Black-throated Blue Warbler *by Dennis Malueg*

New Distributional Records for Summer Birds in Southern Wisconsin Conifer Swamps

"Our long cherished tamarack swamp . . . had been bereft of its trees, its ericaceous under shrubs, and its delightful orchids," drained and planted with market-garden vegetables—Thure Kumlien, Jefferson Co. (Greene 1888, in Schorger 1946)

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Conifer swamps, still a familiar part of the landscape in northern Wisconsin, were also common in many southern counties when Yankee and European settlers arrived in the state in the mid 1800s. In seven southeastern counties, for example, presettlement conifer swamps occupied about 26 thousand ha (nearly 100 sq mi) in the land surveys of 1835–36, almost twice the area of hardwood swamps and 22% of all of the region's original wetlands (SEWRPC 1997:Table 31).

Many of these southern conifer swamps have since been destroyed or degraded—as in Kumlien's long-ago lament—by a combination of human and biotic impacts including cutting, drainage, agricultural conversion, insect outbreaks, and invasive non-native plants (Rhodes 1933; Catenhusen 1950; Curtis 1959; Luebke 1976; Dunn 1985; Reinhartz and Kline 1988). In Waukesha Co., for instance, the 5500 ha of conifer swamp in 1836 (SEWRPC 1997) had dwindled to 1600 ha in 1934 (Bordner et al. 1936) and perhaps as little as 250 ha in the 1980s (pers. obs.).

Botanists have had a long-standing

interest in remnant southern swamps, partly because these supposed "relicts" of boreal conifer forest (Curtis 1959:254) are apt to contain locally rare plants of northern affinities. Historical records also suggest that some boreal birds such as the Nashville Warbler may have nested in southern conifer swamps in the 1800s (Kumlien and Hollister 1903; Atwood 1948), yet ornithological studies have lagged behind botanical work in recent years. Except for counts in Ozaukee and Kewaunee Cos. (Weise 1973; SAPC 1974; Idzikowski 1982; Fowler and Howe 1987) and local or qualitative data elsewhere (Jackson 1914; Rudy 1967; Mossman 1980; Jaeger 1981), there is little modern information on the breeding birds of Wisconsin's conifer swamps.

During 1983–93, we conducted summer bird counts in 168 stands of conifer swamp throughout Wisconsin, including 125 stands in the southern half of the state (Fig. 1). As reported

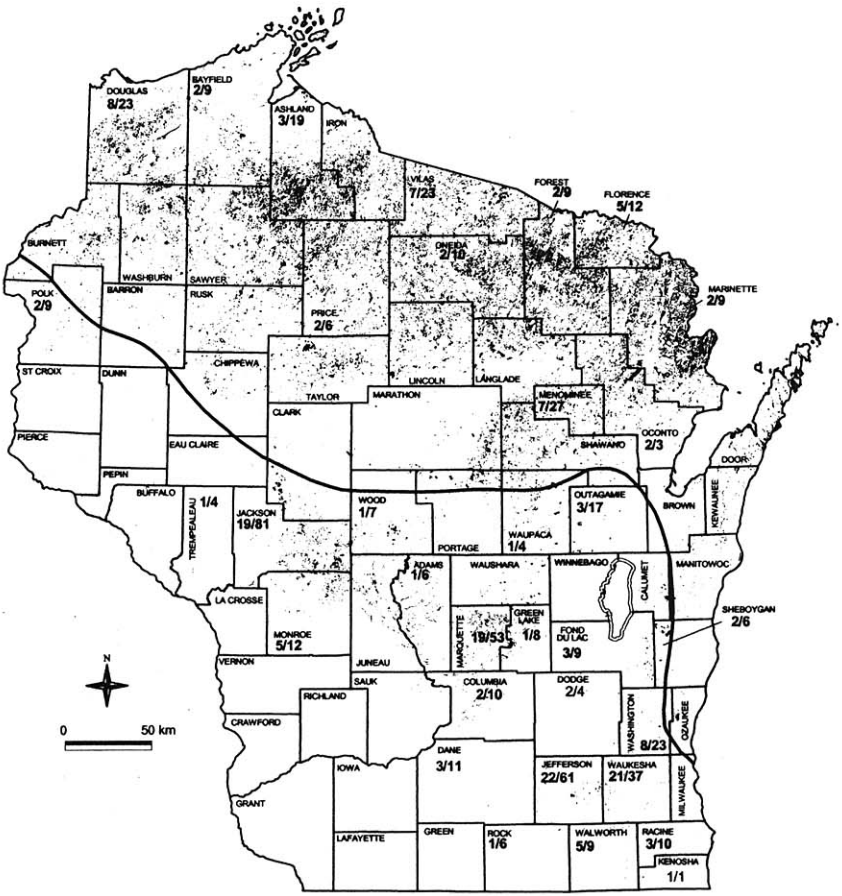

Figure 1. Number study stands (n=168)/number counting stations (n=538) in Wisconsin conifer swamps, by county, 1983–93. Stippling shows state conifer swamps ≥ 2 ha in size. Heavy line delimits southern Wisconsin at upper boundary of vegetational tension zone (see text).

here, we detected 20 species—many of them widespread or locally numerous—beyond the southern limits of their previously recognized summer ranges. Most of these new distributional records in southern Wisconsin conifer swamps thus seem to represent real revisions of known summer ranges, not casual out-of-range appearances. These new distributional data from a little-studied habitat type will complement the forthcoming results of the Wisconsin breeding bird atlas, and will also serve as a baseline for ongoing avian inventory efforts in statewide conifer swamps.

Study Sites and Methods

Conifer swamps were defined as wetlands in which tamarack (*Larix laricina*), black spruce (*Picea mariana*), and/or northern white cedar (*Thuja occidentalis*), plus other conifers, provided ≥ 5% absolute cover and ≥ 25% relative cover (vs. hardwoods) in tree and/or sapling layers over an area ≥ 2 ha. Additional conifers in some swamps in central or northern Wisconsin included white (*Pinus strobus*), red (*P. resinosa*), or jack (*P. banksiana*) pines, balsam fir (*Abies balsamea*), eastern hemlock (*Tsuga canadensis*), and/or white spruce (*P. glauca*). Jack pine was co-dominant with tamarack or black spruce in three study swamps, but these additional species were otherwise a minor component of conifer cover in study stands.

Although narrowly phrased in terms of the presence and prominence of tamarack, spruce, or cedar, this definition nevertheless encompassed much variety in vegetational composition and habitat structure. It included, for example, densely forested coniferous wetlands, mixed hardwood-conifer swamps, sparsely canopied stands allied to heath-like open bogs, and shrub swamps with scattered conifers. Our definition also admitted the effects of past and present disturbances such as drainage or grazing because we were interested in conifer swamps as extant bird habitats rather than homogenous or undisturbed plant communities.

