Gnatcatcher.—Found at the beginning of the period in Dane, Oconto, Polk, and Trempeleau Counties. Last reported by Woodmansee in Sheboygan County on October 22.

Eastern Bluebird.—Found throughout the state at the beginning of the period. Hudick found 45 in Polk County on October 17 and the Sheas found 121 in Burnett, Douglas, and Polk Counties from September 22–24. Last reported by Parsons in Walworth County on November 10.

Townsend's Solitaire.—Soulen heard one calling in Pierce County on November 24–25.

Veery.—Reported at the beginning of the period in Ashland, Bayfield, Dane, Douglas, Forest, and Langlade Counties. Berner found 16 in Manitowoc County on August 31. Last reported by Woodmansee in Milwaukee County on October 17.

Gray-cheeked Thrush.—First reported on August 30 in Brown County by Wierzbicki and in Manitowoc County by Sontag. Tessen found 20 in Ozaukee County on September 17. Last reported by Woodmansee in Ozaukee County on October 22.

Swainson's Thrush.—Reported at the beginning of the period in Milwaukee County by Woodmansee. Ziebell found 110 in Winnebago County on September 3. Last reported by Tessen in Ozaukee County on October 16.

Hermit Thrush.—Found at the beginning of the period in Ashland, Bayfield, Burnett, Douglas, Forest, Oconto, Sauk, and Vilas Counties. Woodmansee found 22 in Milwaukee County on October 10. Last reported by Bontly in Milwaukee County on November 14.

Wood Thrush.—Reported at the beginning of the period in Oconto, Shawano, and Walworth Counties. Peterson found 10 in Shawano County on August 1. Last reported by Tessen in Ozaukee County on October 2.

American Robin.—Found throughout the state at the beginning of the period. Tessen found 150 in Walworth County on September 17. Reported at the end of the period in scattered areas north to Ashland, Bayfield, Taylor, and Brown Counties.

Varied Thrush.—Reported in Milwaukee County on November 15 by Donald and Sunby and on November 16 by Sundell.

Gray Catbird.—Found throughout the state at the beginning of the period. Hunter found 15 in Trempeleau County on August 30 and Ashman found 15 in Dane County on September 18. Last reported by Offord in Taylor County on October 11.

Brown Thrasher.—Reported throughout the state at the beginning of the period. Ashman found 12 in Dane County on September 18. Last reported by Ashman in Dane County on November 13.

Water Pipit.—First reported on September 10 in Ashland and Bayfield Counties by Verch and in Milwaukee County by Gustafson. Tessen found 45 in Columbia County on October 22. Last reported by Cowart in Milwaukee County on November 6.

Bohemian Waxwing.—First reported by Verch in Ashland and Bayfield Counties on Oc-

tober 26. Verch found 77 in Ashland and Bayfield Counties on November 23. Reported at the end of the period in Ashland, Bayfield, and Polk Counties.

Cedar Waxwing.—Found throughout the state at the beginning of the period. Ashman found 200 in Dane County on September 22. Reported at the end of the period in Brown, Dane, Milwaukee, Sauk, Trempeleau, and Winnebago Counties.

Northern Shrike.—First reported on October 11 in Ashland and Bayfield Counties by Verch. Reported at the end of the period in Ashland, Bayfield, Burnett, Clark, Door, Monroe, Polk, Portage, Sauk, and Taylor Counties.

Northern Shrike.—First reported on October 11 in Ashland and Bayfield Counties by Verch. Reported at the end of the period in Ashland, Bayfield, Burnett, Clark, Door, Monroe, Polk, Portage, Sauk, and Taylor Counties.

European Starling.—Found throughout the state during the period. Merkel found 250 in Wood County on August 21.

White-eyed Vireo.—Tessen heard one singing along the warbler walkway near Lake Geneva in Walworth County on September 17.

Bell's Vireo.—Richter found one in Monroe County on August 21.

Solitary Vireo.—Reported at the beginning of the period in Ashland, Bayfield, Douglas, Forest, and Marathon Counties. Berner found 8 in Portage County on September 21. Last reported on October 6 by Hansen in Columbia and Dane Counties.

Yellow-throated Vireo.—Found at the beginning of the period in Outagamie, Richland, and Shawano Counties. Last reported by Peterson in Shawano County on September 26.

Warbling Vireo.—Reported at the beginning of the period in scattered areas throughout the state. Belter found 3 in Marathon County on August 7. Last reported by Tessen in Ozaukee County on September 17.

Philadelphia Vireo.—First reported by Sontag in Manitowoc County on August 16. Berner found 3 in Portage County on September 13. Last reported by Cowart in Ozaukee County on October 7.

Red-eyed Vireo.—Found throughout the state at the beginning of the period. Berner found 52 in St. Croix County on August 26. Last reported by Hansen in Dane County on October 18.

Blue-winged Warbler.—Reported by Hansen in Dane County on August 11, by Berner in St. Croix County on August 19, and by Peterson in Shawano County on September 5.

Golden-winged Warbler.—Found at the beginning of the period in Ashland, Bayfield, Chippewa, Dunn, Eau Claire, and Shawano Counties. Last reported by Polk in Eau Claire County on September 24.

Brewster's Warbler.—Hansen found one in Dane County on August 20.