However, despite transitional stands and some local exceptions, most study sites were congruent in aspect and composition with the three vegetational and geographic categories proposed by Clausen (1957), Curtis (1959), and Eggers and Reed (1987):

- **Conifer-ericad** swamps in black spruce-tamarack or tamarack bogs with low-growing understories of heath-like ericads—e.g., huckleberry (*Gaylussacia baccata*)—on saturated acidic peats in most of the northern half of the state and occasionally in the south, especially in Jackson Co.
- **White cedar** or **cedar-hardwood** swamps—e.g., yellow birch (*Betula lutea*) and black ash (*Fraxinus nigra*)—on somewhat drier, less acidic, and more fertile soils along the northern and eastern rims of the state, south to Washington and Ozaukee Counties.
- **Tamarack** and **tamarack-hardwood** swamps with tall shrub-sapling layers—e.g., American elm (*Ulmus americana*), green ash (*F. pennsylvanica*), red maple (*Acer rubrum*), red-osier dogwood (*Cornus stolonifera* of most references, now reduced to the synonymy of *Cornus sericea*), winterberry (*Ilex verticillata*)—but few or

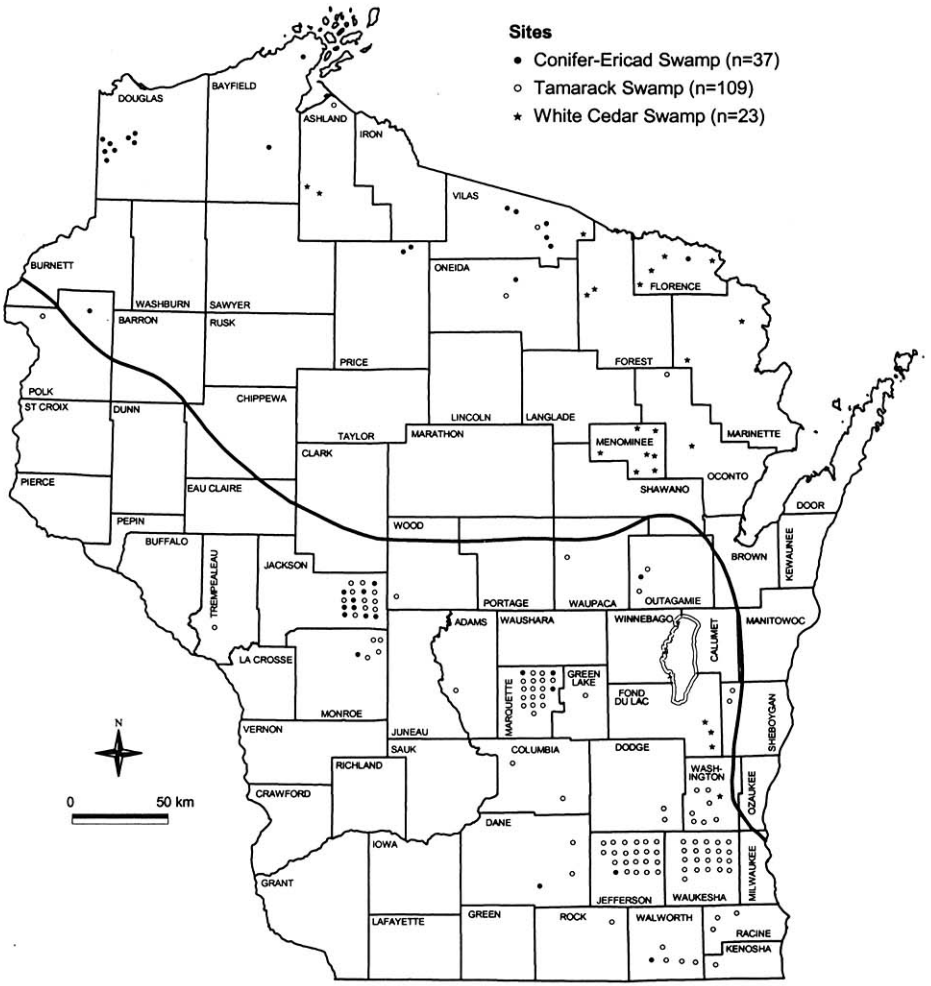

Figure 2. Distribution and vegetational category of study stands (n=168) in Wisconsin conifer swamps, 1983–93. Heavy line delimits southern Wisconsin.

no ericads on peats or mucks in the southeastern quarter of the state.

Figure 1 shows the distribution of Wisconsin conifer swamps ≥ 2 ha in size (WDNR 1998). Figure 2 arrays study stands in the three vegetational categories used here, and also gives a geographic picture of the regional availability of those three types as bird habitat.

We located study stands via reconnaissance, personal contacts, and historical or current land use, topographic, and wetlands maps. Although not random, the resulting sample is believed to incorporate a full spectrum of stand sizes, vegetational attributes, and other habitat features, especially in southeastern counties where most existing stands were surveyed.

We made single-visit, unlimited radius, six-minute point counts at one or more counting stations per study stand, depending on stand size (see below), between 0400 and 0900 CST on dates between 1 June and 7 July in 1983–93. Most statewide fieldwork and all but one count in southern swamps were conducted in 1983-86.

Station counts excluded birds flying above canopy level and birds beyond the edge of a stand in habitats other than conifer swamp. In each study swamp, we also listed additional bird species and additional individuals of selected species detected before, after, or between station counts. Figure 1 maps the number of study stands and stations per county. Conifer swamps are virtually absent in southwestern Wisconsin (Fig. 1), and we chose not to repeat the work of Weise (1973), Fowler and Howe (1987), and others in east-central counties. With these exceptions, our surveys were statewide.

Figures 1 and 2 also split the state into northern and southern halves along a dividing line that follows the northern edge of the "tension zone" (Curtis 1959), a midstate vegetational transition between southern floristic elements vs. northern elements such as white pine (Zimmerman 1991) and black spruce. In general—with the principal exception of southern conifer swamps—this line separates the pre-settlement prairies and hardwood forests of southern counties from the conifer-hardwood forests of northern Wisconsin (Curtis 1959). Other analysts of avian distribution have used a similar north-south division in view of the observed and potential correlations among floristics, avian habitats, and bird species' breeding ranges within Wisconsin (Beimborn 1970; Temple and Cary 1987; Robbins 1991).

For distributional purposes, we combine station counts and between-station lists, and report *stand presence* and total count of bird species in conifer swamps outside a species' previously recognized summer range. "Previously recognized" or "known" summer ranges are defined as the shaded summer ranges in Wisconsin in Robbins' (1991) maps, which we interpret as depicting the areas where a species is annually present in summer and presumably breeding in suitable habitats.