Tennessee Warbler.—Reported at the beginning of the period in Clark and Vilas Counties. Berner found 22 in Portage County on September 20. Last reported by L. Risch in Clark County on October 10.

Orange-crowned Warbler.—First reported by Johnson in Douglas County on August 13. Zehner found 3 in Milwaukee County on August 29, Berner found 3 in Portage County on September 21, and Ashman found 3 in Dane County on October 9. Last reported by Hansen in Dane County on October 26.

Nashville Warbler.—Found at the beginning of the period in Ashland, Bayfield, Door, Douglas, and Shawano Counties. Merkel found 7 in Sawyer County on September 11. Last reported by Bontly on October 12.

Northern Parula Warbler.—Reported at the beginning of the period in Ashland, Bayfield, Door, Douglas, Shawano, and Vilas Counties. Ashman found 3 in Dane County on September 22. Last reported by Epstein in Monroe County on September 24.

Yellow Warbler.—Found at the beginning of the period south to Manitowoc, Winnebago, and Dane Counties. Lindberg found 5 in Oconto

County on August 9. Last reported by the Kuhns in Sheboygan County on October 1.

Chestnut-sided Warbler.—Reported at the beginning of the period in Ashland, Bayfield, Clark, Door, Douglas, Price, Sauk, Shawano, and Vilas Counties. Berner found 26 in St. Croix County on August 19. Last reported by Norris in Brown County on October 8.

Magnolia Warbler.—Found at the beginning of the period in Ashland, Bayfield, and Douglas Counties. Tessen found 15 in Ozaukee County on September 17. Last reported by Bontly in Milwaukee County on October 26.

Cape May Warbler.—First reported by Semo in Douglas County on August 6. Zehner found 6 in Milwaukee County on August 29. Last reported by Sontag in Manitowoc County on October 10.

Black-throated Blue Warbler.—Reported at the beginning of the period in Clark, Menominee, and Shawano Counties. Peterson found 4 in Menominee County on August 1. Last reported by Hansen in Dane County on October 8.

Yellow-rumped Warbler.—Reported at the beginning of the period south to Door, Marinette, Oconto, and Clark Counties. Belter found 150 in Marathon County on September 17. Last reported by Bontly in Milwaukee County on November 22.

Black-throated Green Warbler.—Found at the beginning of the period in Ashland, Bayfield, Douglas, and Shawano Counties. Merkel found 12 in Sawyer County on September 11. Last reported by Bontly and Zehner in Milwaukee County on October 17.

Blackburnian Warbler.—Reported at the beginning of the period in Ashland, Bayfield, and Door Counties. Berner found 13 in Trempeleau County on August 10. Last reported by the Brassers in Sheboygan County on September 25.

Pine Warbler.—Found at the beginning of the period in Ashland, Bayfield, and Forest Counties. Epstein found 3 in Monroe County on September 5. Last reported by Hansen in Dane County on October 4.

Palm Warbler.—Reported at the beginning of the period in Oconto County by Lindberg. Hardy found 50 in Price County on September 11. Last reported by Tessen in Dane County on October 22.

Bay-breasted Warbler.—Reported at the beginning of the period in Douglas County by Johnson. Berner found 13 in Manitowoc County on August 31. Last reported by Offord in Taylor County on September 25.

Blackpoll Warbler.—First reported by Sunby in Milwaukee County on August 8. Berner found 26 in Manitowoc County on September 2. Last reported by P. Risch in Taylor County on October 8.

Black and White Warbler.—Reported at the beginning of the period in Burnett, Dane, Douglas, Sauk, Shawano, and Vilas Counties. Berner found 20 in Manitowoc County on August 31. Last reported by Wierzbicki in Brown County on October 3.

American Redstart.—Reported at the beginning of the period south to Manitowoc, Winnebago, Dane, and Sauk Counties. Berner found 22 in St. Croix County on August 19. Last reported by Tessen in Walworth County on October 10.

Prothonotary Warbler.—Zehner found one in La Crosse County on August 19.

Worm-eating Warbler.—Sontag found one in Manitowoc County on September 2.

Ovenbird.—Reported at the beginning of the period south to Manitowoc, Dane, and Monroe Counties. Berner found 13 in Manitowoc County on September 10. Last reported by Wierzbicki in Brown County on October 12.

Northern Waterthrush.—Found at the beginning of the period in Ashland, Bayfield, Door, Manitowoc, Ozaukee, and Shawano Counties. Sontag found 5 in Manitowoc County on August 17. Last reported by Sontag in Manitowoc County on October 14.

Louisiana Waterthrush.—The Brassers found one in Sheboygan County on September 10.

Kentucky Warbler.—The Brassers found one at Wyalusing State Park in Grant County on September 3.

Connecticut Warbler.—Reported at the beginning of the period in Vilas County by Karow. Last reported by L. Risch in Clark County on October 1.

Mourning Warbler.—Reported at the beginning of the period in Manitowoc and Shawano Counties. Last reported by Bontly in Milwaukee County on September 17.

Common Yellowthroat.—Found throughout the state at the beginning of the period. Belter found 81 in Marathon County on September 17. Last reported by Berner in Portage County on October 22.

Hooded Warbler.—Hansen found 3 in Sauk County on August 10.

Wilson's Warbler.—First reported on August 19 in Manitowoc County by Sontag, in Milwaukee County by Bontly, and in St. Croix County by Berner. Berner found 14 in St. Croix County on August 19. Last reported on September 22 in Dane County by Ashman and in Price County by Hardy.

Canada Warbler.—First reported on August 19 in Manitowoc County by Sontag, in Milwaukee County by Bontly, in St. Croix County by Berner, and in Shawano County by Peterson. Berner found 13 in St. Croix County on August 19. Last reported by Cowart in Ozaukee County on October 10.

Scarlet Tanager.—Reported at the beginning of the period in Dane, Door, Oconto, Polk, and Sauk Counties. Belter found 4 in Marathon County on August 12. Last reported by Ashman in Dane County on October 1.

Northern Cardinal.—Found during the period north to Burnett, Bayfield, Ashland, Price, Forest, Marinette, and Door Counties. Duerksen found 12 in Richland County on November 8.

Rose-breasted Grosbeak.—Found throughout the state at the beginning of the period. Ashman found 12 in Dane County on September 18. Last reported by Robbins in Dane County on October 3.

Indigo Bunting.—Reported throughout the state at the beginning of the period. Peterson found 48 in Shawano County on August 1. Last reported by Robbins in Dane County on October 3.

Dickcissel.—Reported at the beginning of the period in Dane, Jefferson, and Marathon Counties. Last reported by Belter in Marathon County on August 12.

Rufous-sided Towhee.—Found throughout the state at the beginning of the period. Last reported by Diehl in Milwaukee County on November 10.

American Tree Sparrow.—First reported by Wierzbicki in Brown County on September 24. Belter found 100 in Marathon County on November 5. Reported at the end of the period north to Burnett, Taylor, and Door Counties.

Chipping Sparrow.—Found throughout the state at the beginning of the period. Merkel found 21 in Wood County on August 21. Last reported by Parsons in Walworth County on November 10.

Clay-colored Sparrow.—Reported at the beginning of the period in Burnett, Clark, Door, Oconto, and Shawano Counties. The Engbergs found 40 in Oneida County on August 25. Last reported by Robbins in Dane County on October 13.

Field Sparrow.—Found at the beginning of the period north to Burnett, Marinette, and Door Counties. Tessen found 5 in Walworth County on September 17. Reported at the end of the period in Walworth County by Parsons.

Vesper Sparrow.—Reported at the beginning of the period in Burnett, Columbia, Door, Marinette, Oconto, Polk, Richland, Sauk, and Shawano Counties. Duerksen found 3 in Richland County on August 9. Last reported by Hudick in Polk County on November 1.

Lark Sparrow.—Reported on September 14 in Price County by Hardy, on September 23 in Burnett County by the Sheas, and from October 9 to October 29 in Dane County by Ashman.

Savannah Sparrow.—Reported at the beginning of the period south to Brown, Winnebago, Dane, Sauk, and Monroe Counties. Peterson found 7 in Shawano County on August 1. Last reported by Tessen in Dane County on October 22.

Grasshopper Sparrow.—Reported at the beginning of the period in Door, Monroe, Sauk, Shawano, and Trempeleau Counties. Last reported by the Smiths in St. Croix County on October 2.

Henslow's Sparrow.—Reported by Johnson in Douglas County on August 10.

Le Conte's Sparrow.—Reported by Robbins in Columbia County on September 30 and by the Smiths in St. Croix County on October 15.

Sharp-tailed Sparrow.—Sunby found one at the Coast Guard Impoundment in Milwaukee on September 12.

Fox Sparrow.—First reported by Offord in Taylor County on September 16. Lison and Ottinger found 40 in Milwaukee County on October 22. Last reported by Norris in Brown County on November 28.

Song Sparrow.—Found throughout the state at the beginning of the period. Ziebell found 60 in Winnebago County on September 25. Reported at the end of the period in Brown, Clark, Dane, and Walworth Counties.

Lincoln's Sparrow.—Reported at the beginning of the period in Ashland, Bayfield, and Langlade Counties. Berner found 14 in Marathon County on September 25. Last reported by Woodmansee in Milwaukee County on October 18.

Swamp Sparrow.—Found throughout the state at the beginning of the period. Belter found 250 in Marathon County on September 17. Last reported by Ashman in Dane County on November 13.

White-throated Sparrow.—Reported at the beginning of the period south to Clark, Shawano, and Door Counties. Hardy found 50 in Price County on September 11 and Tessen found 50 in Ozaukee County on September 24. Found at the end of the period in Dane and Outagamie Counties.

White-crowned Sparrow.—First reported by Woodmansee in Milwaukee County on September 14. Duerksen found 15 in Richland County on October 10 and Tessen found 15 in Ozaukee County on October 16. Last reported by Hudick in Polk County on November 12.

Harris' Sparrow.—First reported on September 20 in Clark County by L. Risch and in Douglas County by Johnson. Johnson found 4 in Douglas County on October 8. Last reported by Hudick in Polk County on October 21. Also reported from 8 additional counties.

Dark-eyed Junco.—Reported at the beginning of the period in Brown, Forest, and Vilas Counties. Hardy found 200 in Price County on September 30. Found throughout the state at the end of the period.

Lapland Longspur.—First reported on September 15 in Ashland and Bayfield Counties by Verch. Hardy found 300 in Price County on October 29. Reported at the end of the period in Clark County by L. Risch.