Stand presence is appropriate for displaying our distributional results because sampling effort (i.e., detection effort) was proportional to stand size. We established one bird counting station per 4 ha, up to a maximum of 12 stations in conifer swamps $\leq$ 50 ha in size. Only 16 of 125 study swamps in southern Wisconsin, mostly (7) in Jackson Co., exceeded 50 ha in size, so under-sampling and diminished detection probabilities were rarely a problem in southern swamps. Bird counting stations were objectively positioned 200-300 m apart along pre-determined transects through the interior of study stands, $\geq$ 60 m from stand's edge. Between-station effort as well as station counting was accordingly proportional to stand size. The probability of detecting a given species in stands of differing size thus depended on its absolute numbers within a stand (or set of stands) and not only its density in numbers per unit area. In other words, our chance of detecting a species was approximately equal in all stands (or sets of stands) where its absolute population sizes were similar.

Results

Surveys of summer birds in 168 Wisconsin conifer swamps in 33 of the state's 72 counties, including 125 swamps in 21 southern counties (Fig. 1), recorded 20 species outside known summer range, all south rather than north of previously identified range, as follows:

Sharp-shinned Hawk—We found one nest in a tamarack swamp in Waukesha Co. in 1983, another nest in a tamarack-pine swamp in Monroe Co. in 1985, and five other birds beyond known summer range in Jackson (2 stands), Marquette, Fond du Lac, and Jefferson Cos. in 1983–86. Trexel et al. (1999) reported that swamp conifers provided 38% of nest trees at 24 Wisconsin breeding sites discovered by unbiased methods, but this hawk is often inconspicuous in summer beyond the immediate vicinity of nests (Rosenfield et al. 1991). Our tally of seven observations in one or more of six counties in each of four years may thus suggest that it nests regularly in southern conifer swamps, as it also does in some upland conifer plantations in southeastern counties (Bielefeldt and Rosenfield 1994).

Broad-winged Hawk—Although hardwood-dominated forests are described as typical nesting habitat in recognized breeding range in northern Wisconsin (Robbins 1991) and elsewhere (Goodrich et al. 1996), a 1985 nest in tamarack in Fond du Lac Co. and a 1986 adult in a tamarack stand in Sheboygan Co. may be unexceptional in terms of habitat use and revised summer range in the state. Broad-wings do occur (Jaeger 1981; Fowler and Howe 1987; pers. obs.) and nest (Rosenfield 1984) in conifer swamps in known breeding range in northern counties. Recent nesting beyond previously acknowledged range has also been noted in upland conifer plantations or hardwood forests in Waukesha (Bielefeldt and Rosenfield 1994), Ozaukee (R. N. Rosenfield pers. comm.), and probably Jefferson and Walworth Cos. (pers. obs.).

Olive-sided Flycatcher—Single birds were recorded 50–200 km south of known summer range in Jefferson Co. 11 June 1984, Washington Co. 5 June 1984, and Outagamie Co. 13 June 1986, the last at least presumably resident in a swamp where Lincoln's Sparrow (see below) was also numerous. These and other June–July reports in southern conifer swamps in Waukesha (Bielefeldt 1977) and Ozaukee Cos. (Idzikowski 1982) could involve late migrants or non-breeding individuals, but occurrences in such characteristic summer habitat (Dawson 1979; Robbins 1991) suggest that a few might occasionally nest in southern swamps.

Yellow-bellied Flycatcher—In southeastern Jackson Co., counts at 81 stations in 19 stands yielded single midsummer birds at 5 stations, 23 June 1985 and 2–3 July 1986, about 125 km south of known range. It was locally frequent (5 of 12 stations) in the two spruce-tamarack-ericad stands where detected, in habitats co-occupied by Yellow-rumped Warblers at two stations.

Our survey's 29 statewide observations of this flycatcher, all prompted by song (12) or call notes (17), indicate that aural detectability is nil beyond 50–60 m and falls off quickly past 30–40 m, especially for calling rather than singing birds. (By comparison, most passerines are vocally de-

tectable at distances ≥ 100 m.) Its lesser audibility vs. other bird species thus limited the chance of detecting Yellow-bellies in the larger survey swamps (n=7) of Jackson Co., where we did not achieve area-proportional coverage of potential habitats. We speculate that the local summer population may be greater than our five records would indicate.

Another bird in Marquette Co. on 6 June 1984 should not necessarily be set aside as a late migrant: it did occupy the only site with a black spruce component among the eight counting stations in this tamarack swamp, where a bird was again detected near the same spot in a re-survey on 9 June 2001 (MM).

Alder Flycatcher—We tallied 84 Alders in 10 counties at 33 of the 87 study stands lying south of Robbins' (1991) contiguous midstate range limits, while recording only 14 Willow Flycatchers in 8 of these same 87 stands, all within the Willow's recognized range. We cannot preclude the possibility of late migrants among the 62 Alders at 24 (55%) of 44 southern swamps visited 1–10 June, vs. 22 Alders at 9 (21%) of 43 southern stands surveyed ≥ 11 June (Fig. 3).

For two reasons, we nonetheless propose that most Alders in our southern survey swamps were summer residents rather than belated migrants: (1) The Willow Flycatcher, a sibling species of similar wetland habitats at the upper edge of its breeding range in southern Wisconsin—hence probably resident—showed a comparable drop in song-linked detection rates (16% vs. 5%) in early June vs. later visits to southern swamps. Declining incidence of song after territorial establishment (Ettinger and King 1980) instead of migrant departures may be responsible for lower detection and identification rates in both species in mid June-early July. (2) Midsummer residency of Alders in some supposedly disjunct areas in southern Wisconsin (Fig. 3) is well-documented (Robbins 1991; pers. obs.), and multiple singers ($\bar{x}$=2.6 per occupied stand) rather than isolated individuals were detected at many southern swamps surveyed 1–10 June. It seems unlikely that late-migrant Alders were so widely present, in song, in such numbers, in seemingly suitable breeding habitat in early June over three consecutive years (1983–85) in a region otherwise known to be locally occupied by summer residents.

Summer range of the Alder Flycatcher in the state's southeastern counties probably exceeds and connects the disjunct pockets mapped by Robbins (1991). Some Alders may nest in tall shrub-tamarack swamps ≤ 10 km from the Illinois border (e.g., 7 birds in Walworth Co. 5 June 1984). Assuming summer residency and similar rates of detectability by song, we calculate that Alders outnumber Willows about 5 or 6 to 1 in southeastern tamarack-shrub swamps.

Habitat aspect and Alder Flycatcher distribution in southeastern tamarack-tall shrub swamps (Fig. 3) thus seem to parallel regional patterns for other newly-detected summer residents such as Northern Waterthrush (Fig. 4) and Canada Warbler (Fig. 6). Unlike those two species, however, Alders were also detected in Jackson and Monroe Cos. (within known range) in conifer-ericad swamps with minor amounts of tall shrubs such as alder (*Alnus rugosa*).