Snow Bunting.—First reported by the Lukes in Door County on October 7. Pickering found 400 in Langlade County on November 8. Reported at the end of the period in Ashland, Bayfield, Burnett, Clark, Door, Manitowoc, Polk, Portage, and Taylor Counties.

Bobolink.—Found at the beginning of the period in Ashland, Bayfield, Burnett, Clark, Columbia, Langlade, Polk, and Shawano Counties. Ashman found 10 in Dane County on September 14. Last reported by Robbins in Columbia County on September 30.

Red-winged Blackbird.—Reported throughout the state at the beginning of the period. Belter reported 75,000 in Marathon County on September 17. Reported at the end of the period in Ashland, Bayfield, Ozaukee, Price, and Walworth Counties.

Eastern Meadowlark.—Found throughout the state at the beginning of the period. Berner found 11 in Marathon County on October 14. Last reported by Ziebell in Winnebago County on November 5.

Western Meadowlark.—Reported at the beginning of the period east to Marinette, Shawano, Columbia, and Dane Counties. Merkel found 5 in Wood County on August 21. Last reported by Tessen in Dane County on October 22.

Yellow-headed Blackbird.—Found at the beginning of the period in Ashland, Bayfield, Marathon, and Marinette Counties. Last reported in Ashland and Bayfield Counties by Verch on September 11.

Rusty Blackbird.—First reported by Offord in Taylor County on September 16. Ziebell found 24 in Winnebago County on November 1. Reported at the end of the period in Clark and Winnebago Counties.

Brewer's Blackbird.—Reported at the beginning of the period south to Shawano and Trempeleau Counties. Berner found 305 in St. Croix County on August 17. Last reported by Tessen in Columbia County on October 22.

Common Grackle.—Found throughout the state at the beginning of the period. Ashman found 5000 in Dane County on October 24. Reported at the end of the period in St. Croix and Walworth Counties.

Brown-headed Cowbird.—Reported throughout the state at the beginning of the period. Hardy found 150 in Price County on August 7. Last reported by Diehl in Milwaukee County on November 14.

Northern Oriole.—Found throughout the state at the beginning of the period. Belter found 40 in Marathon County on August 15. Last reported by Ziebell in Winnebago County on September 6.

Orchard Oriole.—Berner found one in St. Croix County on August 19.

Pine Grosbeak.—First reported by Verch in Ashland and Bayfield Counties on September 24. Merkel found 7 in Sawyer County on November 21. Found at the end of the period in Ashland, Bayfield, Clark, and Sawyer Counties.

Purple Finch.—Reported at the beginning of the period south to Clark, Langlade, Oconto, and Door Counties. The Lukes found 50 in Door County on October 16 and Zehner found 50 in Milwaukee County on October 17. Reported at the end of the period south to Brown, Dane, Sauk, and Trempeleau Counties.

House Finch.—Reported during the period in Dane, Manitowoc, Milwaukee, Outagamie, Ozaukee, Sauk, Shawano, Sheboygan, Walworth, Waukesha, and Winnebago Counties. Cowart found over 40 in Milwaukee County on October 30.

Red Crossbill.—Reported during the period in Ashland and Bayfield Counties by Verch, on August 10 in Vilas County by Reardon, on October 1 in Douglas County by Johnson, on October 8 in Menominee County by Tessen, and on October 23 in Taylor County by P. Risch.

White-winged Crossbill.—Reported on November 15 in Milwaukee County by Bontly and from November 21 to the end of the period in Sawyer County by Merkel.

Common Redpoll.—First reported by Johnson in Douglas County on October 20. Swengel found 70 in Bayfield County on October 26. Reported at the end of the period in Langlade County by Pickering.

Pine Siskin.—Found at the beginning of the period in Ashland, Bayfield, Burnett, Clark, and Douglas Counties. Swengel found 30 in Bayfield County on October 28. Reported at the end of the period south to Manitowoc, Sauk, and Trempeleau Counties.

American Goldfinch.—Reported throughout the state during the period. Cowart reported over 1000 in Ozaukee County on November 8 and November 17.

Evening Grosbeak.—Reported at the beginning of the period in Ashland, Bayfield, Douglas, Forest and Price Counties. Swengel found 20 in Bayfield County on October 26 and Hardy found 20 in Price County on November 3. Reported at the end of the period south to Door, Langlade, and Taylor Counties.

House Sparrow.—Found throughout the state during the period. Berner found 150 in Portage County on November 17.

Contributors

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White-breasted Nuthatch *by Thomas R. Schultz*

"By the Wayside"

Pacific Loon, Frigatebird, Eurasian Wigeon, Red Phalarope, Black-legged Kittiwake, Royal Tern, Mississippi Kite, Ferruginous Hawk, Gyrfalcon, and carnivorous Northern Cardinals were highlights of the past year.

Pacific Loon (*Gavia pacifica*)

26 October 1988, Bayfield County, in Squaw Bay, east of Cornucopia.—The loon had its back to me most of the time, offering a good view of the crown, nape and back. Once it turned sideview for a lengthy view, then turned back the way it had been. It did not dive the entire time I watched it. Once it started to fly northwest and only covered a few meters, giving me a view of its upper wing surface. It appeared nervous that I was scoping it. After 5 minutes, it aimed itself northeast and took flight until it was too far away for me to see any details. I wrote the following description immediately.