Red-breasted Nuthatch—Robbins

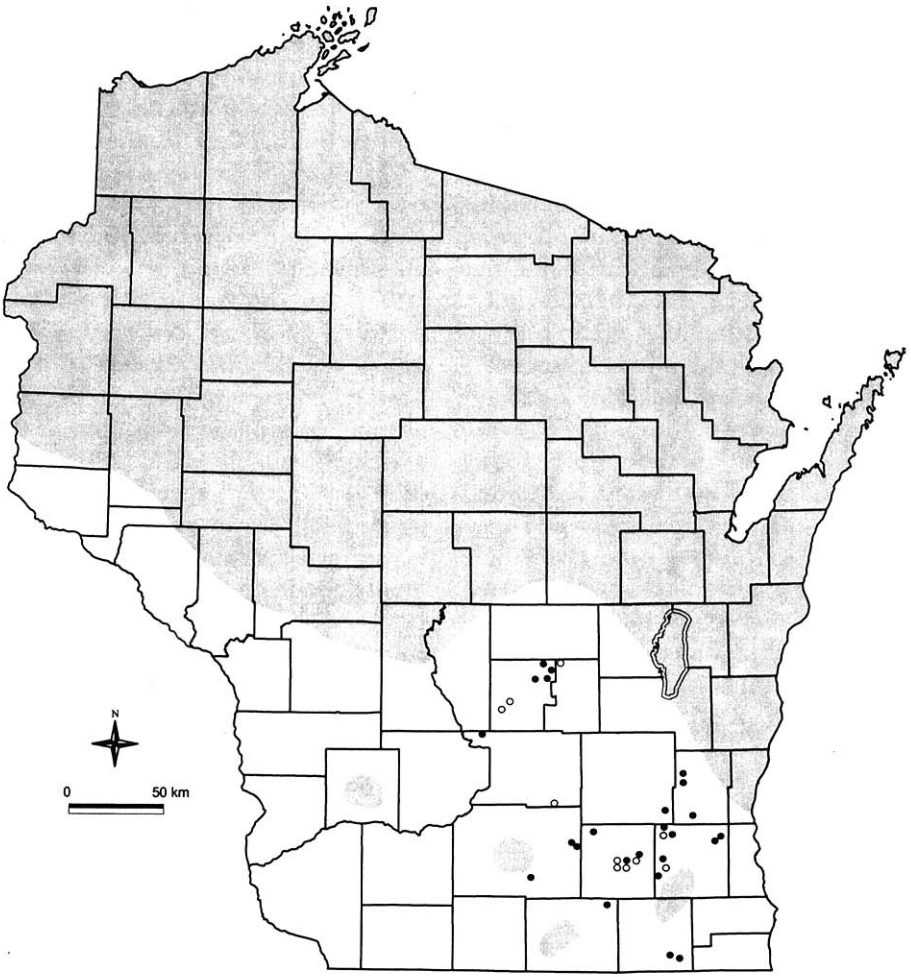

Figure 3. Detections of Alder Flycatcher beyond previously recognized summer range (shaded) in southern Wisconsin conifer swamps, 1983–93. Closed circles = 1–10 June, open circles = 11 June –7 July.

(1991) suggested that this nuthatch may be a rare summer resident in some west-central counties but did not map these areas as part of the usual summer range. In late June–early July, 1985–86, we detected single birds in three tamarack or tamarack-spruce stands, each with small amounts of white pine, in Jackson and Monroe Cos.

Brown Creeper—We found individuals outside known range in 3 tamarack or cedar swamps in Waupaca, Fond du Lac, and Jefferson Cos. in 1983–85. Creepers do occur in both hardwood and conifer swamps within recognized range in northern and eastern counties (Weise 1973; Robbins 1991; pers. obs.), and also in bottomland hardwood forests along the Mis-

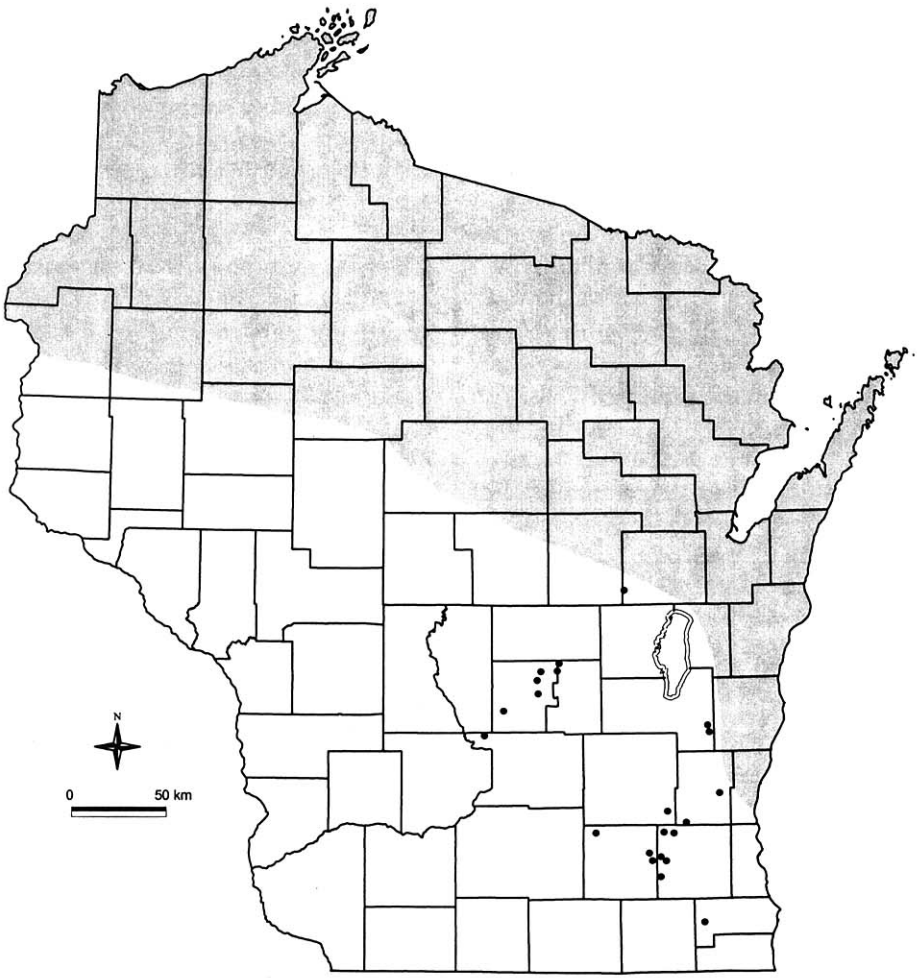

Figure 4. Detections of Northern Waterthrush beyond previously recognized summer range (shaded) in southern Wisconsin conifer swamps, 1983–93.

sissippi and Wisconsin Rivers in some southwestern counties (DeJong 1976; Mossman and Lange 1982; Robbins 1991). Not cited or mapped among other southern records in Robbins (1991) are additional summer birds in hardwood swamps in Columbia, Jefferson, and Fond du Lac Cos. \in 1974 (De Jong 1976 and pers. comm.), Waushara Co. in 1984 (Mossman et al. 1984), and Waukesha Co. in 1976–77 (Bielefeldt 1977; L. Safir pers. comm.). Taken together, these various southern reports suggest that creepers may be local summer residents in lowland forests in most of the lower half of the state.