Probably smaller than a Common Loon, but no comparison was available. It held its head about horizontal; round crown when viewed from the side. The bill was smaller than a Common Loon's and straight, with no thickenings along its length. The upperside was dark, contrasting sharply with the white throat and underparts. The cap and nape were dark gray and had a smooth edge where they met the white throat. The back was nearly black, darker than the hindneck and crown. The dark crown extended to the eye, while before the eye it was white. The back was unspotted. The white side of the belly was visible below the wing. In flight, the wings were entirely dark above, but I did not see the underwing. When it flew away, I had a half profile, half rear view and saw its structure in flight. Its head was small for a loon, and its feet were smaller than those of a Common Loon.

Less than three hours later I observed a Common Loon in Siskiwit Bay and noted its markedly heavier structure, its blurry upperside/underside border, and its larger head and feet when in flight. This one flew also. Based on this, I can make comparisons on structure and plumage, but not on absolute size, since the Pacific Loon was alone on the water.—*Scott Swengel, 4th Avenue, Baraboo, WI 53913.*

Frigatebird (species unknown)

28 September 1988, Douglas County, at St. Louis Bay, City of Superior.—At about 10:30 A.M., four of us (all employees of

the U.S. Fish and Wildlife Service-Ashland Biological Station), were in an open boat trawling in the bay adjacent to the Whaleback Vessel, Superior, Wisconsin. We had completed a trawl tow and were sorting the catch, throwing back the fish that we did not want. I was piloting the boat at an idle speed while the others were preparing the trawl for another haul and sorting the catch. All of the fish other than river ruffe and white perch were being returned to the lake. I looked behind the boat where some gulls were hovering, trying to catch the fish that were being thrown back. In with the gulls was a large black bird that my first impression led me to believe must be a cormorant. However, as I watched it, I realized it could not be a cormorant, because it hovered 10 to 20 feet above the water watching for fish. When the bird saw a fish, it would swoop down to just above the water and pick the fish out of the water with its bill, swallow the fish without landing in the water, and fly back up to the 10′ to 20′ level to watch for another. The bird was all black, at least as large as an adult cormorant, and had a long deeply forked tail. The bird's bill appeared cormorant-like, but the neck was shorter and thicker and the head appeared larger and was entirely black. The deeply forked tail was as long or longer than the body of the bird. It was a strong and agile flyer with a long wingspan. Its behavior in the air reminded me of a tern.

I asked the others to look at the bird and their first impression was cormorant, but after observing the bird feeding they said it can't be a cormorant because it feeds like a gull. I returned to the office and checked *A Field Guide to the Birds* by Roger Tory Peterson and concluded it had to be a frigatebird.—*Donald Swedberg, 111 East 7th Street, Washburn, WI 54891.*

Eurasian Wigeon (*Anas penelope*)

21 October 1988, Dunn County, on the east end of Lake Tainter in Dunn County.—In the late morning of October 21, 1988, I found an Eurasian Wigeon at the marshy east end of Lake Tainter in Dunn County. It was feeding with about 20 American Wigeons and was similar in size and shape to the drakes of that species, but was strikingly different in color. The first thing I noticed was the deep red head with a creamy-yellow patch from the bill to the crown. The back and sides were silvery-gray and the front and sides of the breast were a pale reddish color. Like the American Wigeon, this bird had large white wing patches, a white flank patch on either side between the gray sides and black undertail coverts, a white belly, and a short, bluish, concave, black-tipped bill. I saw the bird several times in flight, when it was always readily distinguishable from the American Wigeons by its paler underparts.

I watched this bird numerous times between October 21 and November 13; viewing distance varied from about ½ mile from Champney Park to the west, to about 200 feet from private property. The Eurasian Wigeon was always in the company of American Wigeons (down to 6 on November 13). Other birds present included American Coots, Mallards, Gadwalls, Lesser Scaups and Common Mergansers on various dates.—*Janine Polk, 1407 Frederic, Eau Claire, WI 54701.*

Red Phalarope (*Phalaropus fulicaria*)

19 November 1988, Milwaukee County, off the Milwaukee Gun Club in the Mil-

waukee Harbor Area.—Feeding close to shore with the Bonaparte's Gulls, it looked like a ½-sized Bonaparte's Gull. Its head was white, with dark smudge just below and behind eye (remnants of breeding plumage?) leaving wide 3-toned crown stripe (dark outer edges, lighter next inside, and dirty white inner stripe) blending into a narrow black stripe down nape to back. The back was basically solid gray with no noticeable feather edging or stripes, and a few blackish remnant feathers near the shoulder. The wingtips on folded wings contrasted solid dark with gray back. In flight there was a very distinct white inner wing stripe. The rump area was the same gray as the back. The ventral area was seen only on "floating" bird. It was white, with smudgy area below wing/upper flank. The bill was dark, no longer than "straight-line" width of head; thick to tip-more like bill of plover than sandpiper. On November 12, in stormy weather and unfortunately, in waning light, a single "dark-rumped, wing-striped phalarope was seen in with Bonaparte's Gulls close to this spot."—*William Cowart, 4034 North 45th Street, Milwaukee, WI 53216.*

Black-legged Kittiwake (*Rissa tridactyla*)