Winter Wren—Single detections, both in cedar-tamarack habitat, were slightly outside known range in south-

western Outagamie Co. (1 June 1986) and south-central Washington Co. (4 June 1992).

Golden-winged Warbler—Only marginally beyond the southern summer limits shown in Robbins (1991) were 6 individuals in 4 tamarack swamps in Green Lake and northeastern Marquette Cos. Except for these birds and 3 others *within* known range in Washington, Adams, and Monroe Cos., Golden-wings were undetected in our surveys of conifer swamps (n=125) in the southern half of Wisconsin. However, we saw Blue-winged Warblers or heard Blue-winged song types in 23 of these southern swamps, north to Trempeleau, Monroe, Adams, Marquette, and Sheboygan Cos., all within areas where prior summer reports have been frequent (Robbins 1991). We saw one hybrid in "Brewster's" plumage in a tamarack- alder swamp in Waukesha Co. in 1985.

Nashville Warbler—Marquette Co. straddles the south-central boundary of the Wisconsin summer range mapped by Robbins (1991). Here we detected Nashvilles in 10 of 19 study stands, mainly (69 of 89 individuals and 3 nests) in three tamarack or spruce-tamarack swamps with low understories of huckleberry or bog birch (*Betula pumila*), as in the conifer-ericad swamps where this bird is common within recognized range in northern and west-central counties (e.g., Jackson). However, one nest and 20 birds elsewhere in Marquette Co. (within known range) occurred in tall shrub-tamarack stands similar in aspect to southeastern swamps occupied by Northern Waterthrush.

Elsewhere in such tall shrub-tamarack habitats, we detected 14 Nashvilles, 10–60 km past known range, in 6 swamps in Green Lake, Columbia, Dane, Jefferson, Waukesha, and western Sheboygan Cos. Also outside known range were 28 birds in a conifer-ericad swamp in Outagamie Co. (1986) and 5 birds in a cedar-tamarack swamp in Washington Co. (1992).

Yellow-rumped Warbler—Detected beyond known range only in Jackson Co., about 100 km south of Robbins' (1991) summer limits, but here we recorded 22 adults and one fledgling in 7 of 19 study stands, 22 June–3 July 1985–86. Habitat at occupied stations (n=21) was dominated by stunted tamarack ≤ 6 m in height, with small to equal proportions of black spruce for a combined canopy cover estimated at 30–60%. Tall shrubs and hardwood saplings were usually sparse (n=7) or absent (n=14) within ericaceous understories ≤ 1 m in height, as were dead trees and windthrown tip-overs. These stands resemble the conifer-ericad swamps of northern Wisconsin and differ in many compositional and structural respects from the tall shrub-tamarack swamps of southeastern counties.

Black-throated Green Warbler—With a single curious exception, all detections inside recognized summer limits in the northern third of the state (Robbins 1991) plus one bird outside known range in Washington Co. (4 June 1992) occurred in white cedar or cedar-hardwood swamps with tall (14–18 m) well-developed canopies (median closure 85%). Where listed in such stands (n=6) in known range, this warbler was common (12 of 33 stations). Habitat use thus agrees with Dawson's (1979) review of 30 breeding bird censuses in U.S. and Canadian conifer swamps: it

was recorded only in census plots dominated or co-dominated by white cedar.

We did not detect this species in counts at 144 tamarack or spruce-tamarack stands, in or out of known range, even in areas where nearby summer residents were meanwhile present in upland conifer forests in northern Wisconsin (Robbins 1991), Waukesha Co. (Bielefeldt and Rosenfield 1994), or Monroe and Jackson Cos. (pers. obs.). The exception was one bird on 7 June 1985 in a pure tamarack stand at Lima Bog, Rock Co., about 225 km south of Robbins' recognized range.

This bird in seemingly atypical habitat might be dismissed as an aberration or vagrant had not T. Ellis reported four Black-throated Greens at Lima Bog on 25 June 1972 (SAPC 1974; Robbins 1991). Moreover, Kumlien and Hollister (1903) also mentioned summer records for Rock Co. They did not specify a locale but Kumlien was familiar with this swamp (Jackson 1961:110) and collected other birds at Lima Bog (Atwood 1948), which was and is the only major conifer swamp in a county that historically lacked other coniferous habitats (Peet 1971). If the surmise that Kumlien found this warbler at Lima Bog in the late 1800s were accepted, it is perhaps equally difficult to believe that a small population has persisted for a century—or re-colonized at least once—in an atypical habitat patch in an isolated 40 ha tamarack stand far past the present margin of its summer range in other Wisconsin conifer swamps.

Black-and-white Warbler—Birds were detected in southeastern counties in each of the 1983–86 years, slightly past known range in Marquette (13 individuals in 6 stands) and southern Washington Cos. (1 bird), or farther beyond in Waukesha Co. (4 individuals in 3 stands). Occupied stations in these counties included single conifer-ericad, cedar-hardwood, and hardwood-tamarack swamps, but it was more often co-detected with the Northern Waterthrush in tall shrub-tamarack habitat that characterized 7 of 10 stands and 7 of 15 stations where recorded, including all of 3 stations in Waukesha Co.

This warbler has also been found beyond recognized summer range in lowland hardwood forests in Columbia, Green, Grant, and Buffalo Cos. (DeJong 1976 and pers. comm.), Waushara Co. (Mossman et al. 1984), and Waukesha Co. (pers. obs.). Breeding season distribution and habitat use in lowland forests seem similar to those of the Brown Creeper.

Northern Waterthrush—We found this bird beyond known range in unexpected numbers, with 62 individuals in 24 stands in 10 southeastern counties (Fig. 4), where detected in 26% of 92 survey swamps and each of the 1983–86 years. Habitat at occupied stations was variable in total tree canopy cover (10–90%) and hardwood cover (co-dominant to absent), but absolute cover of tall shrubs (2–4 m) was ≥ 50% at 30 of 39 stations. As in most southeastern swamps, tall tamarack (11–18 m) was the sole conifer in 21 of 24 occupied stands. Other features of these tall shrub-tamarack stands also contrast with conifer-ericad swamps: abundant dead trees and windblown tip-overs (often ≥ 20–40 per ha), an uneven substrate of drier hummocks and wet or muddy pools with common wetland herbs—

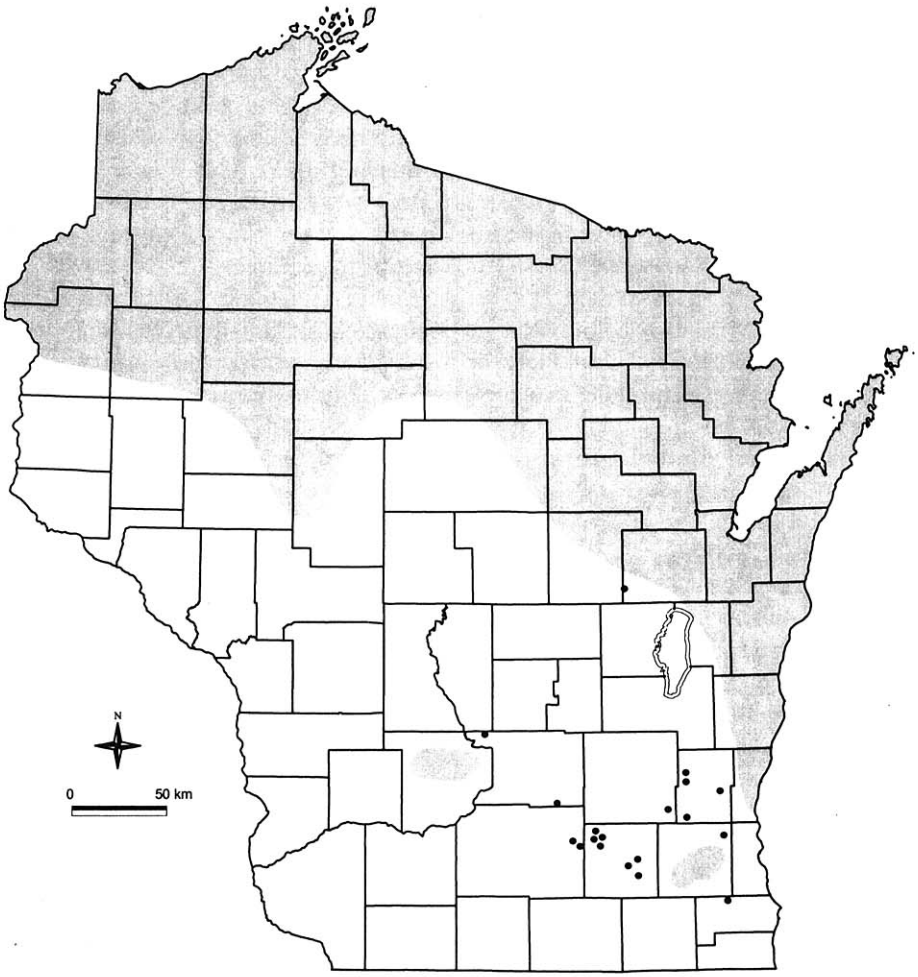

Figure 5. Detections of Mourning Warbler beyond previously recognized summer range (shaded) in southern Wisconsin conifer swamps, 1983–93.

e.g., jewelweed (*Impatiens biflora* of older references, now *Impatiens capensis*), marsh marigold (*Caltha palustris*), cattail (*Typha* spp.)—but few or no ericads, and often a prominent non-native element such as glossy buckthorn (*Rhamnus frangula*) and deadly nightshade (*Solanum dulcamara*).

Mourning Warbler—Robbins (1991) mapped almost identical summer limits to known Wisconsin ranges in this warbler and the Northern Waterthrush. Detections of 28 Mourning Warblers beyond recognized range in 20 conifer swamps in 7 southeastern counties—annually 1983–86 in Columbia, Dane, Dodge, Jefferson, Washington, Waukesha, and/or Racine Cos. (Fig. 5)—were also geographically congruent with out-of-range records for the waterthrush. Most birds of both species occurred in

tall shrub-tamarack swamps but Mournings were usually found at stand edges where scattered conifers (5–10% canopy cover) gave way to shrub-hardwood swamp. These two species were co-detected in only 6 (16%) of the 38 southeastern stands where one or the other was recorded (compare Canada Warbler). Unlike the waterthrush, Mournings are also widely present in summer in non-coniferous and/or upland habitats in southeastern Wisconsin—hardwood swamps in Columbia, Waushara, Fond du Lac, Dodge, Waukesha, Racine, and Jefferson Cos. (DeJong 1976 and pers. comm.; Mossman et al. 1984; pers. obs.) as well as upland thickets that follow clearcuts or heavy thinnings in oak forests and pine plantations in Walworth, Jefferson, and Waukesha Cos. (Bielefeldt and Rosenfield 1994; pers. obs.). Islands of southern summer range in Robbins (1991) should probably be consolidated in a distribution that includes most of the southeastern quarter of the state.

Canada Warbler—All detections of 41 individuals beyond known summer range came from 10 southeastern counties (Fig. 6), where it was recorded in 18 of 95 study stands, with annual regional observations in 1983–86. Nearly half (18) of these birds were found in 4 stands of tamarack-cedar or tamarack-spruce in Washington, Fond du Lac, Marquette, and southwestern Outagamie Cos., the remainder in 14 stands of tall shrub-tamarack as far south as Waukesha and Jefferson Cos. In the latter habitat, vegetational attributes at occupied stations were similar to those described for the Northern Waterthrush, as co-detected in 12 (38%) of 32 stands where one or both species were noted (vs. 3 [9%] of 34 stands for Canada vs. Mourning Warblers).

Dark-eyed Junco—Three adults outside known summer range were visually confirmed at a single station in Menominee Co. on 15 June 1991. Relatively small cedars (10–15 cm in diameter, 9 m in height) with lesser amounts of tamarack, black spruce, and balsam fir contributed a joint canopy cover of 80%.

Purple Finch—Single birds were listed at 6 stations in 5 stands in Jackson Co. in late June–early July 1985–86, about 50 km south of recognized range, in habitat where co-detected with Yellow-rumped Warbler in all stands and 3 stations.

Lincoln's Sparrow—Single birds were detected in 4 tamarack-spruce-ericad swamps in southeastern Jackson Co., 23 June 1985 and 29 June–2 July 1986, where habitat at occupied stations was similar to that of the Yellow-rumped Warbler except for a somewhat lesser canopy cover (30–40%) on average. We did not find both species at the same station. We also discovered a nest with 4 eggs (1 June) plus 10 other individuals (1–13 June) in 1986 near New London, Outagamie Co., in ericaceous muskeg with a scant cover (median 5%) of small tamarack and a few black spruce. These two sites are 60–140 km south of prior summer range in Wisconsin (Robbins 1991). [Nesting was proven (MM) in re-surveys of Jackson Co. swamps in 2001.]

White-throated Sparrow—In conifer swamps, at least, Robbins' (1991) map of the southern boundary of summer range seems to be remarkably accurate in portraying a very abrupt change in presence and abundance.