15 November 1988, Dunn County, Lake Menomin.—On November 15 at about 10:30 A.M. I was scanning from my car at Wakanda Park, on the west side of Lake Menomin, when I noticed a small gull in the middle of the lake (about ¼–⅓ mile away). It was sitting in the water near two Ring-billed Gulls and was somewhat smaller and darker-mantled than that species. It had a white head with a dark ear spot, and there appeared to be a dark bar at the base of its neck. Occasionally it flew around for short periods of time, displaying a broken black "W" on the mantle and a dark band at the end of the tail. After a minute or two, I was persuaded to get out of the car and set up my Questar, despite the drizzle and strong wind. Through the Questar I could see the following: white head with dark ear spot and black, slender, fairly short bill; thick black bar at the nape from shoulder to shoulder; gray mantle (somewhere between Ring-billed and Franklin's Gull in shade); somewhat ragged, shallow V on each wing, formed by black outer primaries and outer primary coverts connected to a diagonal black carpal bar; whitish triangle effect on each wing (created by pale inner primaries, inner primary coverts, and secondaries); underside of body and wings white except for a small amount of black in each wing tip, corresponding to, but less extensive than the black on the upper surface; white tail with a black terminal band-tail appeared slightly forked when folded, rounded when spread.

I watched the gull for several minutes and finally stopped to check a couple of field guides. When I looked up, the Ring-billed Gulls were flying north, apparently flushed by a Bald Eagle, but the kittiwake was nowhere in sight. I searched for it unsuccessfully for several minutes before having to leave.—*Janine Polk, 1407 Frederic, Eau Claire, WI 54701.*

Royal Tern (*Sterna maxima*)

2 August 1988, Milwaukee County, Milwaukee Coast Guard Impoundment.—The single most noticed characteristic which immediately drew attention to this bird was the yellow-orange bill. The bill color was much closer to yellow than any of the juvenile Caspian Terns nearby, which had orange bills. Also, the bill was

more slender than the Caspian Tern's, but the same length, quite obviously in side by side comparison. The other very distinctive head markings were the forehead, cap, and crest. The feathers at the upper base of the bill were white and beyond this narrow band was a region of increasing black speckling on the cap ending fairly abruptly near the peak of the cap with a solid black crest. The crest was longer and more ragged than that of the adult Caspian Terns (this tern was also an adult). The wind would sometimes elevate the Caspian Tern crest feathers, but they still would look shorter and more uniform than the Royal Tern crest, which looked even more ragged and longer when it caught the wind right. I could not locate any adult Caspian Terns which were losing their caps at this time, but I believe they do not usually have much white at the base of the upper mandible and the speckling is more uniform across the top. One other very distinctive field mark was the lack of dusky color on the underside of the primaries, which is so noticeable in adult Caspian Terns. At best there may have been a very narrow dusky band on the trailing edge of the primaries (I only had one look at this). Other field marks were a matter of degree, but are as follows: size (distinctly shorter and slimmer than all Caspian Terns adjacent to it or about the size of Ring-billed Gulls, but far slimmer); white body with pearl gray mantle, like adult Caspian Terns; blackish legs; one brief glimpse of tail seemed to be slightly more forked than Caspian; at rest the wings and tail were almost the same in length; appeared a little more tern-like in flight than the Caspian Terns which are somewhat more gull-like (heavier flight-more labored)—*Dennis K. Gustafson, 15440 Linfield Lane, New Berlin, WI 53151.*

2 August 1988, Milwaukee County, Milwaukee Coast Guard Impoundment.— I happened to stop at the impoundment to see what was there because there had been a good variety of birds present the previous few days. I was scanning a flock of gulls and terns and there it was: a sitting bird in company of adult Caspian Terns, juvenile Caspian Terns, Ring-billed Gulls and Common Terns. The bird was slightly shorter in length than the Caspian Terns, but was longer than the Ring-billed Gulls. The bird was also shorter in height than the Caspian Terns. The bird was of typical tern shape: a long, thin bill, flat head, and long wings. This bird, although near the size of the accompanying Caspian Terns, was much slimmer and less bulky.

The back and wings of the bird were light gray except for the primaries which were a dark gray. The tail was not visible on the sitting bird. The throat, breast, sides and abdomen were a clear white. The legs were black. The head was flat on top with a fairly long wispy crest extending off the back. The forehead and front top of the head were mottled black and white in approximately equal amounts. The back of the head and the wispy crest were solid black. This mottled cap extended to eye level on the bird. Below eye level the head was white. The bill was long, thin, and light orange. The eye was black.

During the length of the observation the bird flew twice and extended its wings a few times. The upper wing was pale gray, except for the outermost primaries, which were dark gray. This dark gray graded into the more proximal primaries. The underwings were whitish, except for the trailing edge of the primaries, which were dark. The wings themselves were long and narrow.