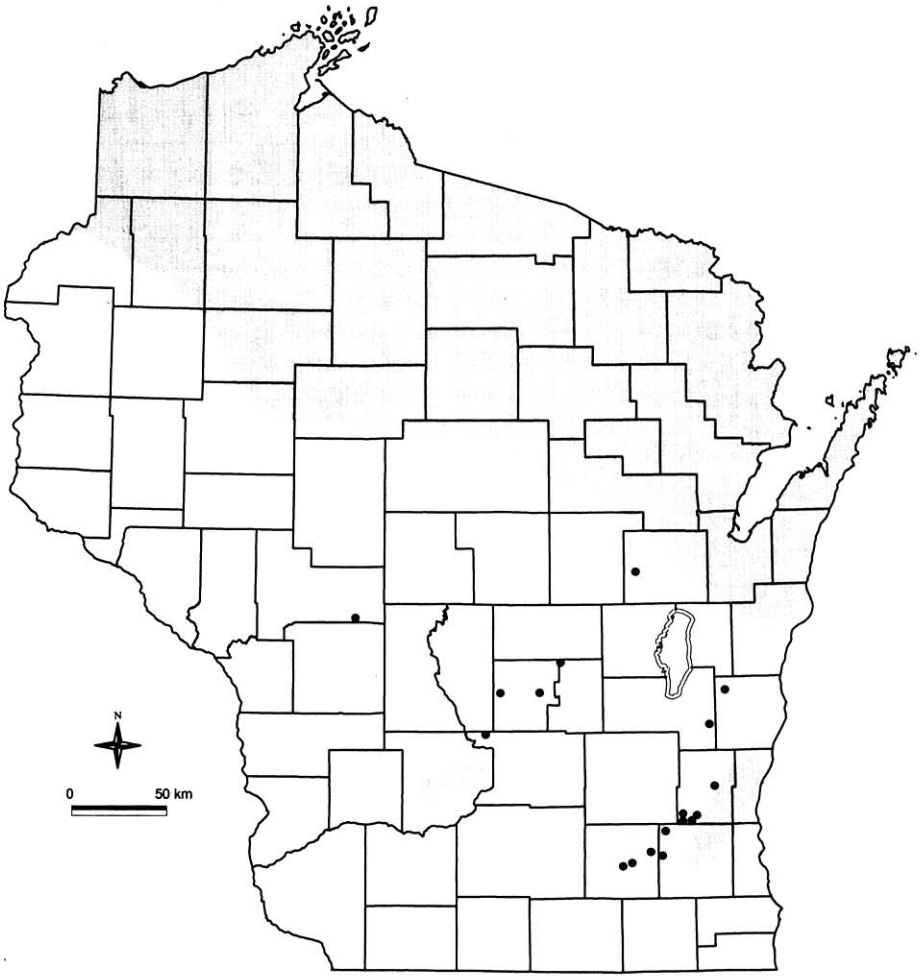

Figure 6. Detections of Canada Warbler beyond previously recognized summer range (shaded) in southern Wisconsin conifer swamps, 1983–86.

For example, we tallied 122 birds in 11 of 19 study stands at the margin of known range in southeastern Jackson Co., but none in 5 swamps only 7–20 km farther south (past known range) in Monroe Co. Similar contrasts on opposite sides of recognized range limits were noted in southwestern Outagamie Co. (34 birds in one stand at the edge of known range) and in eastern Fond du Lac Co.

An admixture of spruce, cedar, and/or pine may be essential to the White-throat's regular summer presence in conifer swamps. We did not find it in southeastern tamarack swamps, including a Columbia Co. stand where previously recorded by K. Lange (1980) and Mossman and Lange (1982). Our only detections outside known range were 14 birds in a cedar-tamarack swamp in south-cen-

tral Washington Co. on 16 June 1984 (with 8 also listed there on 4 June 1992), and one in tamarack with small amounts of black spruce in Marquette Co. on 6 June 1984.

Discussion

Among the 123 species in our cumulative list of summer birds at 538 counting stations in 168 conifer swamps in Wisconsin, 1983–93, 20 species were detected 20–225 km south of known summer limits as predicated on maps of contiguous breeding ranges in Robbins (1991). Seventeen of these 20 species (excepting Golden-winged Warbler, White-throated Sparrow, and Dark-eyed Junco) were recorded at multiple stands (range 2–18 stands) ≥ 50 km south of previously identified limits (median 80 km, n=108 stand-level detections).

Of 125 southern conifer swamps in our sample, 61 stands (49%) yielded detections of one or more bird species (x=1.8 species) ≥ 50 km beyond known range during single-visit survey work. (For perspective on these distances, the state's north-south midline between Vilas and Green Cos. is about 440 km in length.) No species was detected north of known range in our surveys of 43 conifer swamps in northern Wisconsin or other stands elsewhere in the state, although the Blue-winged Warbler seems to give a historical example of a species that previously encountered and occupied conifer swamps (in southern Wisconsin) as its summer range expanded northward.

Criteria of the Wisconsin breeding bird atlas would class many of our single-visit observations as possible rather than probable or confirmed breeding records, but multiple lines of evidence suggest that most of the distributional data reported here do represent real range revisions for regularly present and presumably breeding birds, not "exceptional" (Robbins 1991) or casual records. Despite limitations on single-visit detectability, as discussed below, several species were widely and frequently recorded beyond known summer range in seemingly appropriate habitats (e.g., Mourning Warbler). Annual presence in one or more southern conifer swamps during 1983–86 surveys also points to regular residency in several species (e.g., Black-and-white Warbler). Many summer records were obtained several weeks after a species' usual migrational departures from southern counties (e.g., Brown Creeper) and even among species that might be regarded as late migrants in early June in southern Wisconsin, most detections occurred ≥ 9 June (e.g., 88% in Canada Warbler). Although nest finding was not an objective in counts, we opportunistically discovered fledglings or nests for 5 of the 20 species found beyond recognized range (e.g., Lincoln's Sparrow). Other sources also support revisions of confirmed breeding ranges in some species (e.g., Broad-winged Hawk).

Finally, patterns of detection appeared to be geographically consistent with habitat variants in conifer swamps in several bird species. Brief single-visit counts cannot detect all species actually present in a survey stand and do not detect different species with equal efficacy. However, for passerine birds that give frequent songs or call notes, stand presence is a

relatively efficient measure of regional distribution. It requires only a single detection of a species at distances constrained only by audibility, and the likelihood of an aural detection rises rapidly when multiple individuals are present.

Proportionality between stand size and counting effort meant that detectability of a given species was correlated with its absolute numbers in a stand or set of stands; we had a similar chance of detecting a species in stands where its absolute numbers were the same. We surely overlooked some species (and many individuals) at the stand level, but it is unlikely that we missed the regional presence of a species in numbers comparable to those of other in-state regions. For example, we cannot assert that the Yellow-rumped Warbler is absent in summer in southeastern tamarack swamps (where unrecorded) but we can say with confidence that its summer population in the southeast (if any) is apparently much smaller than that in the conifer-ericad swamps of Jackson Co. (where numerous). The converse applies to the Northern Waterthrush.