For most of the time of the observa-

tion, the bird stayed still with the bill agape. It often pointed its bill up, about 30 degrees above horizontal. On the occasion it flew, it did so with the company of the entire flock of gulls and terns. It stayed on the outer edge of this flock. A few other times, the flock flew, but this bird remained behind. It seemed a little less skittish than the Caspian Terns. The bird normally ignored the other surrounding birds, but would look up when an adult Caspian Ten would bring a fish to a nearby juvenile. The bird remained silent for the duration of the observation.—*Paul Sunby, 7909 West Lorraine Place, Milwaukee, WI 53222.*

3 August 1988, Milwaukee County, Milwaukee Coast Guard Impoundment.—I learned of the apparent Royal Tern from Mary Donald, and then accompanied her to the area where it had been reported. I found the bird at rest on the south end of the impoundment area, later observed it fly from there to the northwest margin, and again observed the bird at rest at that location. The two most striking features of this bird were the long, relatively slender, and rich yellow or yellowish-orange bill, and the white area extending back from the bill over the head, giving the appearance of a "receding hair line"—a receding black cap. This latter feature accentuated both the flat-headedness of this individual, as compared with nearby Caspian Terns, and the black feathering at the back of its head. The white area back from the bill and over the eye revealed, on close inspection, some black flecking that was not visible at a distance. The black feathering at the back of the head was often raised (in typical Royal Tern fashion), giving a distinctive kingfisher-like profile.

In flight, the Royal Tern's underwing showed very little dark. What was present was confined, so far as I could tell, to the outer primary feathers. This mark contrasted sharply with the much greater amount of dark underwing color on Caspian Terns with which the Royal Tern associated. The Royal Tern flew only once and for a rather short distance. In flight, its tail was not easily visible from where I stood, and I could not observe a clear difference in shape.

At rest, often within inches of adult and juvenile Caspian Terns, the Royal Tern was clearly smaller, with an obviously thinner, more yellowish bill, a flatter head, a black cap that was relatively extended and raised at the back of the head, a more obvious receding white area in front of the cap, and slightly shorter black legs. The neck also seemed thinner and the head less massive and much less rounded than on Caspians. Yet like the Caspian Terns, the Royal Tern was strikingly larger and more bulky than the nearby Forster's Terns. I observed all these features in favorable light, at times, and from as close as 20 yards or so.

Distances during the period of observation ranged from as far as 150 to 200 yards to approximately 20 yards. Depending on the point of observation, the sun created variously poor and excellent visibility. But under all the conditions here, the Royal Tern always appeared distinguishable from neighboring Caspian Terns. Good lighting and close range merely clarified major distinguishing features and points of comparison.—*Roger H. Sundell, N64 W5719 Columbia Road, Cedarburg, WI 53012.*

Mississippi Kite (*Ictinia mississippiensis*)

20 September 1988, Ozaukee County at Condordia College.—This first day of very

strong westerly winds brought interestingly few raptors along the Lake Michigan shore. However, most of these were merlins and peregrines. Another apparent peregrine was coming directly towards me from the north, but had a noticeably different wing stroke. It set its wings and glided directly over me, at about 75–100 feet. It was a rather slow and uncharacteristic glide for a bird which appeared to be an immature peregrine, because of the general shape and the heavily streaked, front to rear, body. Then, I noticed the all dark tail, with 2–3 light bars evenly spaced, which blatantly flared out. At this, my eyes went immediately to the wing-tips, which very nicely showed the "too-short" first primary (thanks to prior study, for a change).—*William Cowart, 4034 North 45th Street, Milwaukee, WI 53216.*

Ferruginous Hawk (*Buteo regalis*)

8 October 1988, Ozaukee County, just south of Harrington Beach State Park.—At about noon on October 8, 1988, Mike Jones, a bander from South Bend, Indiana, arrived at the Cedar Grove Ornithological Station holding what I first took to be a Red-tailed Hawk. After taking a second look, I realized that it was not a red-tail, but rather an immature Ferruginous Hawk.

After John L. Kasper arrived, we weighed, measured, and photographed the bird. Noteworthy among its characteristics were: the large size, the wide yellow gape, the feathers extending well down on the tarsi, the light proximal ⅓ of the tail, and the light colored inner webs of the primaries when viewed from above.—*Daniel D. Berger, 1806 Grevelia Street, South Pasadena, CA 91030.*

Gyrfalcon (*Falco rusticolus*)

4 October 1988, Milwaukee County, in and around the southern part of the Milwaukee Harbor and along Bayview Park Bluff.—At 11:15 A.M. on October 4, 1988, looking east and northeast from Bayview Park, along the lakeshore bluff, near the southern end of the Milwaukee Harbor, I saw a large, dark falcon 500–600 yards from shore. Flying near large gulls, and into the wind, it came very near some of those gulls and harassed them briefly. A minute or two later, it approached the shoreline north of me, turned south, and then flew southward along the bluff until it was within 200–250 feet of my position. It then left the bluff area and flew southeastward acrose the harbor toward the breakwater. Along the way, it again harassed some gulls, and was very close to some adult Herring Gulls, which gave a good size comparison. It was the same length or a bit longer than a Herring Gull, and had a wingspan the same as a Herring Gull, also. I would estimate its body length, including the tail, to be 24–25 inches, and its wingspan to be 55–60 inches. It was very dark brown to nearly black, showing little or no contrast between the flight feather and the underwing coverts. It never came close enough, unfortunately, to see any facial markings. When it flew toward the breakwater, it flew only 3–4 feet above the surface of the water.

The bird landed on the rocks of the breakwater, where it sat for several minutes. When it was there, it perched in the typical "attitude" of a falcon, with its body held approximately 60 degrees above the horizontal. In other words, it did not have the "attitude" of a gull or jaeger. When it soared, which I saw it do several times during the time of ob-

servation, it fanned its tail out somewhat. Otherwise, the characteristic falcon shape was evident when it was in flight: mostly pointed wings and long tail. Its body looked heavier than that of other falcons.