Geographically congruent patterns in distribution seem most evident in Canada Warbler (Fig. 6) and Northern Waterthrush (Fig. 4), which showed nearly identical limits to revised range in tall shrub-tamarack habitats in southeastern counties. Although they also use upland and/or hardwood habitats in southern Wisconsin, five more species may fit this pattern within southeastern conifer swamps: Brown Creeper, Mourning Warbler (Fig. 5), Black-and-white Warbler, Nashville Warbler, and (Fig. 3) Alder Flycatcher. Of these seven species in "new" range in southeastern tamarack-shrub swamps, only the last two were detected (within known range) in the conifer-ericad swamps of Jackson Co. In comparison, "new" southern detections of Yellow-rumped Warbler, Purple Finch, Yellow-bellied Flycatcher, and (in part) Lincoln's Sparrow were mainly confined to the extensive spruce-tamarack-ericad swamps of Jackson Co. Within lowland coniferous habitats, the Black-throated Green Warbler appears to be virtually restricted to northern and eastern swamps dominated or co-dominated by white cedar.

Such discernible patterns in range revisions and habitat use in many species suggest that our distributional data (with a few possible exceptions mentioned earlier) do not involve an unstructured mix of vagrants and laggard migrants. This conclusion is also supported by re-survey work using comparable methods in the 2001 breeding season (MM, BB) at 28 of the same southern stands in Jackson (11), Jefferson (10), and four other counties. This re-sample was much smaller than the earlier set of 125 southern swamps in 21 counties in 1983–86. Even so, 15 of the 19 bird species (excluding Dark-eyed Junco) recorded beyond previously recognized range in 1983–86 were again detected in 2001. After 15+ years—and several avian generations—many species were re-encountered in the same stands where previously found—e.g., Purple Finch, Yellow-rumped Warbler, and others in Jackson Co.; White-throated Sparrow and others in Washington Co.; and Alder Flycatcher in Rock Co.

Conservation Implications

As noted above, many of the 19 bird species (excluding Dark-eyed Junco) detected beyond previously recognized summer ranges in conifer swamps in southern Wisconsin were not evenly distributed in comparable numbers among vegetational variants or, in turn, among the southern subregions where such variants prevail within local swamps. In the Northern Waterthrush, for example, tall shrub-tamarack swamps provided 88% of 24 stand-level detections—all in southeastern counties (Fig. 4)—and 81% of the 62 individuals detected beyond known range.

Only 5 of these 19 species were recorded beyond their known summer ranges in all three of the vegetational categories used here (conifer-ericad, tall shrub-tamarack, and cedar swamps), but our sample (n=5) of regionally rare cedar swamps in southern counties (Washington, Fond du Lac, and—not shown in Fig. 2—a small portion of one stand in Outagamie) was unavoidably small. Only 7 of 17 species (omitting Winter Wren and Black-throated Green Warbler as cedar affiliates) were detected beyond known ranges in both conifer-ericad and tall shrub-tamarack swamps.

Nevertheless, despite our small sample of cedar swamps in southern Wisconsin, each of these three variant types of conifer swamp yielded similar numbers of species (11–13) in stand-level detections beyond known ranges. Although most of them may also occur in other non-wetland or non-coniferous habitats elsewhere in the state, about 9–11 of these 19 species appear to be entirely or principally limited to conifer swamps in revised or possible summer ranges in southern Wisconsin: Olive-sided, Yellow-bellied, and perhaps Alder Flycatchers; Winter Wren and Northern Waterthrush; Yellow-rumped, Canada, and probably Nashville Warblers; Purple Finch and Lincoln's and White-throated Sparrows. Other species within but near the southern limits of known range—e.g., Veery in 6 tall shrub-tamarack stands among 10 survey swamps in Kenosha (1), Racine (2), Walworth (2), and Rock (1) Cos.—may also show frequent summer use of conifer swamps at the state's southeastern edge.

"The conifer swamp has always been considered an exceptionally distinct plant community," said Curtis (1959:239–240), "with great similarity throughout its range . . . [but] the apparent unity is really a physiognomic unity, imparted by the two trees, tamarack and black spruce." Much the same can be said for conifer swamps as breeding bird habitats in southern Wisconsin: summer bird assemblages in southern swamps do overlap but do also differ geographically with the prevalent composition and structure of vegetation in local swamps.

We thus suggest that the entire vegetational and geographic spectrum of southern Wisconsin conifer swamps merits protection as avian habitat if their breeding birds are to be conserved within newly recognized range limits. Many outlying cedar swamps (e.g., Jackson Marsh in Washington Co.) and conifer-ericad swamps (e.g., Beulah Bog in Walworth Co.) in the south already have full or partial protection as designated state natural areas or other public ownerships. Recently re-asserted wetlands law will

also offer partial protection against habitat loss in many conifer swamps.

Protective needs may be most acute for conifer-ericad swamps and their disjunct bird populations in Jackson Co. and for the tamarack swamps of southeastern counties. Jackson Co. holds many of the largest individual conifer swamps in southern Wisconsin—some exceeding 200 ha—as well as the biggest aggregate area of swamps (ca. 6400 ha) among all southern counties. These stands are also the largest remaining outpost of spruce-tamarack-ericad swamps in the south (Fig. 2); their newly documented breeding birds (e.g., Yellow-rumped Warbler) show these stands' affiliation, as bird habitat, with the conifer-ericad swamps of northern Wisconsin. In terms of vegetational integrity, avian habitats in these Jackson Co. stands rank among the least disturbed and most intact of the state's southern conifer swamps. Continuing inventory work in Jackson Co. since 1993 (not reported here) also suggests that a small but vegetationally distinctive set of white pine-red maple swamps will yield additional records beyond previously known summer range for several bird species including Winter Wren, Blue-headed Vireo, and Blackburnian Warbler.

Although their alliance with boreal forest and northern conifer swamps is uncertain (Curtis 1959), southeastern tall shrub-tamarack stands are sometimes seen in vegetational perspective as decadent versions of post-glacial and/or pre-settlement conifer-ericad swamps. In the past, preservation priorities in southeastern swamps have thus tended to focus on those supposedly "intact" stands that more closely resemble northern swamps in vegetational aspects. This viewpoint, accurate or not in vegetational and historical terms, is moot in terms of these swamps' current utility as avian habitat because several bird species—Alder Flycatcher, Northern Waterthrush, Canada Warbler, and others—appear to show habitat use and range revisions congruent with the availability of tall shrub-tamarack swamps in southeastern Wisconsin.

Remnant conifer swamps are a long-declining and now scarce resource in the landscape of southern Wisconsin. The role of conifer swamps in preserving avian diversity and other biological diversity on local, sub-regional, and regional scales in southern counties might be best served by protective plans (e.g., SEWRPC 1997) that give mutual consideration to vegetational assessments and to habitat values, as exemplified here by breeding birds.

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Blackburnian Warbler *by Dennis Malueg*