I have seen a fair number of dark, immature tundra Peregrine Falcons over the years, but this bird was larger and heavier and darker than any of those. The blond crown which most immature tundra Peregrine Falcons posses was not present on this bird. I saw the bird from above and below. As is mentioned in various references, the motion of flight of this bird seemed to be noticeable in the "hands," or outer half of the wing, not with the entire wing. This bird was so large and so dark, I am convinced that it was a dark phase Gyrfalcon. The length of time I saw the bird was perhaps 5 minutes total, from when I first saw it, then lost it, then found it again, and finally lost it. After I saw it land on the breakwater, I watched it for less than a minute with binoculars, then went to my car for a telescope and tripod. When I returned, the bird was gone, and although I waited for 20 minutes more, I could not relocate it.—*William Mueller, 1244 South 45th Street, Milwaukee, WI 53213.*

28 October 1988, Ozaukee County, at Condordia College.—I was standing near the south end of the Concordia College campus, close to the lakebluff edge, and watching migrating hawks, when I saw a large, sleek, dark raptor approaching, flying parallel to the lakeshore and inland perhaps thirty feet, and low—eight to ten feet above the field to the north. The bird moved steadily and rapidly towards me, never swerved off its southward course, passed within twenty feet of me, and then disappeared as it continued south. The flight was swift and straight and wonderfully forceful, though the bird did not flap its wings rapidly—in fact, the wingbeat seemed oddly slow for so swift a flier. Because this raptor was very large-bodied, powerful in flight, falcon-like in shape (though heavy), and lacking in any obvious distinctive markings other than heavily-streaked underparts, I guessed immediately that I was watching my first Wisconsin Gyrfalcon, and only the second in my life.

As the bird neared, then passed me closely, I noted the following points: it was almost as big, or perhaps as big as a Red-tailed Hawk; its wings were broad-based, but narrowed sharply toward the tips; its tail was long and also narrowed somewhat towards the tip; it was big-chested and thus appeared somewhat front-heavy (like some Merlins), but still sleek in shape.

In plumage, the Gyrfalcon was primarily very dark brown, uniformly dark brown on the back, tail, and upper portion of the head. At the nearest point of its approach (twenty feet or less), it showed no pattern or color variation on the back or tail. Its sleek head was dark brown on top, with a slightly lighter shade of brown washing the facial area. It revealed no eyeline as in a young Goshawk, or hooded pattern as in a Peregrine Falcon. (I was near enough and in good enough light to have seen such marks had they been present, and I was of course, looking for them.) The underparts were light, but very heavily and continuously streaked with dark brown also. I did not observe any underwing pattern, though the bird was low enough to make such a pattern difficult or impossible to see.

The falcon-like shape of this raptor, its large size, swift and deceptively powerful flight, uniformly dark brown col-

oration, heavily-streaked underparts, and the absence of eyeline, other facial pattern, or tail bands all indicated that this was in fact a dark-phase gyrfalcon.—*Roger H. Sundell, N64 W5719 Columbia Road, Cedarburg, WI 53012.*

Northern Cardinal (*Cardinalis cardinalis*)

17 March 1989, Juneau County, Union Center.—Snowfall had begun before dawn and continued through the morning accumulating over four inches. Birds were active at my feeder, including juncos, goldfinches, chickadees, nuthatches, and cardinals (the only regular visitors to my feeders this winter). At 11 A.M. (temperature 16°F, snowing heavily), I observed a female Northern Cardinal in the snow near an arbor vitae hedge. She was picking at and tossing what first appeared to be a leaf. Binoculars revealed the object to be a dead Black-capped Chickadee. I do not know how long the cardinal had been picking at the dead bird prior to my first observation, nor do I know the origin of the dead bird. From 11 A.M. until 11:12 A.M. the female cardinal fed on the dead chickadee for 12 minutes without interruption, pulling pieces of flesh and feathers from the underbelly. She sat in the snow chewing with the feathers falling away as the flesh was consumed. At 11:12 A.M. a male cardinal emerged from the arbor vitae and sat on a branch about two feet away watching the female. At 11:13 A.M. the female flew away and the male immediately dropped down to the dead bird and began feeding. At 11:15 A.M. a loud clap of thunder startled him, and he picked the body up in his beak and flew two feet to the hedge where he resumed uninterrupted feeding for 13 minutes until 11:28 A.M., at which time he flew away. At 11:31 A.M. the female returned and fed on the body without interruption for 17 minutes until 11:48 A.M., at which time the male returned, aggressively chased the female away, picked up the body and flew sixteen feet with it in his beak. He landed in deep, soft snow on an open lawn area. He dropped the body and attempted to pick at it, but the body sank down into the snow. The male flew to a nearby lilac, cleaned his beak and left the scene. I then went outside to examine the body and confirmed it to be the remains of a chickadee. The head was entirely missing. Approximately half of the viscera was missing. In addition to my surprise at witnessing this incident, I found it unusual that these generally flighty birds would feed for such long, uninterrupted intervals. If anyone has observed similar feeding activity or can provide related references in the literature, I would appreciate a response.—*Robert K. Searles, Rt. 2, Box 171A-1, Wonewoc, WI 53968.*

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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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